Jan. 12, 1943. J. A. COY 2,307,823

CIRCUIT BREAKER

Filed Sept. 12, 1940

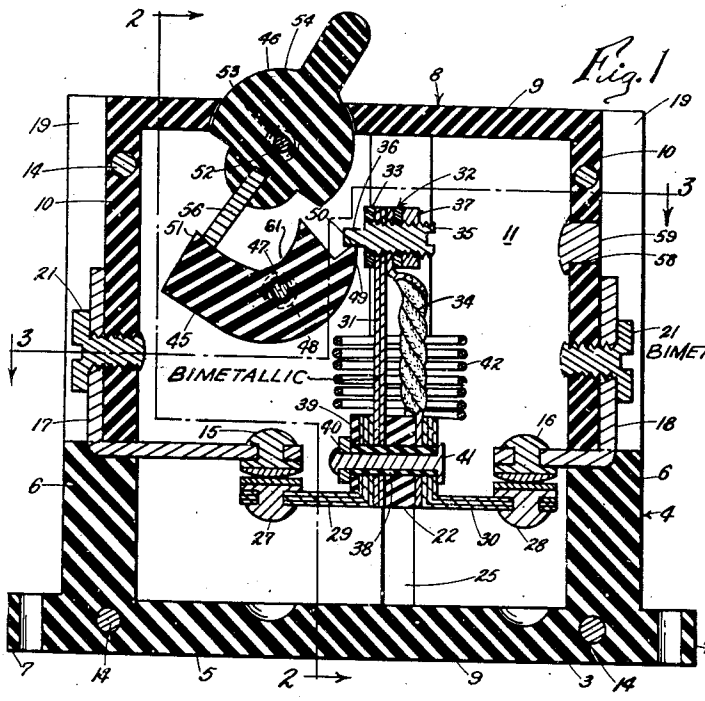


Fig. 1

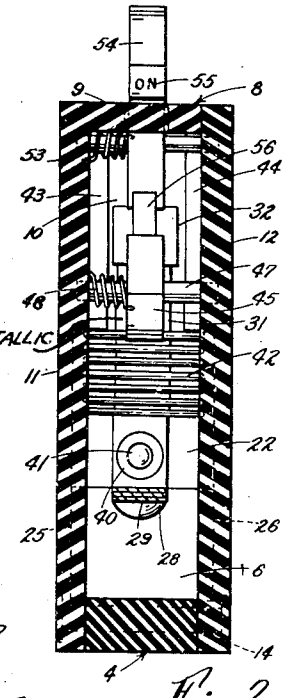


Fig. 2

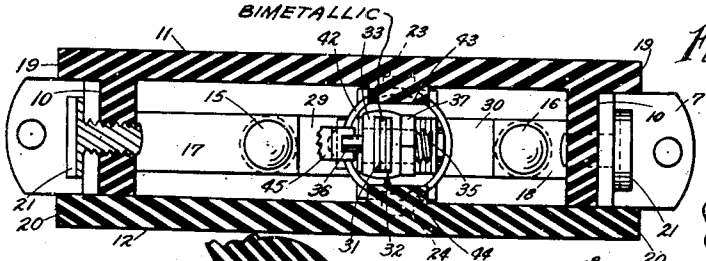


Fig. 3

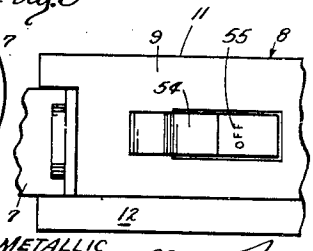


Fig. 6

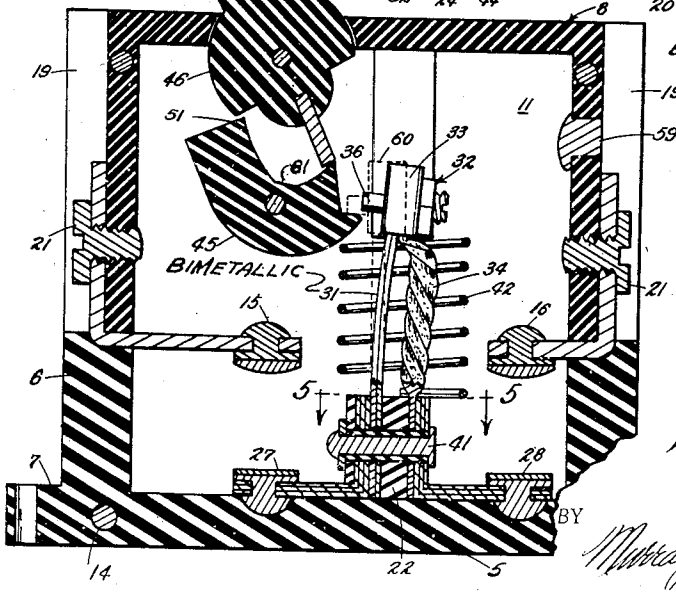


Fig. 4

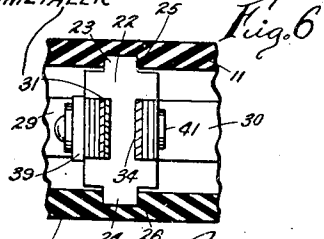


Fig. 5

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CIRCUIT BREAKER

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Application September 12, 1940, Serial No. 356,521

12 Claims. (Cl. 200—116)

The present invention relates to improvements in circuit breakers and is particularly adapted for use in connection with small capacity circuit interrupters which are substituted for fuses in residences or are used in circuits which supply small motors or household appliances or the like.

An object of the invention is to provide a circuit breaker which has a simplified and effective manual opening and resetting mechanism and also a quick automatic opening action due to the elimination of parts connected to and movable with the contact carrying mechanism.

Another object of the invention is to provide a manual operating mechanism for a contact carrying member which is adapted to engage said member only during the resetting of the mechanism and while the mechanism functions to normally hold the breaker contacts in closed circuit position.

A further object of the invention is to provide a simplified and compact contact carrying member which is easily and quickly moved to rupture a circuit by a comparatively light spring biasing it to open circuit position.

Another object of the invention is to provide a mechanism for controlling a contact carrying means of a circuit breaker which comprises a manual operating member and an actuating member which are mounted for movement independent of each other and are biased to their respective open circuit positions by any suitable means, said members being in bodily contact with each other and cooperating to form a locking condition between them to hold the contact carrying means in closed circuit position said locking condition being overcome either by manual movement of said operating member or automatically by current conditions in the circuit.

Other objects will be apparent from the following specification and drawing, in which:

Fig. 1 is a central, cross-sectional view taken longitudinally through a circuit breaker illustrating a form of my invention.

Fig. 2 is a cross-sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a cross-sectional view taken on line 3—3 of Fig. 1.

Fig. 4 is a view similar to Fig. 1 showing the breaker in open circuit position.

Fig. 5 is a cross-sectional view taken on line 5—5 of Fig. 4.

Fig. 6 is a fragmentary plan view of the manual operating member in the position shown in Fig. 4.

The embodiment of my invention consists of a casing 3 made of insulating material and having a base 4 comprising an open-sided bottom 5 and opposed end members 6. Perforate projections 7 are formed on the base for bolting the breaker to a suitable mounting. A cover 8 having one open side forms a part of the casing 3 and comprises a top 9, end walls 10 which at their lower ends engage the base end members 6, and a rear side wall 11 (Figs. 1 and 2). A front side wall 12 completes the casing; the base, cover and front side wall being fastened together by transverse rivets 14.

Stationary contacts 15 and 16 are positioned in spaced relationship within the casing by means of L-shaped conducting strips 17 and 18 respectively, the contacts being riveted to the inner ends of the horizontal portions of said strips which extend interiorly of the casing while the vertical portions of the strips engage the outer surface of the end walls 10. As shown in Fig. 3, the vertical portions of the strips are of a greater width than the horizontal portions thereof and snugly fit between longitudinal extensions 19 and 20 of the side walls 11 and 12 respectively. Screws 21 are threaded in the vertical portions of said strips and the end walls and serve as binding posts for terminal wires (not shown) comprising one branch of a circuit to be protected by the breaker.

The contact carrying member for my breaker may take the form of an electrically non-conductive block 22 provided with guides 23 and 24 (Figs. 3 and 5) which move in vertical guideways 25 and 26 formed in the side walls, said guideways being adapted to control the movement of the contact carrying member in a rectilinear direction. Movable contacts 27 and 28 are mounted on the block 22 in vertical alignment with the stationary contacts 15 and 16 respectively, by means of resilient laminated arms 29 and 30 which are fastened to the block in a manner to be hereinafter described.

The means responsive to current conditions in the circuit is illustrated as a bi-metal strip 31 mounted at its lower end to the contact carrying member 22 in electrical engagement with the resilient arm 29. As shown in Fig. 4 in full lines, the bi-metal strip is deflectable to the right when heated by overload conditions in the protected circuit. The upper end of the bi-metal strip is provided with a latch means generally indicated by the reference character 32 which is illustrated as a metal band 33 surrounding the upper end of said strip and adapted to encircle the upper end of an electrical conductor which is shown

as a flexible lead 34 to maintain the conductor in electrical contact with the upper end of the bi-metal strip. A set screw 35 is threaded in a hole formed centrally through the bend, said screw having a reduced annular portion 36 extending beyond the bend 33. A lock nut 37 is theaded to the set screw 35 and may be forcibly turned against the band 33. The lower end of the flexible lead is fastened to the contact carrying member 22 in electrical engagement with the flexible arm 30.

As shown in Figs. 1 and 5, an electrically insulating sleeve 38 passes through the center of the contact carrying member 22, the resilient arms 29 and 30 which carry the movable contacts 27 and 28 respectively, and the lower ends of the bi-metal strip and the flexible lead 34. An insulating plate 39 encloses the vertical portion of the arm 29 and is engaged by a washer 40. A rivet 41 passes through the washer and the sleeve 38 to bind the parts together, the foregoing construction serving to insulate the resilient arms 29 and 30 from each other whilst providing electrical contact between the arm 29 and the bi-metal strip 31 and also between the arm 30 and the flexible lead 34. In closed contact position, as seen in Fig. 1, the electrical circuit through the breaker is as follows: strip 18, stationary contact 16, movable contact 28, arm 30, flexible lead 34, bi-metal strip 31, arm 29, movable contact 27, stationary contact 15, and strip 17, or the current could flow through the breaker in a reverse direction, i. e., from strip 17 to strip 18.

The means for biasing the contact carrying member to contact disengaged position is preferably a coiled expansion spring 42 which encircles the bi-metal strip and the flexible lead 34. As shown in Figs. 2 and 3, opposed portions of the spring partially enter the guideways 25 and 26 formed in the side walls of the casing and serve to position said spring relative thereto. The upper end of the spring abuts the lower edge of elongated shoulders 43 and 44 positioned in vertical alignment with said guideways whilst the lower end of the spring engages the upper surface of the contact carrying member 22.

The means for holding the contact carrying member in contact engaged position or for manually moving said contact carrying member to disengaged contact position comprises an actuating member 45 cooperable with an operating member 46. As shown in Figs. 1 and 2, the actuating member is rotatably mounted on a cross-pin 47 which is fastened to the side walls 12 and 13 of the casing. Means for biasing the actuating member to a contact disengaged position (the position shown in Fig. 4) may consist of a spring 48 having its one end fastened to said actuating member and its other end fastened to the casing and adapted to constantly urge said member in a clockwise direction to its contact disengaged position. The actuating member is pivoted intermediate its ends for rocking movement and has a latch engaging end 49 which takes the form of an upwardly extending portion provided with an edge 50 which normally engages the extended portion 36 on the set screw 35. The free end 51 of the actuating member engages the lower portion of the operating member 46, the latter member being rotatably mounted for oscillating movement on a cross-pin 52 having its ends mounted in the side walls of the casing. The operating member is constantly urged in a counter-clockwise direction to its contact disengaged position, shown in Fig. 4, by means of a coil spring 53 which has its one end fastened to the operating member and its other end fastened in the casing. The operating member is mounted so that an elongated reduced portion 54 extends outwardly from the casing, the curved portions immediately adjacent said extended portion being provided with indicia 55 to indicate the "Off" and "On" positions of the breaker mechanism (Figs. 2 and 6). The downwardly extending portion 56 of the operating member bodily engages the actuating member 45. In contact engaged position (Fig. 1) the downwardly extending portion 56 of the operating member bodily engages the actuating member at a point beyond the dead center of the actuating member and the operating member which is defined by a straight line passing through the cross-pins 47 and 52 respectively of said members, thus creating a frictional engagement between said members which locks them in said contact engaged position against the action of their respective biasing springs and the tendency of the contact carrying member to rotate the actuating member in a clockwise direction due to the action of the spring 42 in biasing the contact carrying member to a contact disengaged position. In other words the members are frictionally held in this position by means of the downward force exerted on the actuating member by the contact carrying member through its connection with the latch means, the action of springs 48 and 53 of the respective members being insufficient to maintain the members in said locked position but having enough energy to bias said members to contact disengaged position when the downward force of said contact carrying member is released from the actuating member. When this pressure is released as, for instance, when current conditions in the circuit have distorted the bi-metal element 31 to a point where the latch means disengages the actuating member, the friction between said operating member and actuating member is greatly reduced and permits the springs 48 and 53 to rotate said members to open circuit position shown in Fig. 4, whilst said contact carrying member moves under its own bias to contact disengaged position.

When the contact carrying member is in circuit contact engaged position, a means is provided for adjusting the rupture capacity of the breaker which consists of a hole 58 formed in one end wall 10 of the casing in horizontal alignment with the set screw 35 on the latch means so that a suitable tool may be entered in said hole to rotate the set screw 35 and thereby relatitvely move the extended portion 36 of said screw inwardly or outwardly relative to the engaging edge 50 of the actuating member. A suitable plug 59 for closing the hole after adjustment is made may be provided.

In operation, the movable contacts bridge the stationary contacts in contact engaged position by means of the cooperation between the operating member 46 and the actuating member 45, the latter member engaging the latch means to retain the contacts in said position against the bias of spring 42. When an overload condition occurs in the circuit protected by the breaker, the bi-metal strip is deflected from the position shown in Fig. 1 to the position illustrated in full lines in Fig. 4, thereby disengaging the extended portion 36 on the latch means from the edge portion 50 of the actuating member and the contact carrying member 22 is quickly moved

downwardly under the action of spring 42 to contact disengaged position shown in Fig. 4. Disengagement of the latch means from the actuating member also lessens the frictional connection between the said actuation member and the operating member, thus permitting both of them to move under action of their springs to a disengaged contact position shown in Fig. 4. As the bi-metal strip 31 cools, it again returns to a substantially vertical position shown in dotted lines 60 in Fig. 4, thus permitting engagement between the actuating member and the extended portion 36 on the latch means, manual rotation of the operating member 46 clockwise acting to return the mechanism from a position shown in Fig. 4 to the position shown in Fig. 1.

Manual opening and closing of the switch independently of the automatic opening thereof by means of the bi-metal thermostat may be attained by merely moving the operating member to an "On" and "Off" position, that is, from a position indicated in Fig. 1 to the position indicated in Fig. 4. During the interval between these positions the downwardly extending portion 56 on the manual operating member 46 moves along the concave portion 61 formed in the actuating member from the over dead center position of bodily contact of said members shown in Fig. 1 to the opposite over dead center position in Fig. 4. The reverse of the described movement returns the breaker parts to contact engaged position after the circuit has been broken manually or automatically.

What is claimed is:

1. In an automatic circuit breaker the combination of a casing having opposed vertical guides formed in the side walls thereof, a pair of stationary contacts mounted on side walls of the casing diametrically opposed to the walls having the guides, a contact carrying member comprising an insulating block movable in the guides, a pair of resilient contacts mounted on opposed sides of the block and positioned in vertical alignment beneath the stationary contacts, a bimetal strip connected at its lower end to a resilient contact and extending upwardly from the block and deflectable in response to current conditions in the circuit, a latch means upon the strip, a flexible connection between the free end of the strip and the remaining resilient contact, a coil spring surrounding the bimetal strip and engaging the casing and the block for biasing the contact carrying means to disengaged contact position, an actuating member pivoted intermediate its ends to the casing and having an extended portion for engaging the underside of the latch means, means for biasing the actuating means to contact disengaged position, a manual operating member bodily engaging the actuating member and adapted to normally cooperate with said actuating member to hold the contact carrying member in contact engaged position, and means for biasing the manual operating member to contact disengaged position, said actuating member being disengaged by the latch means when current conditions cause movement of the deflectable means whereby the contact carrying member, the actuating means and the manually operable means are automatically moved to their respective contact disengaged positions independently of the movement of the contact carrying member.

2. In a circuit breaker the combination of a stationary contact, a contact carrying member mounted for rectilinear movement, means for biasing the contact carrying member to contact disengaged position, a contact on said member and movable therewith into and out of engagement with the stationary contact to close and open the circuit respectively, a means deflectable by current conditions in the circuit mounted on said member, a latch means on the deflectable means, a rotatable actuating member biased to open circuit position and having an extended portion for engaging the latch means and a concave portion formed thereon adjacent to and approximately centered with respect to the axis of said member, a rotatable manual operating member biased to open circuit position and normally in bodily contact with the concave portion of the actuating member and cooperating therewith to effect the normal opening and closing movements of the contact carrying member, said contacting portions being normally beyond the dead center of the respective axes of said members to hold the contact carrying member in contact engaged position whereby upon automatic disengagement of the deflectable means from the latch means the contact carrying member, the actuating member and the manual operating member move to their respective open circuit positions and the extended portion on the manual operating member is then in contact with the concave portion on the actuating member at a point on the opposite side of the dead center of the axes of the members than that normally taken by said members in contact engaged position.

3. In a circuit breaker the combination of a stationary contact, a contact carrying member mounted for rectilinear movement, means for biasing the contact carrying member to contact disengaged position, a contact on said member and movable therewith into and out of engagement with the stationary contact, a latch means, a rotatable actuating member biased to contact disengaged position and having an extended portion for engaging the latch means, a means deflectable by current conditions in the circuit mounted on the contact carrying member, fastened to the latch means, and adapted upon the occurrence of an overload in the circuit to disengage the latch means from the actuating member, a rotatable manual operating member biased to open circuit position, a concave portion formed in an edge of the actuating member adjacent the operating member and disposed transversely of and substantially centered relative to the axis of said members said operating member being normally in bodily contact with said concave portion and cooperating therewith to tilt the actuating member and thereby move the contact carrying member to engaged and disengaged positions.

4. An automatic circuit breaker, as set forth in claim 3, wherein the latch means has an adjustment means thereon and the casing is provided with an opening in alignment with the adjustment means and a semi-permanent closure for said opening.

5. An automatic circuit breaker, as set forth in claim 3, wherein the lower end of the bi-metal strip is connected to one resilient contact and a flexible electrical conductor is connected to the free end of the bi-metal strip and the remaining resilient contact.

6. In a circuit breaker the combination of a casing, a stationary contact on the casing, a contact carrying member, a contact on said member and movable therewith into and out of en-

gagement with the stationary contact, means for biasing the contact carrying member to open circuit position, a bi-metallic strip mounted on said member, an actuating member having an axis disposed intermediate its ends and mounted on the casing for rocking movement, one end of said member normally engaging the strip, means for biasing the actuating member to contact disengaged position, a rotatable manual operating member mounted for oscillating movement on the casing and normally in bodily contact with the free end of the actuating member, means for biasing the operating member to contact disengaged position, said contact carrying member being adapted in normal contact engaged position to exert a force on the actuating member substantially equal and opposed to the force of the biasing means for the contact carrying member and sufficient to constitute the bodily contact between said member and the operating member, a locking means for holding all of the said members in their respective contact engaged positions whereby upon the occurrence of an overload in the circuit the latch means is disengaged from the actuating means to break the normal holding connection between said actuating member and the operating member and permit said members and the contact carrying member to move in accordance with their respective biases to their contact disengaged positions.

7. In a circuit breaker the combination of a stationary contact, a contact carrying member mounted for rectilinear movement, means for biasing the contact carrying member to contact disengaged position, a contact on said member and movable therewith into and out of engagement with the stationary contact, a latch means, a rotatable actuating member biased to contact disengaged position and having an extended portion for engaging the latch means, a means deflectable by current conditions in the circuit mounted on the contact carrying member, fastened to the latch means, and adapted upon the occurrence of an overload in the circuit to disengage the latch means from the actuating member, a rotatable manual operating member biased to contact disengaged position, a concave portion formed in an edge of the actuating member adjacent the operating member and disposed transversely of and substantially centered relative to the axes of said members, said operating member being normally in bodily contact with said concave portion and cooperating therewith to tilt the actuating member and thereby move the contact carrying member to engaged and disengaged positions, said contact carrying member being adapted in normal contact engaged position to exert a force on the actuating member sufficient to constitute the bodily contact between said member and the operating member, a locking means for holding all of the said members in their respective contact engaged positions.

8. In an automatic circuit breaker the combination of a casing having opposed vertical guides formed in the side walls thereof, a pair of stationary contacts mounted on side walls of the casing diametrically opposed to the walls having the guides, a contact carrying member comprising an insulating block movable in the guides, a pair of resilient contacts mounted on opposed sides of the block and positioned in vertical alignment beneath the stationary contacts, a bimetal strip connected at its lower end to a resilient contact and extending upwardly from the block and deflectable in response to current conditions in the circuit, a latch means upon the strip, a flexible connection between the free end of the strip and the remaining resilient contact, a coil spring surrounding the bimetal strip and engaging the casing and the block for biasing the contact carrying means to disengaged contact position, an actuating member pivoted intermediate its ends to the casing and having an extended portion for engaging the underside of the latch means, means for biasing the actuating means to contact disengaged position, a manual operating member bodily engaging the actuating member and adapted to normally cooperate with said actuating member to constitute a locking means for holding the contact carrying member in contact engaged position, and means for biasing the manual operating member to contact disengaged position, said actuating member being disengaged by the latch means when current conditions cause movement of the deflectable means whereby the contact carrying member, the actuating means and the manually operable means are automatically moved to their respective contact disengaged positions independently of the movement of the contact carrying member.

9. In an automatic circuit breaker the combination of a casing having opposed vertical guides formed in the side walls thereof, a pair of stationary contacts mounted on side walls of the casing diametrically opposed to the walls having the guides, a contact carrying member comprising an insulating block movable in the guides, a pair of resilient contacts mounted on opposed side of the block and positioned in vertical alignment beneath the stationary contacts, a bi-metal strip connected at its lower end to a resilient contact and extending upwardly from the block and deflectable in response to current conditions in the circuit, a latch means upon the strip, a flexible connection between the free end of the strip and the remaining resilient contact, a coil spring surrounding the bimetal strip and engaging the casing and the block for biasing the contact carrying means to disengaged contact position, an actuating member pivoted intermediate its ends to the casing and having an extended portion for engaging the underside of the latch means, means for biasing the actuating means to contact disengaged position, a manual operating member bodily engaging the actuating member and adapted to normally cooperate with said actuating member to constitute a locking means for holding the contact carrying member in contact engaged position, said contact carrying member exerting sufficient force on the actuating member to create a locking condition between said member and the operating member to hold the contact carrying member in said contact engaged position, and means for biasing the manual operating member to contact disengaged position, said actuating member being disengaged by the latch means when current conditions cause movement of the deflectable means whereby the actuating means and the manually operable means are automatically moved to their respective contact disengaged positions independently of the movement of the contact carrying member.

10. In an automatic circuit breaker the combination of a casing having opposed vertical guides formed in the side walls thereof, a pair of stationary contacts mounted on side walls of the casing diametrically opposed to the walls having the guides, a contact carrying member com-

prising an insulating block movable in the guides, a pair of resilient contacts mounted on opposed sides of the block and positioned in vertical alignment beneath the stationary contacts, a bi-metal strip connected at its lower end to a resilient contact and extending upwardly from the block and deflectable in response to current conditions in the circuit, a latch means upon the strip, a flexible connection between the free end of the strip and the remaining resilient contact, a coil spring surrounding the bimetal strip and engaging the casing and the block for biasing the contact carrying means to disengaged contact position, an actuating member pivoted intermediate its ends to the casing and having an extended portion for engaging the underside of the latch means, and a concave portion formed thereon adjacent to and approximately centered with respect to the pivot point of said member, means for biasing the actuating means to contact disengaged position, a manual operating member bodily engaging the concave portion of the actuating member and adapted to normally cooperate with said actuating member to effect the normal opening and closing movements of the contact carrying member, said contacting portions being normally beyond the dead center of the respective axes of the actuating member and the operating member to hold the contact carrying member in contact engaged position, and means for biasing the manual operating member to contact disengaged position, said actuating member being disengaged by the latch means when current conditions cause movement of the deflectable means whereby the contact carrying member, the actuating means and the manually operable means are automatically moved to their respective contact disengaged positions and the manual operating member is then in contact with the concave portion on the actuating member at a point on the opposite side of the dead center of the axes of the members than that normally taken by said members in circuit closed position.

11. In a circuit breaker the combination of a casing, a stationary contact on the casing, a contact carrying member mounted on the casing for rectilinear movement, means for biasing the contact carrying member to contact disengaged position, a contact on said member and movable therewith into and out of engagement with the stationary contact, a means deflectable by current conditions in the circuit mounted on said member, a latch means on the deflectable means, a rotatable actuating member having an extended portion for engaging the latch means, a spring fastened to the casing and the actuating member for biasing said member to contact disengaged position, a rotatable, manual operating member normally in bodily contact with the actuating member, and a spring fastened to the casing and the operating member for biasing said member to contact disengaged position, said operating member normally engaging said actuating member at a position which is beyond dead center relative to the respective axes of rotation of said members, said members in said normal positions being adapted to hold the contact carrying member in contact engaged position whereby upon the occurrence of an overload in the circuit the latch means is disengaged from the actuating means to break the normal holding connection between said actuating member and the operating member and permit said members to move under the influence of their respective biases to contact disengaged positions.

12. In a circuit breaker the combination of a casing, a stationary contact on the casing, a contact carrying member mounted on the casing for rectilinear movement, means for biasing the contact carrying member to contact disengaged position, a contact on said member and movable therewith into and out of engagement with the stationary contact, a means deflectable by current conditions in the circuit mounted on said member, a latch means on the deflectable means, a rotatable, actuating member mounted intermediate its ends on the casing and having one end in normal engagement with the latch means, a spring fastened to the casing and the actuating member for biasing said member to contact disengaged position, a rotatable, manual operating member mounted concentrically on the casing and having a peripheral extension in bodily contact with the free end of the actuating member, and a spring fastened to the casing and the operating means for biasing said member to contact disengaged position, said operating member normally engaging said actuating member at a position which is beyond dead center relative to the respective axes of rotation of said members, said members in said normal positions being adapted to hold the contact carrying member in contact engaged position whereby upon the occurrence of an overload in the circuit the latch means is disengaged from the actuating means to break the normal holding connection between said actuating member and the operating member and permit said members to move under the influence of their respective biases to contact disengaged positions.

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