

Aug. 10, 1954

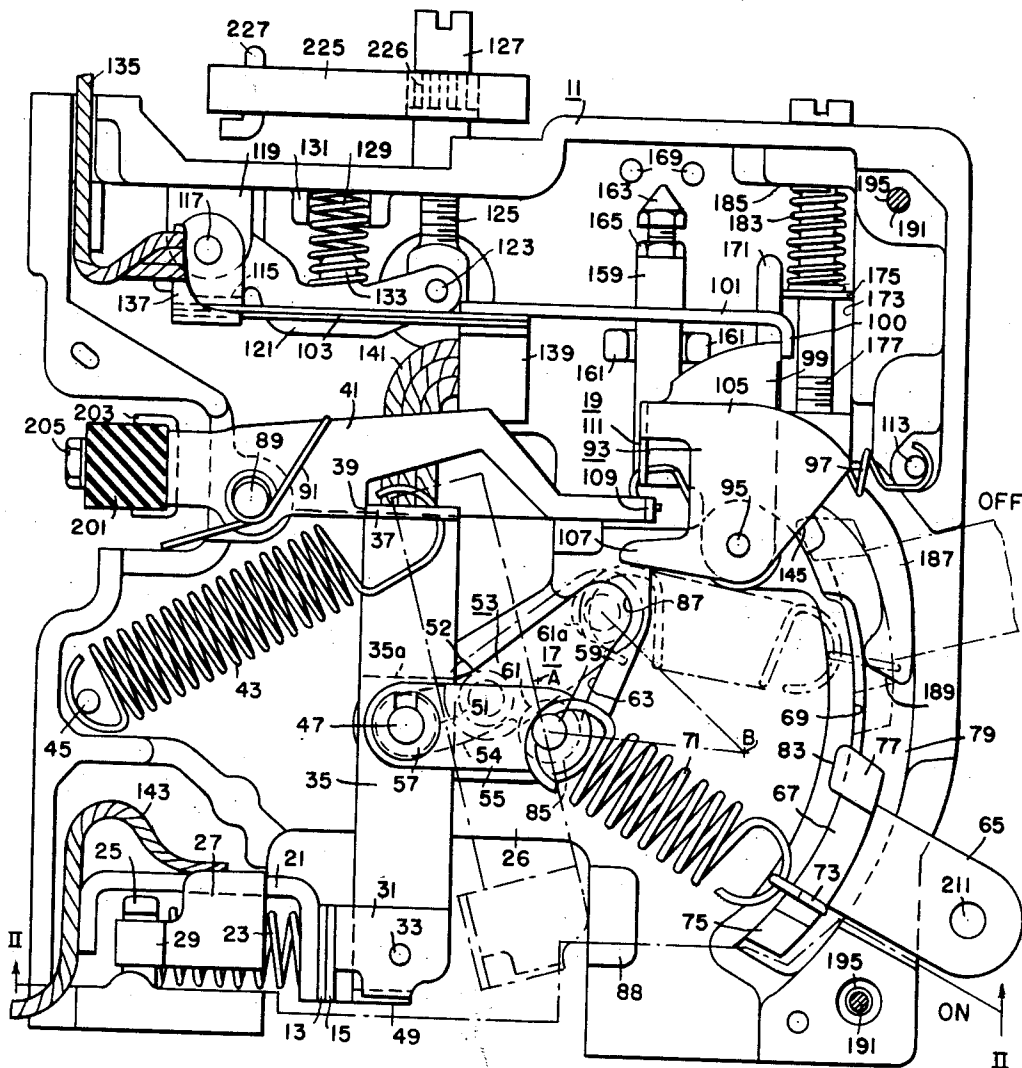
M. G. LEONARD ET AL
CIRCUIT BREAKER

2,686,242

Filed July 26, 1952

3 Sheets-Sheet 1

Fig. 1.



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3 Sheets-Sheet 2

Fig. 2.

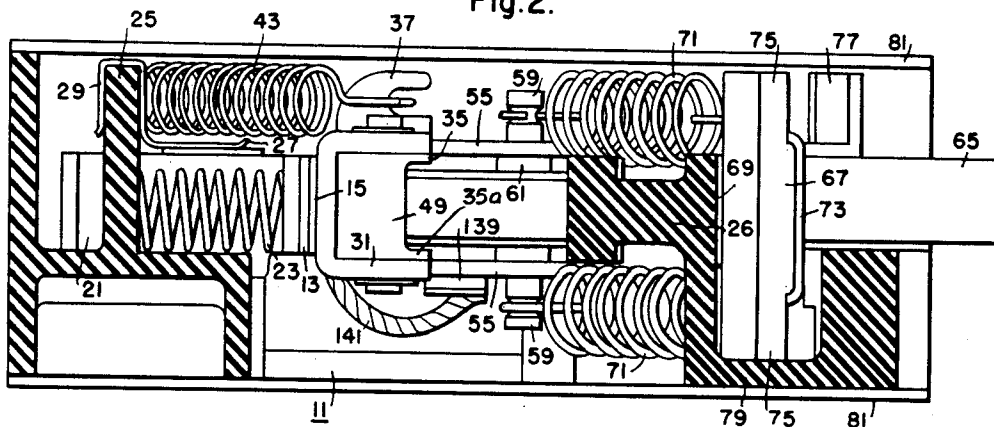
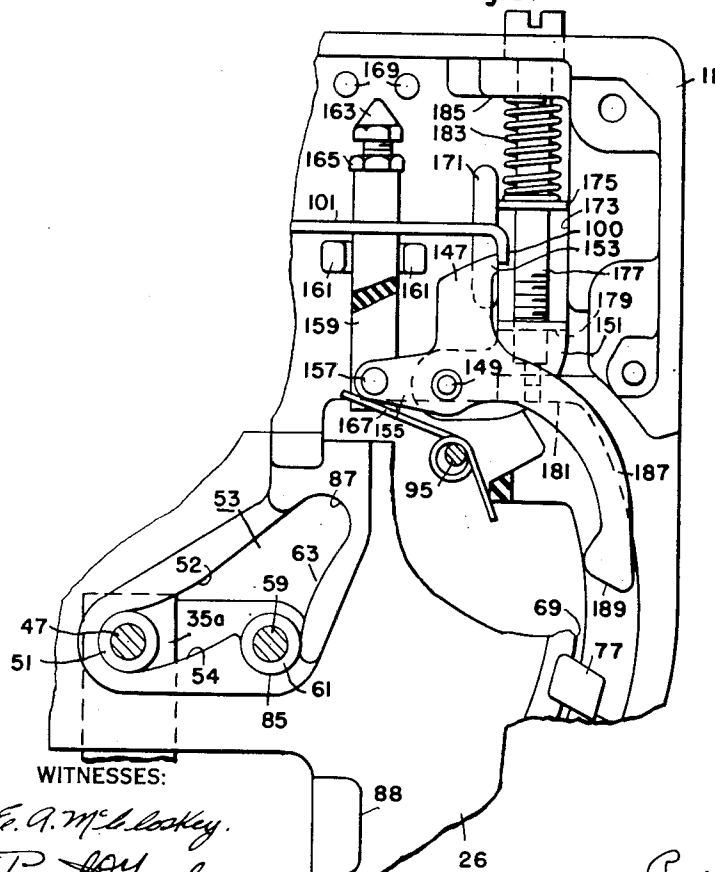


Fig. 3.



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3 Sheets-Sheet 3

Fig. 4.

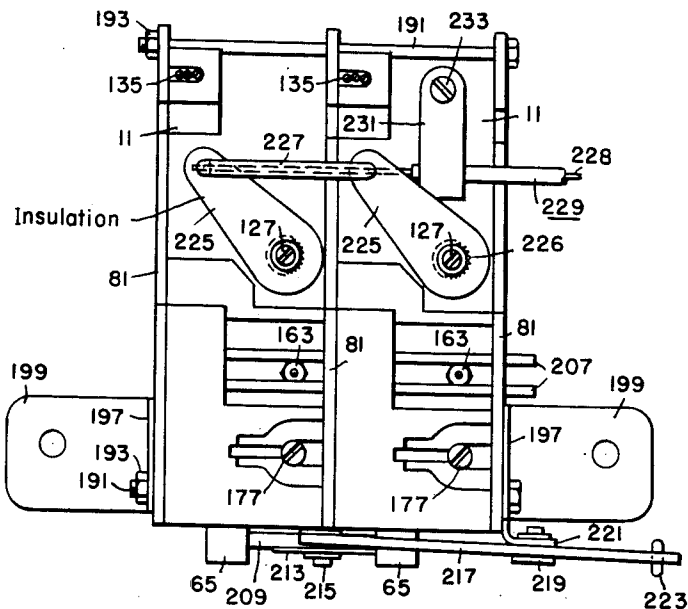
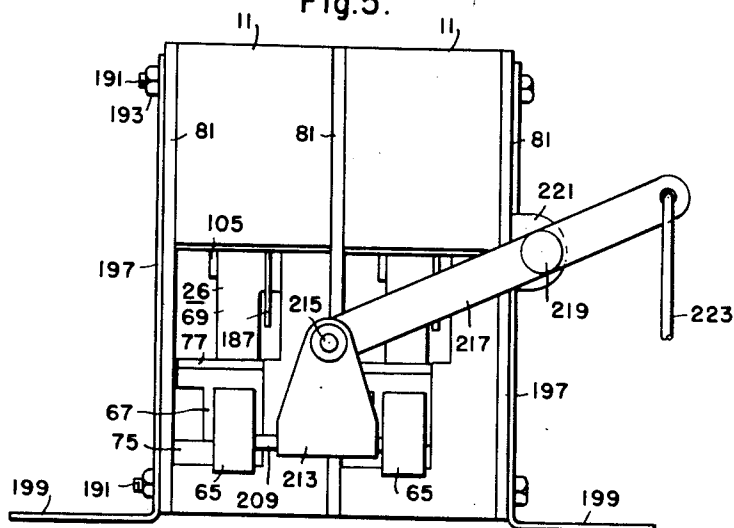


Fig. 5.



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2,686,242

CIRCUIT BREAKER

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Application July 26, 1952, Serial No. 301,032

21 Claims. (Cl. 200—116)

1

The invention relates to circuit breakers and more particularly to circuit breakers for mounting in transformers to control moderate power distribution on feeder circuits.

An object of the invention is to provide a circuit breaker embodying an improved operating mechanism that is simple and rugged in construction, reliable in operation and which can be manufactured and serviced at low cost.

Another object of the invention is to provide a circuit breaker embodying an overload trip mechanism controlled by a thermally responsive element which element also controls an indicator for indicating predetermined overload or temperature conditions.

Another object of the invention is to provide a circuit breaker embodying an overload tripping device and a current indicating tripping device controlled by a single thermally responsive element in which the current indicating tripping device is reset by partial operation of the breaker operating handle without disturbing the breaker contact position.

A further object of the invention is to provide a circuit breaker embodying a self aligning contact structure.

The invention, both as to structure and operation, together with additional objects and advantages thereof, will be best understood from the following detailed description thereof when read in connection with the accompanying drawings.

In said drawings:

Figure 1 is an elevational view of a circuit breaker embodying the principles of the invention;

Fig. 2 is a sectional view taken substantially along line II—II of Fig. 1 and looking in the direction indicated by the arrows;

Fig. 3 is a detail elevational view showing the signal latch mechanism and the resetting means therefor;

Fig. 4 is a top plan view showing two circuit breakers of the type illustrated in Fig. 1 mounted together for unitary operations;

Fig. 5 is an end elevational view of the circuit breakers shown in Fig. 4 illustrating the handle operating mechanism.

Referring to Fig. 1 of the drawings, the circuit breaker comprises a base or housing mem-

2

ber 11 of molded insulating material on which are mounted the parts of the breaker mechanism which include a stationary contact 13, a movable contact 15, operating mechanism indicated generally at 17 and a trip device indicated generally at 19. The stationary contact 13 is rigidly mounted on one leg of a generally U-shaped slide 21 which is biased by a spring 23 to provide contact pressure in the closed contact position. The spring 23 is compressed between the U-shaped slide 21 and a projection 25 of a central portion 26 of the base or frame 11. A contact guide 27 is mounted on the projections 25 by a spring clip 29 which resiliently engages the projections 25.

The movable contact 15 is rigidly mounted on a U-shaped member 31 pivotally mounted by means of a pivot pin 33 on one end of a floating switch arm 35 for limited movement relative thereto to provide contact alignment in the closed contact position. The switch arm 35 at its upper end (Fig. 1) is formed at right angles as at 37 to provide a latch surface for engaging a latch surface 39 on a pivoted latch member 41. The formed portion 37 of the switch arm 35 also provides a hook (Fig. 2) to which a spring 43 is attached. The other end of the spring 43 is hooked over a spring stud 45 in the portion 26 of the base and the spring biases the switch arm 35 in opening direction about a pivot pin 47 when the latch member 41 is actuated to release the switch arm.

The switch arm 35 is U-shaped at its lower or contact end, the other arm 35a (Fig. 2) thereof being disposed on the opposite side of the portion 26 of base 11 and connected to the switch arm 35 by a yoke portion 49. The portion 35a of the switch arm is not as long as the main switch arm 35 and extends upwardly only far enough to receive the pivot pin 47 (Fig. 1). Mounted on the pin 47 between the switch arm 35 and the portion 35a thereof is a roller 51 (Figs. 1 and 3) which engages a generally triangular opening 53 in the portion 26 of the base or frame 11. The roller 51 is guided between two arcuate guide surfaces 52 and 54 of insulating material at the left end of the opening 53. The surfaces 52 and 54 are generally concentric with the latch portion 39 so that the switch arm 35 is guided for pivotal movement about its

end 37 and is held against substantial longitudinal movement. A pair of spaced links 55 disposed one on the outside of the switch arm 35 and the other on the outside of the portion 35a are pivotally mounted on the pin 47 and are held in place by spring clips 57 (only one being shown). A pin 59 extends through openings in the other ends of the links and through the opening 53 in the portion 25 of the base 11. A roller 61 (Figs. 1 and 2) mounted on the pin 59 between the links 55 cooperates with an arcuate surface 63 of the opening 53.

An operating handle 65 of molded insulating material has an arcuate portion 67 molded integral therewith adapted to slide on an arcuate surface 69 on the portion 25 of the base 11 between an "on" and an "off" position. A pair of operating springs 71 (Figs. 1 and 2) have one end hooked over the pin 59 at opposite ends thereof and the other ends of the springs 71 are attached to opposite ends of a spring support 73 which straddles the arcuate portion 67 of the operating handle 65. The arcuate portion 67 of the handle 65 is provided with projections 75 and 77 extending laterally on each side thereof (Figs. 1 and 2). As viewed in Fig. 2, the lower ends of the projections 75 and 77 cooperate with a flange 79 of the portion 25 to retain the handle 65 substantially centered on the surface 69. For the same purpose the upper ends of the projections 75 and 77 are adapted to cooperate with a cover 81 (Fig. 2), there being a cover 81 provided for each side of the base or housing 11. As will be seen in Fig. 1, the projections 77 have inwardly extending projections 83, one on each side of the portion 25, for guiding the handle in its movement on the arcuate surface 69.

In the closed position of the circuit breaker (Fig. 1) the line of action of the operating springs 71 is below the center indicated at A about which the handle 65 moves, thus biasing the handle to the "on" position. Also the line of action of the springs 71 is below the center indicated at B about which the roller 61 travels on the surface 63 and biases the roller 61 into the lower right hand portion 35 of the opening 53 and through the links 55, holds the roller 61 in the left hand end of the opening 53 (Figs. 1 and 3). This action of the operating mechanism, together with the latch 41 maintains the switch arm 35 in the closed position.

When the operating handle 65 is moved from the position shown in full lines in Fig. 1 upwardly to the position shown by the dot and dash lines, the line of action of the operating springs 71 moves upwardly and at a certain time moves above the center line B-61. When this occurs, a component of the force of the springs 71 biases the roller 61 upwardly and causes the roller together with the associated ends of the links 55 to move upwardly and toward the right with a snap action. The roller 61 travels along the arcuate surface 63 until it is stopped by engagement with the upper right hand end 57 of the opening 53. This movement of the roller 61 acts through the links 55 to move the switch arm 35 with a snap action to the open position shown by dot and dash lines in Fig. 1, where it is stopped by engagement of the contact end thereof with a portion 85 of the base 11.

The breaker contacts are closed by movement of the handle 65 from the "off" to the "on" position. During this movement the line of action of the operating springs 71 crosses over be-

low the center line B-61a whereupon the springs bias the roller 61 downwardly and causes it to move down along the arcuate surface 63 to the lower or full line position with a snap action.

This movement of the roller 61 acts through the links 55 to close the contacts with a snap action. The fact that the opening spring 43 acts on the switch arm 35 adjacent its latched end 37 has the advantage that this spring 43 does not have to be overcome by the operating spring 71 on each manual operation, since the end 37 of the switch arm 35 then remains substantially stationary, having only a generally pivotal movement about its end 37.

The switch arm 35 is automatically moved to open position by the spring 43 upon actuation of the latch member 41 which is effected by the trip device 19. The latch 41 is pivoted on a pin 89 in the base 11 and is biased by a spring 91 to latching position to releasably restrain the switch arm in closed position. When the latch 41 is actuated to unlatching position, releasing the upper end of the switch arm 35, the spring 43 acts to rotate the switch arm counterclockwise about the pivot pin 47 to effect opening of the contacts. The switch arm 35 is stopped in its counterclockwise or opening movement by engaging the portion 83 of the base 11. The operating mechanism including the pin 47, links 55, springs 71 and the operating handle 65 remain in the positions in which they are shown by full lines in Fig. 1 during an automatic opening operation.

In addition to the latch member 41 the trip device 19 includes a U-shaped latch operator 93 pivoted on a pin 95 and biased by a spring 97 in a clockwise direction. One arm 99 of the latch operator 93 is normally engaged by a latch portion 103 of a latch element 101 rigidly mounted on the free end of a bimetal element 103 to releasably hold the latch operator in operative position. The other arm 105 of the latch operator has a projection 107 thereon adapted to engage an ear 109 formed on the end of the latch 41 and actuate the latter upon release of the actuator 93. The two arms 99 and 105 of the latch operator 93, are connected by an integral yoke portion 111 to which one end of the spring 97 is attached, the other end of the spring 97 being hooked over a pin 113 in the base 11.

The bimetal element 103 is rigidly secured to a yoke member 115, the legs of which are pivotally supported on a pin 117 mounted in a boss 119 on the base 11. One leg 121 of the yoke member 115 extends to the right from the pivot 117 and has its free end pivotally connected by a pin 123 to the inner end of an adjusting rod 125 which extends out through an opening in the top portion of the base 11 and has a long internally threaded nut 127 threaded onto the outer end thereof. A spring 129, compressed between a spring seat 131 on the base 11 and a spring guide 133 on the leg 121 of the yoke member 115, biases the yoke member 115 and the bimetal element in a clockwise direction about the pivot pin 117. The end of the adjusting screw 127 bears against the top wall of the base 11 and by turning the screw 127 the bimetal assemblage may be moved either clockwise or counterclockwise according to the direction the screw 127 is turned. This varies the amount of overlap of the latch 103 and thereby varies the tripping time of the breaker.

A flexible terminal conductor 135 is welded or otherwise mechanically and electrically connected

5

to an angular conductor 137 which is, in turn, similarly connected to the bimetal element 103 adjacent the pivot 117 to connect the breaker in an external circuit. A conductor 139 mounted on the free end of the bimetal element 103 has one end of a flexible conductor 141 electrically connected thereto, the other end of the conductor 141 being connected to the U-shaped contact member 31 back of the switch arm 35 as viewed in Fig. 1. Another flexible terminal conductor 143 is connected to the stationary contact slide 21 for connecting the breaker in an electrical circuit. The circuit through the breaker extends from the flexible terminal conductor 135, bracket 137, bimetal element 103, conductor 139, flexible conductor 141, contact members 31, movable and stationary contacts 15-13, and contact slide 21 to the other flexible terminal conductor 143.

When an overload current occurs in the circuit through the breaker the bimetal element 103 becomes heated and when heated a predetermined amount, bends upwardly causing the latch 100 to release the latch actuator 93 whereupon the spring 97 snaps the actuator 93 sharply clockwise about pivot 95 causing the projection 107 to engage the ear 109 on the latch element 41 and move this element to unlatching position to release the upper end of the switch arm 35. The spring 43 thereupon moves the switch arm 35 about the pivot 47 to the open position with a snap action.

The mechanism is reset and relatched following an automatic opening operation by moving the handle 65 to the "off" position. During this movement of the handle the mechanism is actuated to the open position shown by dot and dash lines in Fig. 1 in the previously described manner. This moves the upper end of the switch arm 35 to the right of the latch surface 39 on the latch member 41 permitting the spring 91 to restore this member to latching position. As the handle 65 approaches the "off" position the projection 77 thereon engages a surface 145 on the latch actuator 93 and rotates the latch actuator counterclockwise to effect relatching of the actuator. The contacts are then closed by movement of the handle to the "on" position as hereinbefore described.

Means is provided for indicating an overload condition that is not of sufficient magnitude to trip the breaker open but which indicates that the current in the circuit is approaching a dangerous overload condition or that a dangerous overload condition has existed and has cleared itself without tripping the breaker. The indicating means also indicates that the breaker has been tripped open in response to an overload current.

The indicating means comprises a releasable signal member 147 (Fig. 3) pivotally supported by means of a pivot pin 149 on an adjusting slide 151. The member 147 is provided with a latch portion 153 which is normally engaged and releasably held by the latch portion 100 of the latch member 101 carried by the bimetal element 103. An arm 155 of the releasable member 147 is pivotally connected by means of a pivot pin 157 to a slidable contact rod 159 of insulating material. The contact rod 159 is guided for vertical sliding movement by spaced projections 161 on the base 11. A tapered bridging contact 163 is threaded into a tapped hole in the upper end of the contact rod 159 and is locked in adjusted positions by means of a lock nut 165. A spring 75

6

167 coiled about the pin 95 biases the releasable member 147 in a clockwise direction and upon release of the member 147 moves the contact rod 159 upwardly to engage the bridging contact 163 with a pair of spaced stationary contact members or conductors 169 and thereby establish a circuit for energizing a visual or audible signal means.

The adjusting slide 151 is disposed for vertical sliding movement between an elongated projection 171 molded integral with the base 11 and a shoulder 173 also molded on the base. At its upper end the slide 151 has an ear 175 formed thereon through an opening in which extends an adjusting screw 177. A threaded portion of the adjusting screw 177 engages a threaded opening in an angular portion 179 of the slide 151 and the reduced inner end of the screw 177 bears in an opening in a rib 181 on the base 11. The adjusting screw 177 extends out through an opening in the top wall of the base 11 and the head of the screw bears against the base. A spring 183 coiled about the screw 177 and compressed between a shoulder 185 on the top wall of the base 11 and the ear 175 of the slide 151 biases the slide 151, the screw 177 and the releasable member 147 downwardly, the position of the parts being determined by the head of the screw 177 bearing against the base 11. Rotation of the adjusting screw 177, due to the engagement of the threaded portion thereof with the portion 179 of the slide 151 will move the slide up or down depending on the direction the screw is rotated. This will cause the latch portion 153 of the releasable member 147 to move relative to the latch portion 100 of the latch 101 thus varying the amount of latch overlap which varies the unlatching time of the releasable member 147.

The releasable member 147 (Fig. 3) is adjusted by means of the adjusting screw 177 to trip and close the circuit to the indicating or signalling device (not shown) before the trip actuator 93 (Fig. 1) is released to trip the breaker. Hence, if an overload current occurs which approaches a dangerous magnitude and trips the releasable signal member 147 (Fig. 3), but which overload current is cleared before it releases the trip actuator 93 (Fig. 1), the releasable member 147 will be actuated by the spring 167 (Fig. 3) and cause the bridging contact 163 to close the signal circuit 169 and energize the indicating or signalling means.

The releasable signal member 147 is reset and relatched following an operation thereof by movement of the handle 65 (Fig. 1) part way toward the "off" position but without moving the handle far enough to cause opening of the breaker. The releasable member 147 is provided with a curved, downwardly extending arm 187 having a cam surface 189 on the lower end thereof which is disposed in the path of opening movement of the projection 77 on the operating handle 65. Upon movement of the handle 65 to an intermediate position, but before it is moved far enough to effect opening of the breaker, the projection 77 engages the cam surface 189 and cams the arm 187 and the releasable member 147 in a counterclockwise direction to permit reengagement of the latch 100 with the latch portion 153 of the releasable member. This action also moves the contact rod 159 down out of engagement with the contact members 169 and effects deenergization of the signal circuit. The operating handle 65 can then be restored to

the closed position without having opened the breaker.

Two or more of the circuit breaker units may be assembled and tied together for unitary operation to control a multi-phase circuit. While only a single pole circuit breaker has been described in detail, the breakers to be assembled are identical, hence, only the means for providing unitary operation of two or more circuit breakers will now be described. When two or more breakers are assembled together a single cover plate 81 is disposed between adjacent breakers and a cover plate is mounted on the outsides of the outer breakers of the group as shown in Figs. 4 and 5 of the drawings. The breakers are secured together by means of a plurality of bolts 191 having nuts 193 on one end thereof two of which bolts pass through openings 195 (Fig. 1) in the bases or housings 11 and corresponding openings in the cover plates 91. The other two bolts pass through the cover plates 81 only, which extend beyond the bases 11 (Fig. 4). As viewed in Fig. 1, the two bolts which pass through the bases 11 are disposed adjacent the right side or handle side of the breaker and the two bolts (not shown in Fig. 1) which engage the covers 81 only are at the left of the breaker as viewed in Fig. 1. The two bolts 191 through the front or handle side of the assembled breakers also serve to secure mounting brackets 197 to opposite sides of the assemblage. The brackets 197 have formed mounting feet 199 thereon for mounting the breaker assemblage in position inside the transformer tank.

The trip members 41 of the breakers are tied together by means of an insulating trip bar 291 (Fig. 1) so that tripping operation of the latch member 41 for one of the breakers in response to an overload current occurring in the related phase circuit will operate the latch members of all of the breakers. The trip bar 291 (Fig. 1) is mounted in a channel-shaped portion 293 formed on the end of each trip bar and secured thereto by means of bolts 295 (only one being shown). The signal circuit for the assembled breakers comprises a pair of conducting rods 297 (Fig. 4) which extend through all of the breakers to be engaged and bridged by the bridging contact 163 of each of the breakers. The conducting rods 297 vary in length according to the number of breakers assembled together.

In order to operate the handles 65 of all of the breakers to simultaneously manually open and close the breakers and to reset the mechanisms of the breakers following an automatic tripping operation the handles 65 are tied together by means of a rod 299 (Figs. 4 and 5) which passes through openings 211 in the handles (Fig. 1). Mounted on the rod 299 is a link 213 which is pivotally connected by a pivot pin 215 to one end of a lever 217. The lever 217 is pivotally mounted by means of a pin 219 on an ear 221 formed integral with the right hand mounting bracket 197 (Figs. 4 and 5) and has an operating rod 223 connected to its other end. The rod 223 extends outside the transformer tank to permit manual operation of the breakers. Operation of the lever 217 will effect manual opening and closing of the contacts of all of the breakers, reset and relatch the mechanisms and reclose the contacts of all of the breakers in the same manner as was described for the single pole unit.

It is at times essential that the service of a transformer be restored, at least temporarily, immediately after the circuit has been opened by

operation of the transformer breaker in response to an overload current. However, there are occasions when it is difficult or impossible to reclose the breaker, especially if the oil has been heated by a long continued overload current or high ambient temperature. This is because the hot oil maintains the bimetal element deflected to its tripping position and the mechanism cannot be relatched. Means is provided for emergency adjustment of the bimetal elements from outside the transformer tank to permit the circuit breaker to be closed and latched immediately after a tripping operation and to permit the breaker to temporarily carry a certain percentage of overload current for a predetermined time. This means comprises the pivoted mounting of the bimetal elements and the adjusting screws 127. Mounted on the adjusting screw or nut 127 for each of the breaker units is an arm 225 (Figs. 1 and 4) of insulating material having an opening making a non-slip but adjustable connection with serrations 226 on the nut 127. The arms 225 are placed over the serrations 226 after the nut has been adjusted to give proper tripping, the serrations permitting the arms to be secured to the nut at the proper angle irrespective of the position to which the nut has been turned. The insulating arms 225 of the breaker units are connected by means of a link 227 for unitary movement and the operating wire 229 of a Bowden cable 229 is attached to one of the several arms 225. The cable 229 is attached by means of a clamp 231 and screw 233 to the housing 11 of one of the circuit breakers. The other end of the cable 229 is attached to an operating arm (not shown) mounted on a shaft (also not shown) on the inside of the transformer tank. This shaft may be mounted in a sealed bearing and extends outside the tank and may have an emergency handle mounted on the outer end thereof.

Operation of the emergency handle and shaft, neither of which are shown, acts through the Bowden cable 229 to simultaneously rotate the arms 225 and the adjusting screws 127 a predetermined distance in a clockwise direction as viewed in Fig. 4. This movement of the adjusting screws 127 each of which threadedly engage a corresponding adjusting rod 125 (only one being shown) causes clockwise rotation of the arm 121 and the yoke 115 upon which the bimetal element 103 is mounted about the pivot 117. This moves the latch portion 109 to latching position even though the bimetal remains in deflected condition and permits relatching of the mechanism and closure of the breakers. This action increases the trip temperature setting of the bimetal element and requires a greater overload to trip the breaker. By this emergency adjustment the breaker will carry a given overload for a predetermined time but will still trip out in response to higher overload or short circuit currents. After the overload has cleared, the emergency adjusting means may be restored to its original position and the transformer placed back in normal use.

The invention provides a circuit breaker embodying a tripping mechanism controlled by a thermally responsive element for effecting opening of the breaker contacts under certain overload current or temperature conditions. There is also provided adjusting means for the thermally responsive element to permit relatching the mechanism when the temperature of the surrounding medium is high and the thermal element is deflected, to provide for emergency service. Means is also provided and controlled by the

thermally responsive element for effecting an external indication of the approach of a dangerous overload or temperature condition less than required to trip the breaker. If the condition which caused the indicating means to function disappears without having tripped the breaker, the indicating means may be reset by partial operation of the breaker operating handle while the breaker contacts remain closed.

Having described the invention in accordance with the provisions of the patent statutes, it is to be understood that various changes and modifications may be made in the structural details thereof without departing from the spirit of the invention.

We claim as our invention:

1. A circuit breaker comprising a housing member of molded insulating material, a stationary contact, a movable switch member having a contact thereon for cooperating with said stationary contact, guide means on said housing member, a part movable with said switch member adapted to be moved along said guide means, an actuating member having one end connected to said switch member, a second guide means on said housing member, the other end of said actuating member being adapted to be moved along said second guide means to effect opening and closing movement of said switch member, spring means connected to move said actuating member, and an operating handle connected to operate said spring means.

2. A circuit breaker comprising a housing member of molded insulating material, a stationary contact, a movable switch member having a contact thereon for cooperating with said stationary contact, guide means molded integral with said housing member, a part movable with said switch member adapted to be moved along said guide means, an actuating member having one end connected to said switch member, a second guide means molded integral with said housing member, the other end of said actuating member being adapted to be moved along said second guide means to effect opening and closing movement of said switch member, spring means connected to move said actuating member, and an operating handle connected to operate said spring means.

3. A circuit breaker comprising a base of molded insulating material, a stationary contact, a movable switch member having a contact thereon for cooperating with said stationary contact, guide means on said insulating base, a part movable with said switch member adapted to be moved along said guide means, an actuating member having one end connected to said switch member, a second guide means on said insulating base, a part on the other end of said actuating member adapted to be moved along said second guide means to effect opening and closing movement of said switch member, an overcenter spring connected to said other end of said actuating member, said overcenter spring being operable to move said actuating member along said second guide means, and an operating handle connected to operate said overcenter spring.

4. A circuit breaker comprising a base of molded insulating material, a stationary contact, a movable switch member having a contact thereon for cooperating with said stationary contact, guide means molded integral with said base, a part movable with said switch member adapted to move along said guide means, an actuating member having one end connected to said switch

member, a second guide means molded integral with said base, a part movable with the other end of said actuating member adapted to move along said second guide means to effect opening and closing movement of said switch member, an overcenter spring connected to said other end of said actuating member, said overcenter spring being operable to move said actuating member along said second guide means, and an operating handle connected to operate said overcenter spring.

5. A circuit breaker comprising a frame, a stationary contact, a movable switch member having a contact thereon for cooperating with said stationary contact, guide means on said frame, a part movable with said switch member adapted to be moved, an actuating member having one end connected to said switch member, a second guide means on said frame, a part movable with the other end of said actuating member adapted to move along said second guide means to effect opening and closing movement of said switch member, an overcenter spring connected to said other end of said actuating member, said overcenter spring being operable to move said actuating member along said second guide means, an operating handle connected to operate said overcenter spring, and a third guide means on said frame, said operating handle being adapted to be moved along said third guide means.

6. A circuit breaker comprising a frame of molded insulating material, a stationary contact, a movable switch member having a contact thereon for cooperating with said stationary contact, guide means molded integral with said frame, a part movable with said switch member adapted to be moved along said guide means, an actuating member having one end connected to said switch member, a second guide means molded integral with said frame, a part movable with the other end of said actuating member adapted to be moved along said second guide means to effect opening and closing movement of said switch member, an overcenter spring connected to said other end of said actuating member, said overcenter spring being operable to move said actuating member along said second guide means, and an operating handle connected to operate said overcenter spring, and a third guide means molded integral with said frame, said operating handle being adapted to be moved along said third guide means to open and close said switch member.

7. A circuit breaker comprising a housing member of molded insulating material, a stationary contact, a floating switch member having a contact on one end thereof for cooperating with said stationary contact, latch means normally releasably engaging and supporting the other end of said floating switch member, guide means on said housing member, a part movable with said switch member adapted to be moved along said guide means, an actuator having one end connected to said switch member, a second guide means on said housing member, a part movable with the other end of said actuator adapted to be moved along said second guide means to effect opening and closing movement of said switch member, an operating handle connected to move said actuator, and a current responsive trip device operable to actuate said latch means to unlatching position to permit movement of said switch member to open position.

8. A circuit breaker comprising a base of molded insulating material, a stationary contact,

a floating switch member having a contact adjacent one end thereof cooperating with said stationary contact, a latch portion normally releasably engaging and supporting the other end of said switch member, a spring having one end attached to the latched end of said floating switch member biasing said switch member in opening direction, guide means molded integral with said base, a part movable with said switch member adapted to be moved along said guide means, an actuator having one end connected to said switch member, a second guide means molded integral with said base, a part movable with the other end of said actuator adapted to be moved along said second guide means to effect opening and closing movement of said switch member, an operating handle connected to move said actuator, and current responsive means operable to actuate said latch portion to unlatching position to permit movement of said switch member to open position.

9. A circuit breaker comprising a housing member of molded insulating material, a stationary contact, a floating switch member having a contact on one end thereof for cooperating with said stationary contact, a latch portion normally releasably engaging and supporting the other end of said switch member, a spring attached to the supported end of said floating switch member biasing said switch member in opening direction, guide means molded integral with said housing member, a part movable with said switch member adapted to be moved along said guide means, an actuator having one end connected to said switch member, a second guide means molded integral with said housing member, a part movable with the other end of said actuator adapted to be moved along said second guide means to effect opening and closing movement of said switch member, an operating handle connected to move said actuator, a third guide means molded integral with said housing member, said operating handle being movable along said third guide means to open and close said switch member, and a current responsive trip device for moving said latch portion to unlatching position to permit said spring to move said switch member to open position.

10. A circuit breaker comprising a base of molded insulating material, a movable switch arm having a contact on one end thereof, a latch normally releasably engaging and supporting the other end of said switch arm, means on said base defining a guide for said switch arm, a member on said switch arm cooperating with said guide for controlling the position of said switch arm in the closed position and for guiding the opening and closing movement of said switch arm, operating mechanism for said switch arm comprising a link having guide means on one end and having the other end pivotally connected to said switch arm, a guide surface on said base for guiding the movement of said one end of said link, an operating handle, and an overcenter spring operable by said handle to cause movement of said guide means along said guide surface to effect opening and closing movement of said switch arm.

11. A circuit breaker comprising a frame of molded insulating material, a movable switch arm having a contact on one end thereof, a latch portion normally releasably engaging and supporting the other end of said switch arm, a spring biasing the supported end of said switch arm in opening direction, means on said frame defining

a guide for said switch arm, a member on said switch arm cooperating with said guide for controlling the position of said switch arm in the closed position and for guiding the opening and closing movement of said switch arm, operating mechanism for said switch arm comprising a link having guide means on one end and having the other end pivotally connected to said switch arm, a guide surface on said frame for guiding the movement of said one end of said link, an operating handle, an overcenter spring operable by said handle to cause movement of said guide means along said guide surface to effect opening and closing movement of said switch arm, and a trip element operable to move said latch portion to unlatching position to permit automatic movement of said switch arm to open position.

12. A circuit breaker comprising a housing member of insulating material having a partition wall therein, a movable switch arm having a contact on one end thereof, a latch normally releasably engaging and supporting the other end of said switch arm, means on said partition wall defining a guide for said switch arm, a member on said switch arm extending through said partition wall and coacting with said guide for positioning said switch arm in the closed position and for controlling the movement of said switch arm, operating mechanism for said switch arm comprising an operating handle, an overcenter spring connected to be operated by said handle to cause opening and closing movement of said switch arm, a link having one end connected to said overcenter spring and the other end pivotally connected to said switch arm, and guide means on said partition wall, a part movable with said one end of said link cooperating with said guide means for guiding the movement of said one end of said link to effect opening and closing movement of said switch arm.

13. A circuit breaker comprising a housing member of insulating material having a partition wall therein, a movable switch arm having a contact on one end thereof, a latch normally releasably engaging and supporting the other end of said switch arm, means on said partition wall defining a guide for said switch arm, a member on said switch arm coacting with said guide for positioning said switch arm in the closed position and for controlling the movement of said switch arm, operating mechanism for said switch arm comprising an operating handle, a surface on said housing, said handle being adapted to be moved along said surface, a pair of overcenter springs on opposite sides of said partition wall connected to be operated by said handle to cause opening and closing movement of said switch arm, a link having one end connected to said pair of overcenter springs and the other end pivotally connected to said switch arm, and guide means on said partition wall, a part movable with said one end of said link cooperating with said guide means for guiding the movement of said one end of said link to effect opening and closing movement of said switch arm.

14. A circuit breaker comprising a housing of insulating material having a partition wall therein, a movable switch arm having a contact on one end thereof, a latch normally releasably engaging and supporting the other end of said switch arm, means on said partition wall defining a guide for said switch arm, a member on said switch arm coacting with said guide for positioning said switch arm in the closed position and for controlling the movement of said switch arm, oper-

ating mechanism for said switch arm comprising an operating handle, an overcenter spring connected to be operated by said handle to cause opening and closing movement of said switch arm, a pair of links on opposite sides of said partition wall, a member extending through said partition wall connecting one end of said links together and to said overcenter spring, the other end of said links being pivotally connected to said switch arm, and guide means on said partition wall cooperating with said member extending through the partition wall for guiding the movement of said one end of said links to effect opening and closing movement of said switch arm, and a trip device operable in response to overload currents to cause said latch to release said switch arm and effect automatic opening movement of said switch arm.

15. In a circuit breaker comprising a housing of molded insulating material, a switch member, operating mechanism for effecting movement of said switch member to open and closed positions, an operating handle slidable on a surface on said housing, an auxiliary device, a plurality of members movable from a normal position to an operating position, one of said members when moved being connected to actuate said auxiliary device and the other member when moved being operative to effect movement of said switch member to open position, a trip device operable to effect movement of said one member to actuate said auxiliary device and further operable to effect movement of said other member to thereby effect opening movement of said switch member, and said handle when moved a predetermined distance engaging and resetting said one member while said switch member remains in closed position.

16. In a circuit breaker comprising a housing of molded insulating material, a movable switch member, operating mechanism for effecting movement of said switch member to open and closed positions including an operating handle, a surface on said housing, said handle being adapted to be slidably moved along said surface to open and closed positions, spaced conductors supported in said housing, a plurality of members movable from a normal position to an operating position, a bridging contact member connected to be operated by one of said members, said one member when moved moving said bridging contact member into bridging contact with said spaced conductors, the other of said members when moved being operative to effect movement of said switch member to open position, said handle when slidably moved a predetermined distance along said surface engaging and resetting said one member to effect disengagement of said bridging contact member from said spaced conductors while said switch member remains in closed position.

17. In a circuit breaker comprising a housing of molded insulating material, relatively movable contacts and operating mechanism therefor, an operating handle of insulating material slidable on a surface molded integral with said housing, a releasable trip member operative when released to effect automatic opening of said contacts, a trip device comprising a bimetal element operable in response to overload currents of predetermined value to release said trip member, a pair of spaced conductors supported in said housing, a biased member releasable by said bimetal element in response to overload currents of lesser magnitude, a bridging contact member operable

by said biased releasable member into bridging engagement with said spaced conductors, a slidable member pivotally supporting said releasable member, means molded integral with said housing defining a channel for slidably supporting said slidable member, adjusting means for slidably moving said slidable member to move said releasable member relative to said bimetal element to thereby vary the overload current required to release said releasable member, and a projection on said releasable member disposed in the path of movement of said handle and engageable by said handle when said handle is moved a predetermined distance in opening direction to reset and relatch said releasable member.

18. A multi-pole circuit breaker comprising a floating switch arm for each pole, each of said switch arms having a contact on one end and a latch releasably supporting the other end, a releasable trip member for each pole operable when released to engage and actuate the latch for the associated pole and permit opening movement of the corresponding switch arm, a trip bar interconnecting the latches for all of said poles so that upon release of the trip member for any one of said poles the latches of all of said poles will be operated to effect release of all of said switch arms, a bimetal element for each pole heated in response to overload currents in the circuit of the associated pole and operable when heated a predetermined amount to release the corresponding trip member, adjusting means for each of said bimetal elements, and means interconnecting the adjusting means for all of said poles for effecting simultaneous adjustment of all of said bimetal elements.

19. A multi-pole circuit breaker comprising a floating switch arm for each pole, each of said switch arms having a contact on one end and a latch releasably supporting the other end, a releasable trip member for each pole operable when released to engage and actuate the latch for the associated pole and permit opening movement of the corresponding switch arm, a trip bar interconnecting the latches for all of said poles so that upon release of the trip member for any one of said poles the latches of all of said poles will be operated to effect release of all of said switch arms, a bimetal element for each pole heated in response to overload currents in the circuit of the associated pole and operable when heated a predetermined amount to release the corresponding trip member, adjusting means for each of said bimetal elements, and means interconnecting the adjusting means for all of said poles for effecting simultaneous adjustment of all of said bimetal elements to permit said trip members to be reset and permit said switch arms to be closed while said bimetal elements are hot.

20. In a circuit breaker comprising a switch member and operating mechanism for moving said switch member to open and closed circuit positions, an auxiliary device, a plurality of members each having a latch portion thereon and each being movable from a normal position to an operating position, one of said members when moved actuating said auxiliary device, and the other of said members when moved causing automatic movement of said switch member to open position, a bimetal element having latch means thereon normally engaging the latch portions of said members to restrain said members against movement, said bimetal element being operable in response to overload currents of pre-

15

determined value to release said one member and further operable in response to overload currents above said predetermined value to release said other member, adjusting means for adjusting said one member relative to said bimetal element to vary the magnitude of overload current required to release said one member, and adjusting means for adjusting said bimetal element to vary the magnitude of overload current required to release said other member.

21. In a circuit breaker, a trip device comprising two latch members, a single bimetal element engaging and releasably restraining said latch members, an auxiliary device, one of said latch

16

members when released actuating said auxiliary device and the other latch member when released causing automatic opening of said breaker, adjusting means for adjusting one only of said latch members, and separate adjusting means for adjusting said bimetal element to vary the time said bimetal will release said latch members.

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