July 14, 1936. C. H. HILL 2,047,824

CIRCUIT BREAKER

Filed April 25, 1935 2 Sheets-Sheet 1

Fig. 1.

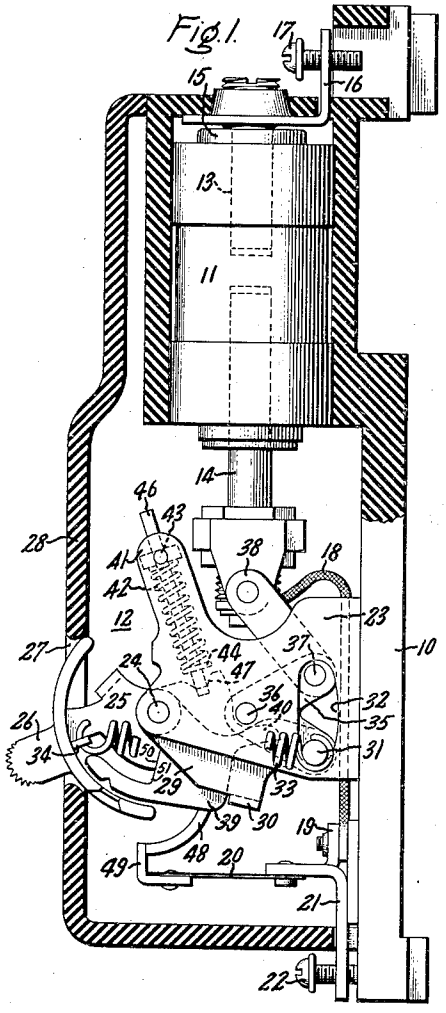


Fig. 2.

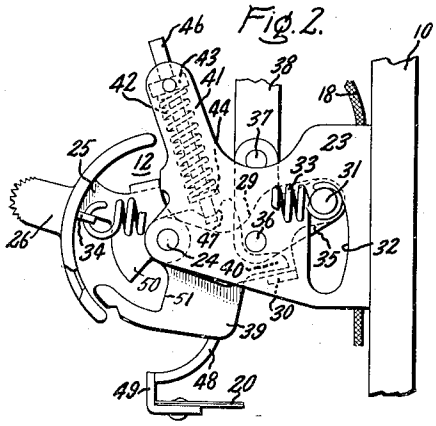
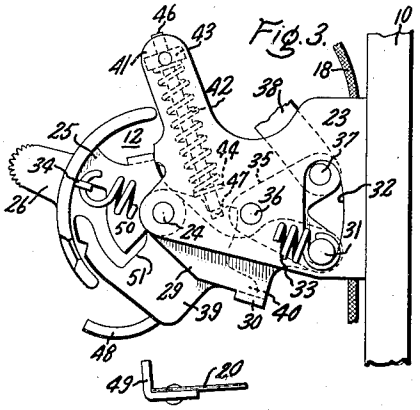


Fig. 3.



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Fig. 4.

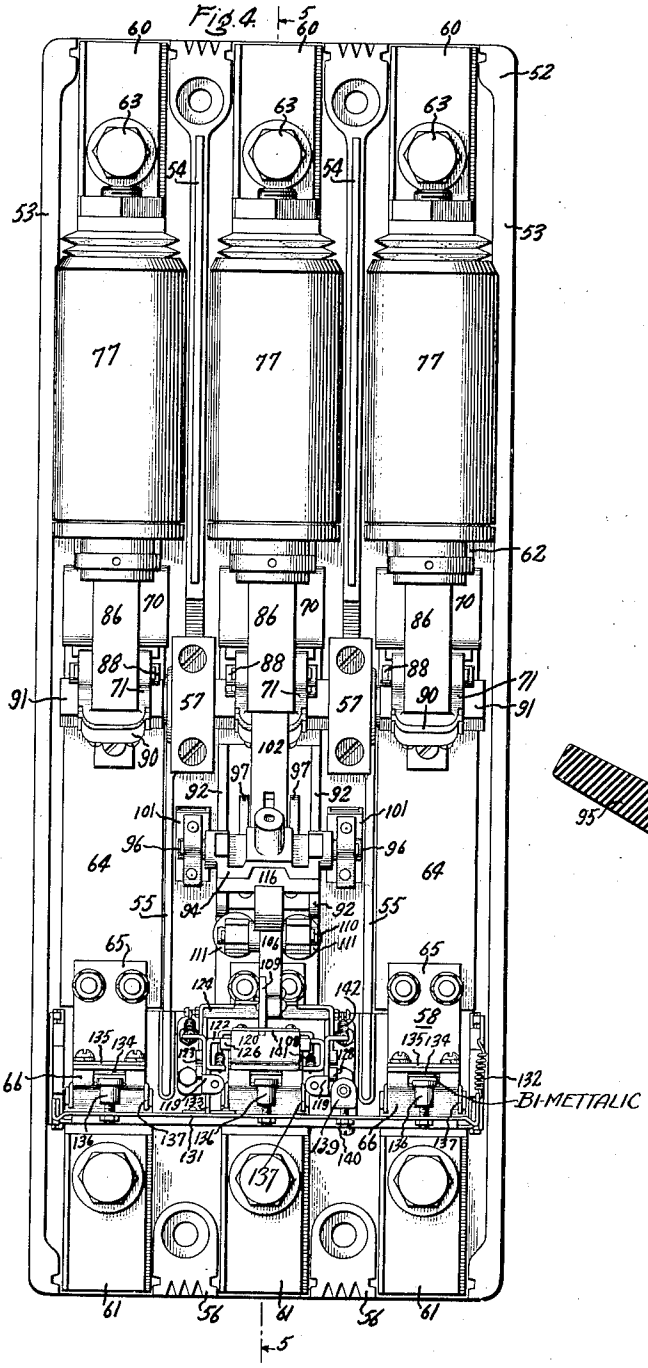
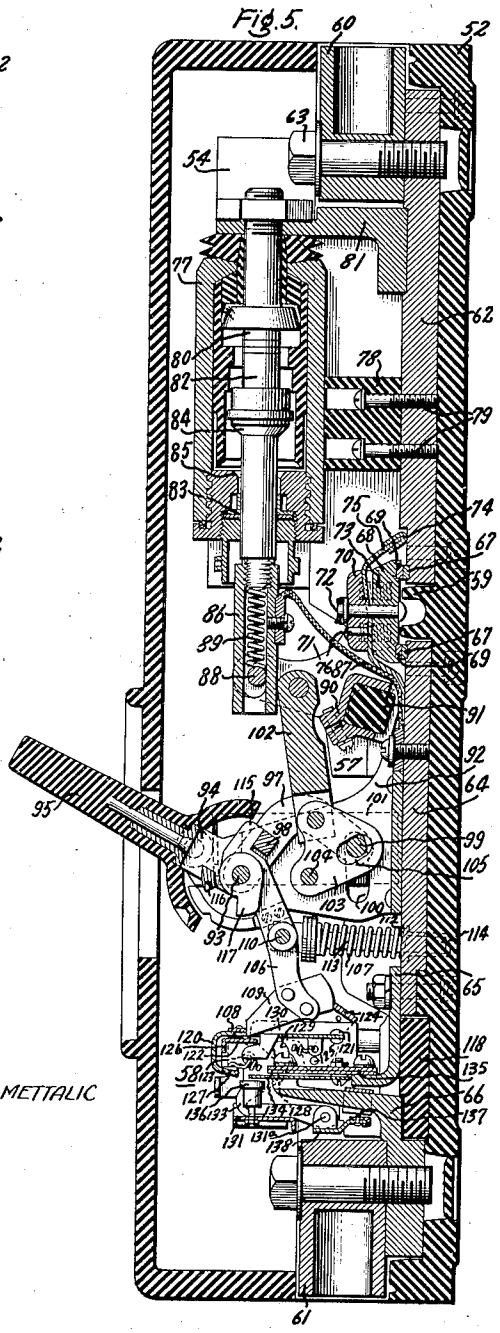


Fig. 5.



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UNITED STATES PATENT OFFICE

2,047,824

CIRCUIT BREAKER

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Application April 25, 1935, Serial No. 18,127

7 Claims. (Cl. 200—116)

My invention relates to circuit breakers, more particularly to circuit breakers of the trip-free type in which the circuit controlling contacts are manually operable between open and closed circuit positions and are automatically operable to open circuit position upon the occurrence of predetermined abnormal current conditions, and has for an object the provision of a circuit breaker of this type which is simple and reliable in its operation and inexpensive to construct.

It has heretofore been proposed to provide circuit breakers of this general type with suitable explosion proof, arc extinguishing devices so as to combine the protective features of a fuse and the advantages of a manually operable switch, and such circuit breakers have found considerable application in the control of distribution and feeder circuits. When applied to the control of circuits of this type, especially in industrial applications, the circuit breaker is often required to carry normal currents of considerable magnitude and to interrupt extremely large currents in case a fault or short circuit occurs in the system. The circuit breaker must therefore be provided with conducting and interrupting elements of considerable size and the circuit breaker operating mechanism must be strong and rugged, which necessitates the use of heavy operating springs.

The forces exerted on the movable contacts of the circuit breaker due to large currents flowing therethrough tend to separate the contacts and may be of such magnitude as to render impracticable the provision of operating springs of sufficient strength to maintain satisfactory contact pressures at the end of the closing stroke. Much is yet to be desired, therefore, in a circuit breaker of this type which is strong and rugged enough to withstand the severe operating conditions encountered and which will quickly interrupt currents of considerable magnitude without loud explosions or destructive arcing. Accordingly, it is a further object of my invention to provide a heavy duty circuit breaker of this type having an operating mechanism which is strong and rugged in its construction, which will maintain good contact pressures when the circuit breaker contacts are in the closed circuit position and which is reliable in its operation.

In carrying out my invention in one form, I provide a circuit breaker comprising relatively movable contacts and an operating mechanism therefor which includes a manually operable mechanism of rugged construction for moving the contacts between open and closed circuit positions with a snap action, and current-responsive means including a normally latched tripping arm biased by suitable tripping springs for operating the contacts to open circuit position upon the occurrence of abnormal current conditions. More specifically, I provide a strong and rugged operating mechanism including a pair of toggle links, one of which is a substantially triangular or three-point link arranged to act as a crank to make or break the toggle when rotated about its pivot. Overcenter spring means are provided for rotating the crank to operate the toggle, and automatic tripping means are provided for rotating the crank against the force exerted by the overcenter springs to break the toggle and operate the contacts to the open circuit position upon the occurrence of abnormal current conditions.

For a more complete understanding of my invention, reference should now be had to the drawings in which Fig. 1 is an elevational view, partly in section, of a circuit breaker embodying my invention; Figs. 2 and 3 are fragmentary views of the circuit breaker shown in Fig. 1, illustrating the operating mechanism in different operating positions; Fig. 4 is a plan view of a preferred type of circuit breaker embodying my invention, the cover of the circuit breaker and certain parts thereof being removed to show the operating mechanism; and Fig. 5 is a sectional view taken along the line 5—5 in Fig. 4.

Referring now to Figs. 1, 2, and 3 of the drawings, I have shown my invention in one form as applied to a circuit breaker comprising a base 10 of molded insulation for supporting a compression chamber, arc-extinguishing device 11 and an operating mechanism indicated generally by the reference numeral 12. The compression chamber 11 is preferably of the type described and claimed in a copending application of Ludwig S. Walle, Serial No. 667,856, filed April 25, 1933, entitled "Circuit breakers" which application is assigned to the same assignee as the present invention, and for the purposes of the present invention this arc extinguishing device may be described as comprising walls of pressure-resistant material enclosing a fixed contact 13 and a reciprocally movable contact 14. As shown, the fixed contact 13 is supported by an insulating bushing 15 and is electrically connected by means of a conductor 16 to a terminal screw 17. The reciprocal contact 14 is slidably supported in the opposite end wall of the compression chamber and is electrically connected by means of a flexible conductor 18 and an L-shaped conductor 19 to one leg of a U-shaped bimetallic element 20,

the other leg of which is connected by a conductor 21 to a terminal screw 22.

My improved operating mechanism 12 is supported on a U-shaped frame 23 secured in any suitable manner to the base 10. Pivotally mounted on a pin 24 carried by the frame 23 is an operating member 25 provided with an insulated handle 26 arranged to extend through an aperture 27 in the circuit breaker cover 28. Also pivoted on the pin 24 is a pair of spaced parallel arms 29 connected together intermediate their ends by a cross member 30, the adjacent ends of the parallel arms remote from the pivot pin 24 carrying an operating pin 31, the opposite ends of which extend through slots 32 in the frame 23. The end walls of the slots 32 form stops for the pin 31 in its two positions.

In order to operate the pin 31 and the arms 29 with a snap action, I provide a pair of overcenter springs 33, one only of which is shown, arranged outside of and on opposite sides of the U-shaped frame 23, one end of each spring being connected to a lug 34 extending laterally outward from the operating member 25 and the opposite end of each spring being connected to the operating pin 31. As shown, the operating pin 31 is connected to a substantially triangular or three-point link 35 which is pivoted on a pin 36 supported by one side of the frame 23 and connected by means of a pin 37 to a second link 38, the opposite end of which is suitably connected to the reciprocal contact 14. The pin 36 extends inwardly from one side of the frame 23 a short distance only and the arms 29 are arranged to move past the extending end of the pin 36 to the position shown in Fig. 2 as hereinafter described.

It will be apparent that when the insulated handle 26 is moved toward the interrupting device 11 to rotate the operating member 25 about the pivot 24 in a clockwise direction as viewed in the drawings, the springs 33 will move overcenter relative to the pivot 24, and the arms 29 and the pin 31 carried thereby will be operated with a snap action to the position shown in Fig. 2, the pin 31 being brought to rest in engagement with the right hand end walls of the slots 32, whereby the link 35 is rotated about the pivot 36 and acts as a crank to make the toggle composed of the links 35 and 38 and thereby move the reciprocal contact 14 to the closed circuit position. Similarly, when the handle 26 is moved away from the arc-extinguishing device 11, the link 35 will be rotated in the opposite direction about the pivot 36 to break the toggle and move the reciprocal contact 14 to open circuit position.

As shown in Fig. 2, when the circuit breaker contacts are in the closed circuit position, the toggle links 35 and 38 are in straight-line relation so that any force exerted on the reciprocal contact 14 tending to open the contacts will be exerted directly on the pin 36 rather than on the overcenter springs 33, and the contact pressure will thus be maintained.

The circuit breaker is also adapted for automatic operation to open the circuit upon the occurrence of predetermined abnormal current conditions and accordingly, I provide a tripping member 39 pivotally mounted on the pin 24 and provided with a portion 40 which extends adjacent the cross member 30 on the parallel arms 29 when the circuit breaker is in the closed circuit position shown in Fig. 2. As shown, the frame 23 is provided with a pair of outwardly extending portions 41, one on each upstanding leg, between which I provide a tripping spring 42, one end of which bears against a cross member 43 extending between the frame portions 41 and the other end of which engages a stop plate 44 carried by a push rod 46, which rod extends through the spring 42 and is slidably guided in the cross member 43. The end of the push rod 46 engages a notch 47 in the tripping member 39 and the spring 42 is normally maintained under compression by a latch 48 carried by the tripping member 39 and arranged to engage a latch plate 49 secured to the free end of the bimetallic element 20.

So long as normal current is flowing in the circuit breaker, the latch 48 will engage the latch plate 49 as shown in Figs. 1 and 2, and the tripping member 39 will be held against the force exerted by the tripping spring 42, and it will be observed that when the tripping member is in this latched position, the arms 29 and the operating pin 31 may be operated between open and closed circuit positions without engaging the extending portion 40 on the tripping member. Upon the occurrence of abnormal current conditions, however, the bimetallic element 20 will be heated sufficiently to move the latch plate 49 out of engagement with the latch 48 whereupon the tripping spring 42 will quickly move the tripping member 39 in a clockwise direction about the pivot 24, and the extending portion 40 thereof will engage the cross bar 30 and move the arms 29 and the operating pin 31 to the position shown in Fig. 3 against the force exerted by the overcenter springs 33, thereby rotating the link 35 to break the toggle and open the circuit breaker contacts.

In order to reclose the circuit breaker after it has been opened automatically by the tripping member 39, it is necessary first to move the operating handle 26 from the position shown in Fig. 3 to the position shown in Fig. 1, during which movement a portion 50 on the operating member 25 will engage a shoulder 51 on the tripping member 39 to return the tripping member to the position shown in Figs. 1 and 2 against the force exerted by the tripping spring 42. If the bimetallic element 20 has cooled sufficiently to permit the latch 48 to engage the latch plate 49, the circuit breaker may be closed by moving the handle 26 to the position shown in Fig. 2.

Referring now to Figs. 4 and 5, I have shown a preferred form of operating mechanism embodying my invention applied to a multipole circuit breaker of the type described and claimed in a copending application of Winfield A. Atwood, Serial No. 18,138, filed April 25, 1935, which application is assigned to the same assignee as the present invention. This circuit breaker comprises a base 52 of molded insulation provided with a pair of side walls 53 and a plurality of intermediate walls 54, 55 and 56 arranged to form a plurality of conductor receiving compartments extending lengthwise of the base. Each of the walls 54 extends from the uppermost end of the circuit breaker, as viewed in Figs. 4 and 5, to a point adjacent one of a pair of bearing blocks 57, the purpose of which will be fully set forth later; each of the walls 55 extends from one of the bearing blocks 57 to a point adjacent a unitary trip device indicated generally by the reference numeral 58, and each of the walls 56 extends from the lowermost end of the circuit breaker to a point adjacent the other side of the trip device 58. Intermediate the ends of each conductor re-

ceiving compartment, a cross wall 59 is provided formed integrally with the base 52.

Each conductor receiving compartment is provided at its opposite ends with the terminal members 60 and 61, respectively, and the arrangement of the conductor members and the circuit controlling contacts for completing an electric circuit therebetween being the same in each compartment, only one such arrangement will be described.

Extending from the terminal member 60 along the base 52 to the cross wall 59 is a conductor bar 62 rigidly fastened to the base in any suitable manner and connected to the terminal member 60 by a bolt 63. Disposed on the opposite side of the cross wall 59 and extending therefrom along the base 52 to the trip device 58 is a second conductor bar 64 also rigidly fastened to the base. It will be observed that the trip device 58 includes a pair of conductors 65 and 66 which are respectively connected as shown to one end of the conductor bar 64 and to the terminal 61. The respective ends of the conductor bars 62 and 64 which are disposed adjacent the cross wall 59 are provided with contact portions 67, and a movable bridging member 68 carrying cooperating contact portions 69 is arranged to span the cross wall 59.

Each of the bridging members 68 nests within the legs of a U-shaped carrier 70 formed on one arm of a bifurcated lever 71 and is supported by a bolt 72 extending therethrough, a plurality of springs 73 being arranged in aligned recesses in the bridging member and the carrier to provide uniform contact pressure. In order to reduce blistering and arcing at the contacts 67 and 69, each bridging member is provided with an arcing tip or contact 74 secured to one end of a conductor spring 75 arranged in a slot in the carrier 70 and secured thereto by a rivet 76. As shown, the end of the spring 75 which is remote from the contact 74 is electrically connected to the conductor bar 64, and the contact 74 is arranged to engage the conductor bar 62 to provide a shunt circuit around the bridging member 68, the conducting spring 75 being arranged so that when the bifurcated lever 71 is operated to move the bridging member to its open circuit position, the contact 74 will not be disengaged from the conductor bar 62 until after the contacts 67 and 69 have separated, and when the bridging member is moved to its closed circuit position the contacts 67 and 69 will not engage until after the contact 74 has engaged the conductor 62.

In order to provide for the interruption of heavy currents without loud explosions or arcing, each pole of the circuit breaker is provided with an arc extinguishing device connected in parallel circuit relation with the bridging member 68, which device is preferably of the type described and claimed in a copending application of Ludwig S. Walle, Serial No. 4,448, filed February 1, 1935, which application is assigned to the same assignee as the present invention. For present purposes this arc extinguishing device may be described as comprising a compression chamber, the body portion of which comprises a cylinder 77 supported on an insulating support 78 which is secured to the conductor bar 62 by a plurality of screws 79.

The cylinder 77 is provided with suitable end closures as shown, a fixed contact 80 extending through one end thereof and being electrically connected to the conductor bar 62 by an L-shaped conductor 81. As shown, the arc extinguishing device also includes a reciprocal contact 82 which slidably extends through the opposite end wall of the compression chamber and is provided with sealing means for substantially gas-tightly sealing the compression chamber. The sealing means comprise a plurality of washers 83 formed of suitable flexible material such as leather, and valve means comprising a shoulder 84 formed on the movable contact 82 and arranged to engage a valve seat 85 in the end wall of the compression chamber. Threadedly connected to the extending end of the movable contact 82 is an extension 86 which is electrically connected by a flexible conductor 87 to the conductor bar 64.

It will be observed that the relatively reciprocal contacts 80 and 82 are connected in parallel circuit relation with the bridging member 68 and the intermediate shunt circuit comprising the arcing contact 74, and in order that the final circuit-breaking action may take place within the compression chamber so as to prevent arcing at the bridging member, the other arm of the bifurcated lever 71 is connected to the reciprocal contact 82 by means of a resilient lost-motion connection which includes a pin 88 carried by the bifurcated lever and extending through a slot in the extension 86, a suitable spring 89 being arranged within the extension 86 with its respective ends bearing against the movable contact 82 and the pin 88. This lost-motion connection is so proportioned that when the bifurcated lever 71 is moved between open and closed circuit position, the circuit through the compression chamber will be opened subsequent to the intermediate circuit through the arcing contact 74 and will be closed prior to the closing of the intermediate shunt circuit.

In order that all of the poles of the circuit breaker may be operated simultaneously by a single operating mechanism, each of the bifurcated levers 71 is provided with a clamping portion 90 arranged to engage an insulated crossbar 91 which extends across the three poles of the circuit breaker and is journaled in the before-mentioned bearing blocks 57. Arranged in one of the conductor receiving compartments adjacent the crossbar 91 is the circuit breaker operating mechanism which includes a U-shaped frame 92 which is secured to one of the conductor bars 64. Pivotally mounted on a pin 93 carried by the frame 92 is an operating element 94 provided with an insulated operating handle 95 arranged to extend through a suitable aperture in the circuit breaker cover. The operating element 94 nests within the U-shaped frame 92 and is provided with the extending portions 96 which extend laterally beyond the legs of the frame. Also pivoted on the pin 93 is a pair of spaced parallel arms 97 connected together intermediate their ends by a cross member 98, the adjacent ends of the arms 97 opposite from the pin 93 carrying an operating pin 99 the respective ends of which extend through slots 100 in the frame 92. Connected between the extending ends of the pin 99 and the extending portions 96 of the operating element 94 is a pair of overcenter spring devices 101, the constructional details of which are fully described in the above referred to Atwood application.

Connected between the operating pin 99 and one of the bifurcated levers 71 is a toggle mechanism comprising a link 102, one end of which engages the bifurcated lever 71 and the other end of which is pivoted to a second link 103 pivotally

supported on a pin 104 and provided with a slot 105 through which the operating pin 99 extends. The link 103 as shown is a substantially triangular link similar to the link 35 described in connection with Figs. 1, 2, and 3.

In Fig 5, the circuit breaker is shown in the closed circuit position, and it will be apparent that when the operating handle 95 is moved to rotate the operating element 94 about the pivot 93, the operating mechanism will function as described in connection with Figs. 1, 2, and 3, to make and break the toggle with a snap action whereby the insulated crossbar 91 will be rotated to move the circuit breaker contacts between open and closed circuit position.

The automatic tripping mechanism in this embodiment of my invention comprises a pivoted tripping member 106 and a pair of tripping springs 107, the operation of which is controlled by the trip device 58 in a manner to be more fully described. The trip device 58 includes a latch 108 arranged normally to engage a latch finger 109 secured to one end of the tripping member 106, the other end of the tripping member being pivotally supported on the pin 93. Intermediate its ends the tripping member 106 is provided with a pin 110, each extending end of which carries a bearing plate 111 arranged to engage an end of one of the tripping springs 107, the opposite ends of which rest in depressions 112 in the conductor bar 64. Each bearing plate 111 carries a guide rod 113 which extends through the associated tripping spring into a drilled hole 114 which extends through the conductor bar 64 and into the base member 52.

In the closed circuit position of the circuit breaker shown in Fig. 5, it will be seen that the cross member 98 which extends between the parallel arms 97 is engaged by an extending portion 115 on the tripping member 106. Upon the occurrence of abnormal current conditions, the latch 108 of the trip device 58 will be moved in a manner to be fully described, to release the latch finger 109 whereupon the tripping springs 107 will quickly move the tripping member 106 about the pivot 93 in a clockwise direction as viewed in the drawings, to move the arms 97 and the operating pin 99 downwardly and rotate the link 103 about its pivot 104 in a clockwise direction against the force exerted by the overcenter spring devices 101 whereby the toggle is broken and the circuit breaker contacts are operated to the open circuit position.

The circuit breaker may be reclosed after an automatic operation to the open circuit position exactly as described in connection with the circuit breakers shown in Figs. 1, 2, and 3, the operating element 94 being provided with a portion 116 arranged to engage a cooperating portion 117 on the tripping member 106.

It will be apparent that in a heavy duty circuit breaker of this type, the tripping springs 107 must exert a force of considerable magnitude and, therefore, it is necessary to provide a rugged trip device for normally latching the tripping member 106 against the force exerted by the springs. Accordingly, the trip device 58 is preferably of the type described and claimed in a copending application of John L. Lappin, Serial No. 4,659, filed February 2, 1935, entitled "Circuit breakers" which application is assigned to the same assignee as the present invention.

This trip device may be described for the purposes of the present application as comprising a subbase 118 which is preferably formed separate from, and rigidly secured to the base 52. Supported centrally of the subbase 118 is a frame having a pair of spaced walls 119 between which are supported a latch plate 120 pivoted at 121, a U-shaped impact member 122 pivoted at 123 and a U-shaped reset member 124 pivoted at 125. The latch plate 120 carries the previously referred to latch 108, and the U-shaped impact member 122 is overturned to provide a striking surface 126 for engaging a portion 127 of the latch plate to impart a hammerlike blow thereto. Each leg of the impact member 122 carries a pin 128 extending through a slot 129 in one of the supporting walls 119 and arranged to engage a cam finger 130 provided on the U-shaped reset member 124, the yoke portion of which is interposed in the path of the tripping member 106. The impact member 122 is normally held in the position shown in Fig. 5 by a trip bar 131 which extends across the three conductor receiving compartments of the circuit breaker and is pivoted on pins 131*a*, the trip bar being normally biased by a spring 132 (Fig. 4) into engagement with a finger 133 carried by the impact member.

Associated with the conductors in each conductor receiving compartment of the circuit breaker is a thermal and a magnetic device for moving the trip bar 131 about its pivot, to release the impact member 122 upon the occurrence of abnormal current conditions. Each thermal device comprises a bimetallic element 134, one end of which is fastened to and adapted to be heated by a heater strip 135, the ends of which are respectively connected to the previously referred to conductors 65 and 66 in the circuit extending between the terminal members 60 and 61. The other end of the bimetallic element 134 is arranged adjacent an adjustable insulating button 136 secured to the trip bar 131, and it will be apparent that when the bimetallic element 135 is heated sufficiently upon the occurrence of an overload, the bimetallic element will flex and engage the button 136 to move the trip bar 131 about its pivot.

Each of the magnetic devices comprises a U-shaped magnetic member 137 which partially encircles one of the conductors 66 so that a magnetic flux will be induced in the member 137 upon the flow of current through the conductor. Arranged adjacent the U-shaped magnetic members 137 is a common armature 138 also pivoted on the pins 131*a*, which armature extends across the three conductor receiving compartments and is provided with an extending finger 139 (Fig. 4) arranged to engage an adjustable screw 140 extending from the pivoted trip bar 131, to move the trip bar upon the occurrence of a sufficiently high overload in one or more of the circuit breaker poles to cause the armature to be attracted by one or more of the U-shaped magnetic members 137.

It will be apparent that upon the occurrence of abnormal current conditions the trip bar 131 will be moved either by the thermal or by the magnetic means, depending upon the character of the abnormal current conditions, to release the impact member 122 for operation in a counterclockwise direction about its pivot 123 by suitable biasing springs 141, to strike the latch plate 120 a hammerlike blow and release the tripping member 106. When the tripping member 106 is moved to tripping position by the tripping springs 107, the U-shaped reset member 124 will be released for operation in a counterclockwise direction about its pivot 125 under the force exerted by suitable resetting springs 142 (Fig. 4), and the

cam fingers 130 will thereupon engage the pins 128 extending from the impact member 122 to return the impact member to its normal position.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A circuit breaker comprising a pair of relatively movable contacts, a frame, an operating member pivotally supported on said frame, a contact actuating toggle having one end operatively connected to one of said contacts and the other end pivoted on said frame, overcenter spring means connected to said operating member for exerting a force on the knee point of said toggle for making and breaking said toggle to actuate said one contact between open and closed circuit positions with a snap action, a tripping arm pivotally mounted on said frame, means including a tripping spring for biasing said tripping arm from one position to a second position, means including a latch for normally restraining said tripping arm in said one position, means for releasing said latch, and means responsive to movement of said tripping arm to said second position for breaking said toggle against the force exerted by said overcenter spring means.

2. A circuit breaker comprising a pair of relatively movable contacts, a frame, an operating member pivotally supported on said frame, a contact actuating toggle having one end operatively connected to one of said contacts and the other end pivoted on said frame, overcenter spring means connected to said operating member for exerting a force on the knee point of said toggle for making and breaking said toggle to actuate said one contact between open and closed circuit positions with a snap action, a tripping arm pivotally mounted on said frame, means including a tripping spring for biasing said tripping arm from one position to a second position, overload current responsive means for normally restraining said tripping arm in said one position and for releasing said tripping arm upon the occurrence of predetermined abnormal current conditions, and means operated by movement of said tripping arm to said second position for breaking said toggle against the force exerted by said overcenter spring means.

3. A circuit breaker comprising a pair of relatively movable contacts, a frame, an operating member pivotally supported on said frame, a contact actuating toggle having one end operatively connected to one of said contacts and the other end pivoted on said frame, one link of said toggle comprising a crank lever, overcenter spring means connected between said operating member and said crank lever for making and breaking said toggle to actuate said one contact between open and closed circuit positions with a snap action, a pivoted tripping arm normally biased from one position to a second position, means including a latch for normally holding said tripping arm in said one position against said bias, means for releasing said latch, and means operated by movement of said tripping arm to said second position for moving said crank lever against the force exerted by said overcenter spring to break said toggle.

4. A circuit breaker comprising a pair of relatively movable contacts, a frame, an operating member pivotally supported on said frame, an arm having an end thereof pivoted on said frame, a substantially triangular link pivoted on said frame and operatively engaging the free end of said arm, a second link pivotally engaging said triangular link and operatively connected to one of said contacts, said two links forming a contact actuating toggle, overcenter spring means connected between said operating member and said arm for making and breaking said toggle to actuate said one contact between open and closed circuit position, a tripping member provided with a portion adapted to engage said arm, a tripping spring normally biasing said tripping member from one position to a second position, means including a latch for holding said tripping member in said one position, and means for releasing said latch whereby said tripping member is operated to said second position by said tripping spring to operate said arm and break said toggle against the force exerted by said overcenter means.

5. A circuit breaker comprising a pair of relatively movable contacts, an operating mechanism comprising a U-shaped frame, an operating member pivotally supported on said frame, a pair of spaced parallel arms having adjacent ends pivotally supported on said frame, an operating pin carried by the other ends of said arms, a three-point link pivotally supported by said frame and engaging said operating pin, a second link operatively connected to one of said contacts and to said three-point link to form a toggle, overcenter spring means connected between said operating member and said operating pin for making and breaking said toggle to move said one contact between open and closed circuit position, a tripping arm pivotally supported on said frame, spring means normally biasing said tripping arm from one position to a second position, means including a latch for normally holding said tripping arm in said one position, and current responsive means for releasing said latch whereby said tripping arm is moved to said second position by said spring means, a portion of said tripping arm being disposed to engage said parallel arms to move said operating pin and break said toggle against the toggle making force exerted by said overcenter springs.

6. A circuit breaker comprising a pair of relatively movable contacts, an operating mechanism comprising a U-shaped frame having a pivot extending between the legs thereof, an operating member mounted on said pivot between said legs, portions of said operating member extending beyond said legs, a pair of spaced parallel arms having adjacent ends mounted on said pivot, an operating pin supported by said arms adjacent the other ends thereof, the ends of said operating pin extending through slots in said legs of said frame, a second pivot supported by said frame, a crank lever mounted on said second pivot having a portion thereof engaging said operating pin, a link operatively connected to said crank lever and to one of said contacts, said link and said crank lever forming a contact actuating toggle, a pair of overcenter springs arranged outside of said U-shaped frame the respective ends thereof being connected to the ends of said operating pin and to said extending portions of said operating member for moving said pin to make and break said toggle with a snap action, and current responsive means including spring biased tripping means for moving said pin

against the force exerted by said overcenter spring means to break said toggle and open said contacts independently of said overcenter springs.

7. A circuit breaker comprising a pair of relatively movable contacts, an operating mechanism comprising a frame, an operating member pivotally supported on said frame, an arm having one end pivoted on said frame, a crank lever pivoted on said frame having a portion engaging the free end of said arm, a link operatively connected to one of said contacts and to said crank lever, said link and said crank lever forming a contact actuating toggle, a pair of overcenter springs connected between said free end of said arm and said operating member for making and breaking said toggle, a pivoted tripping member having a portion arranged to engage said arm, a tripping spring for biasing said tripping member against said arm so as normally to bias said toggle to broken position, and current responsive means for normally latching said tripping member out of engagement with said arm so that said operating member is free to operate said toggle independently of said tripping member, said current responsive means being arranged to release said tripping member upon the occurrence of predetermined abnormal current conditions to break said toggle and open said contacts independently of said overcenter springs.

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