United States Patent

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[72] Inventor **Eldon B. Heft**
West Hartford, Conn.

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[73] Assignee **General Electric Company**

[54] **CIRCUIT BREAKER WITH LOW SHORT CIRCUIT MAGNETIC TRIPPING MEANS**
14 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **335/16**
[51] **Int. Cl.** **H01h 77/10**
[50] **Field of Search** 335/16, 265, 174, 259

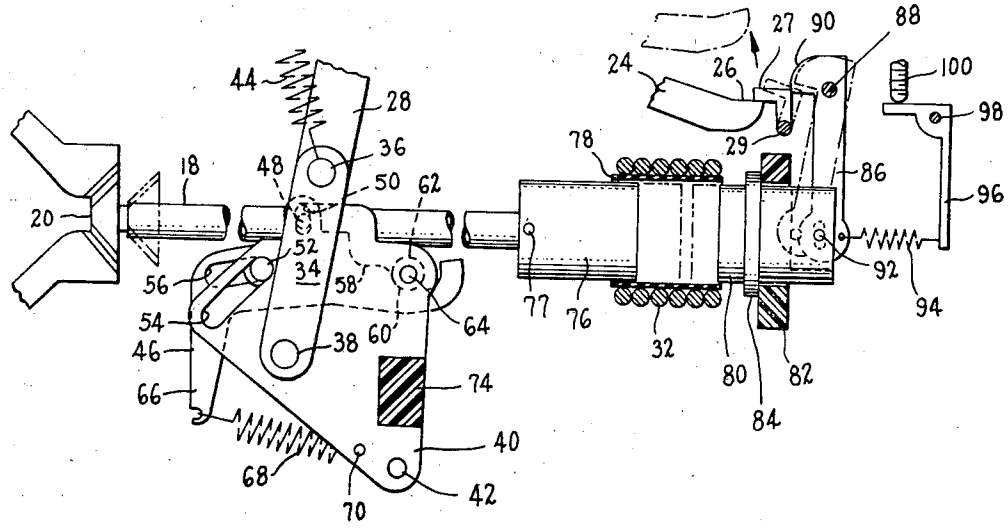
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Primary Examiner—Harold Broome
Attorneys—Robert S. Smith, Robert T. Casey, D. M. Schiller, Frank L. Neuhauser, Oscar B. Waddell and Joseph B. Forman

ABSTRACT: An electrical circuit interrupter has a movable contact carried by a contact operating member for movement relative to stationary contacts between closed and open circuit positions. Operating means will move the operating member from closed to open circuit position upon release of latching means engaged therewith. The contact operating member carries an armature which is subject to the magnetic attraction of a solenoid coil so as to be movable to open circuit position upon passage of a short circuit current of predetermined magnitude therethrough. A second armature also acted upon by the magnetic field of the solenoid coil is movable into a circuit opening position upon passage through the solenoid coil of a lesser short circuit current and acts upon the latching means during such movement to release the operating means for automatic operation thereof.



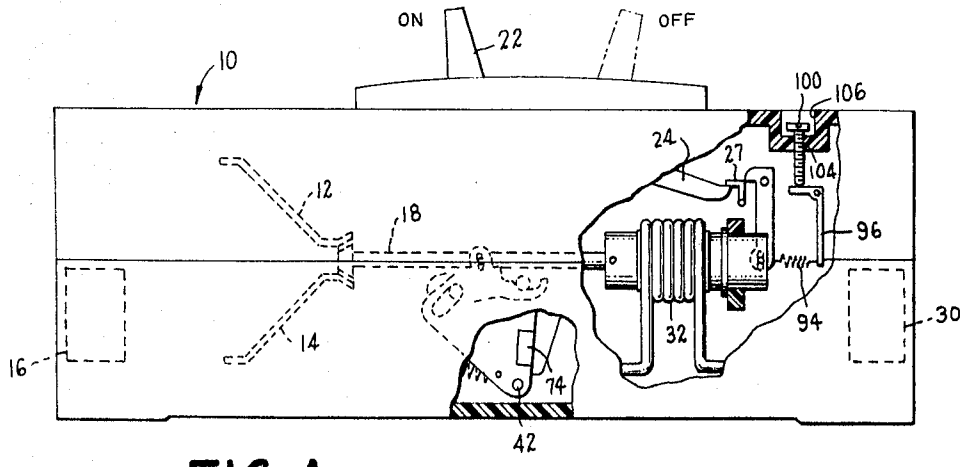


FIG. 1

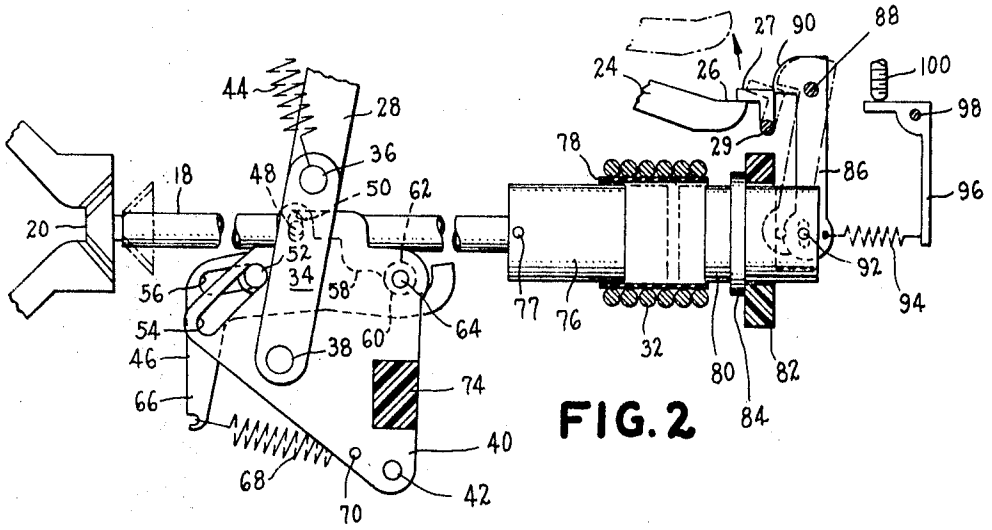


FIG. 2

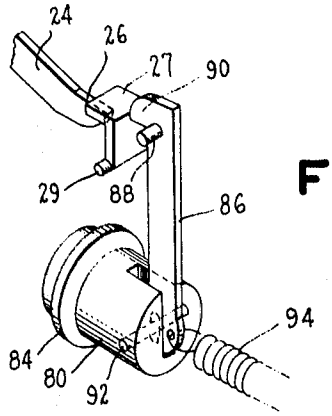


FIG. 3

INVENTOR
ELDON B. HEFT

BY

ATTORNEY

CIRCUIT BREAKER WITH LOW SHORT CIRCUIT MAGNETIC TRIPPING MEANS

BACKGROUND OF THE INVENTION

Increasing use of electrical power has produced requirements for power supply systems of ever increasing capacity and a concurrent requirement for circuit breakers capable of interrupting the high circuit currents which can occur in such power systems. Because of the tendency for arcing in such circuit breakers, there has been continuing activity to develop mechanisms for suppression of the arcing or for increasing the rapidity with which the contacts may be opened.

Since most electrical circuit interrupters employ some form of automatic and manual operating mechanism for moving the contacts between closed and open circuit positions, it is highly desirable that rapid operation of the contact carrying member be effected independently of the bulk of the operating mechanism upon the occurrence of a high short circuit current. In this manner, the inertia of the relatively massive elements of the operating mechanism will not detract from rapid opening.

A number of arrangements for effecting a disengagable coupling or overrideable coupling between a contact operating rod and an operating mechanism have been disclosed. One type of mechanism which has proven advantageous in multipole breakers is that shown in Johnson et al. U.S. Pat. No. 3,384,845 granted May 21, 1968 and assigned to the assignee of the present invention. A disengagable coupling between the operating mechanism and the contact operating rod is also disclosed and claimed in Giger U.S. Pat. No. 3,495,198 issued Feb. 10, 1970 and Hurtle U.S. Pat. No. 3,483,490 issued Dec. 9, 1969, both assigned to the assignee of the present invention.

In the event of rapid opening of the operating rod independently of the manual operating mechanism, it is still desirable to effect operation of that mechanism in order to permit resetting and to indicate the tripped condition. Moreover, in multipole breakers, it is particularly desirable to effect opening of the contacts in the other pole chambers once tripping has occurred in one of the pole chambers.

It is an object of the present invention to provide a novel electric circuit interrupter which is capable of rapidly opening the contacts therein independently of the manual operating mechanism and concurrently effecting movement of the operating mechanism to the tripped condition.

It is also an object to provide such a circuit interrupter which may be simply and economically constructed and wherein the magnitude of the short circuit current required for the tripping of the breaker may be predetermined with a high degree of accuracy.

Still another object is to provide such a circuit interrupter wherein very rapid opening of the contacts will occur by action of magnetic forces generated by the short circuit current and wherein such magnetic forces will act directly upon the contact operating member if the short circuit current is of a relatively high magnitude and will act indirectly upon occurrence of a lesser but more precisely determinable short circuit current.

A further object is to provide such an electric circuit interrupter which may be readily assembled and disassembled and which is capable of long lived operation and facile and accurate variation in the magnitude of short circuit current required for automatic operation.

SUMMARY OF THE INVENTION

It has now been found that the foregoing and related objects can be readily attained in an electric circuit interrupter having a casing containing at least one stationary contact and a movable contact with a contact operating member carrying the movable contact adjacent one end thereof. Means in the casing mounts the contact operating member for movement of the movable contact into and from contact with the stationary contact between closed and open circuit positions. Operating means in the casing is connected to the operating member for automatically moving the contact operating member from closed to open circuit position, and releasable means latches the operating means against such automatic movement.

A first armature is supported on the contact operating member adjacent the end thereof opposite that carrying the movable contact, and it is subject to the magnetic force of a solenoid having one end adjacent thereto. The magnetic force in the solenoid is sufficient to draw the contact operating member into open circuit position upon passage of a short circuit current of predetermined magnitude therethrough.

A second armature is disposed within the casing adjacent the other end of the solenoid and is attractable thereby. Means in the casing mounts the second armature for movement from a normal position towards the solenoid into a circuit opening position upon passage through the solenoid of a short circuit current of predetermined magnitude, and the second armature acts upon the latching means during movement thereof to the circuit opening position so as to release the operating means for automatic operation thereof.

In its preferred aspect, the interrupter includes adjustable biasing means engaged with the second armature and biasing the second armature into the normal position thereof. The biasing means is adjustable to vary the magnetic force required for attraction of the second armature into circuit opening position. The adjustable biasing means includes an adjustment lever pivotably mounted within the casing, tension spring means connected between the second armature and the adjustment lever, and adjustable means for pivoting the adjustment lever to vary the effective length of the tension spring means and thereby the biasing pressure exerted upon the second armature and which must be overcome by the magnetic force generated by the solenoid.

In its usual aspect, the circuit interrupter includes a intermediate latching member cooperating with the latch means and operable upon movement of the second armature to circuit opening position in order to release the releasable means for automatic operation of the operating means. This intermediate latching member will normally comprise a latch arm pivotably mounted in the casing at its one end and pivotably connected to the second armature at its other end. The latch arm is engaged with the releasable latching means in the normal position of the second armature but will release the latching means upon movement of the second armature at the circuit opening position. The releasable means latching the operating means is most desirably a pivoted latch held in latch position by engagement thereof with a portion of the intermediate latching member.

The mounting means for the second armature will normally include a guide member in the casing in which the second armature is slidable seated. The operating means will generally include a pivotable cradle and a toggle mechanism biasing the cradle for pivotable movement upon release of the releasable means. In addition, the operating means includes means connecting the toggle mechanism to the contact operating member for movement thereof into open circuit position upon pivoting of the cradle. In order to facilitate operation of the contact operating member independently of the operating means, the connecting means between the toggle mechanism and the contact operating member is either releasable or overrideable upon operation of the first armature by magnetic action of the solenoid coil.

In a multipole circuit breaker employing the present invention, each of the pole chambers of the circuit breaker assembly will desirably include the stationary contact, the movable contact, the contact operating member, means mounting the operating member for movement between closed and open circuit positions, the primary armature, the secondary armature and the solenoid coil. However, the operating means for automatic movement of the contact member from closed to open circuit position will generally be provided only in one of the pole chambers, conventionally the central pole chamber. In such a multipole breaker construction, the second armatures of the outer poles have means thereon act-

ing upon the latching means of the center pole to release the operating means for automatic operation of the central pole and thereby of the remaining pole, thus opening concurrently the contacts of each of the several poles upon operation of any of the poles.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a three-pole electrical circuit breaker embodying the present invention with portions of the casing broken away to reveal internal construction in the center pole and with certain of the elements of the outer pole illustrated in phantom line, the manual operating handle being shown in full line in the "on" or closed circuit position and in phantom line in the "off" or open position;

FIG. 2 is a fragmentary side elevational view to an enlarged scale of a portion of the mechanism of the center pole of the circuit breaker of FIG. 1 with the parts shown in full line in the closed circuit or "on" position and with certain of the parts shown in phantom line to represent their position during circuit opening action; and

FIG. 3 is a fragmentary perspective view of the secondary armature and latch assembly.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Turning now in detail to the attached drawing, therein illustrated is a three-pole circuit breaker embodying the present invention and having a common insulating casing or housing generally designated by the numeral 10. Mounted within each pole chamber of the casing 10 are a pair of stationary contact assemblies 12, 14, one of which is connected to the line terminal 16 of that pole by conductor elements (not shown). The other of the contact assemblies 12, 14 is connected to the load terminal 30 of that pole through the solenoid coil 32 thereof by conductor elements (not shown).

Mounted for reciprocal movement within each pole chamber of the casing 10 is an elongated contact operating rod 18 which carries at one end the movable wedge-shaped contact member 20 for movement into and from electrical contact with the stationary contact assemblies 12, 14 to provide current flow therebetween. The contact operating rod 18 may be moved from the open to the closed circuit position manually by operation of the manual operating handle mechanism 22 (only partially shown), the movement of which is translated to motion of the operating rod 18 by conventional toggle-type operating mechanism.

The operating mechanism of the center pole on the illustrated embodiment includes a releasable cradle 24 (only fragmentarily illustrated) which has a latch portion 26 at one end and which is supported for pivotal movement upon a pivot (not shown) and held in latched position against pivotal movement by the latch member 27 which is pivotably mounted on the pivot 29. A pair of upper toggle links 28 (only one of which is shown) is positioned on opposite sides of the cradle 24 and is connected thereto by a pivot pin (not shown). A pair of lower toggle links 34 (only one of which is shown) is connected at its upper end to the upper toggle links 28 by the pin 36. A pair of tension springs 44 (only one of which is shown) connects the pin 36 to the manual operating handle mechanism 22.

This embodiment of the invention utilizes a multipole-type operating mechanism of the type described and claimed in Johnson et al. U.S. Pat. No. 3,384,845 granted on May 21, 1968 and assigned to the assignee of the present invention. Accordingly, the operating mechanism in each of the circuit breaker poles includes a pair of movable actuator plates 40 (only one of which is shown in FIG. 1 and in FIG. 2), which are pivotably supported on the casing 10 by the pivot pin 42. In the center pole, the lower ends of the lower toggle links 34 are connected by the pivot pin 38. The operation of the operating mechanism of the central pole chamber of the three-pole breaker assembly serves to operate the movable contacts of all three poles by connection of the actuator plates 40 in the center pole and corresponding actuator plates 40 in the outer pole chambers by means of the insulated tie bar 74 which extends through apertures in the barrier sidewalls of the casing 10 between the center and outer poles.

The contact operating rod 18 is bifurcated adjacent the movable contact 20 and straddles a portion of the high speed connecting link or latch 46 and is connected thereto by the pin 48 which extends through a vertically elongated aperture 50 therein. The pin 52 is supported in fixed position on the casing 10 and extends through arcuate slots 54 in the contact actuator plates 40 and arcuate slot 56 in the latch 46. The slots 54 and 56 are dimensioned and configured to provide clearance for movement of the pin 52 therein and to act as a stop or limit for the actuator plates 40 in the open and closed circuit positions thereof. The latch 46 is configured to provide a pair of vertically spaced, horizontally extending shoulder portions 58, 60 upon which rides the roller 62 which is carried by the shaft 64 seated in the actuator plates 40.

The depending angular portion 66 on the latch 46 is engaged with an end of tension spring 68 which has its other end connected to the pin 70 extending between the actuator plates 40. In this manner, the latch 46 is biased counterclockwise about the pin 48 (as seen in FIG. 2) to retain the roller 62 upon the shoulder portion 60 of the latch 46 during normal operation.

Automatic operation of the contact operating rod 18 from closed to open circuit position may be effected rapidly upon the occurrence of a high short circuit current by means of magnetic action of the solenoid coil 32 upon the primary armature or plunger 76 which is secured by the fastener 77 on the end thereof opposite that carrying the movable contact 20. As best seen in FIG. 2, the coil 32 is disposed about the tubular sleeve 78 in which the primary armature 76 is slidable, and current flowing therethrough generates a magnetic field acting upon the primary armature 76. When a high short circuit current of predetermined magnitude passes through the solenoid coil 32, the magnetic force acting upon the armature 76 is sufficient to draw the operating rod 18 from the full line position shown in FIG. 2 to the phantom line position thereof, thus effecting movement of the movable contact 20 from the contact assemblies 12, 14 and breaking the circuit. The action of the operating mechanism upon such movement of the operating rod 18 will be described in detail hereinafter.

According to the present invention, the contact operating rod 18 may also be moved from the closed to open circuit position by a lesser, but more precisely predeterminable, short circuit current passing through the solenoid coil 32. A trip or secondary armature 80 is slidably supported in the guide member 82 adjacent the solenoid coil 32 and is subject to the magnetic force generated by current flowing therethrough so as to be attracted thereto. Movement of the armature 80 away from the solenoid coil 32 is limited by the collar 84 thereof which abuts the guide member 82.

As best seen in FIG. 3, a latch arm 86 is pivotably supported in the casing 10 by the pivot pin 88 adjacent its upper end and it has a hook-shaped latch portion 90 which abuts the latch member 27 to prevent its pivoting. At its lower end, the latch arm 86 is pivotably connected to the armature 80 by the pivot pin 92. Attached to the lower end of the latch arm 86 is one end of the tension spring 94 which has its other end connected to the adjustment lever 96 which is pivotably supported on the casing 10 by the pin 98.

The effective length of the spring 94 and thereby the biasing pressure during normal operation can be varied by the trip adjustment screw 100 which is threadably seated in an aperture 104 in the recess 106 of the casing 10. As the screw 100 is turned inwardly of the casing 10, the adjustment lever 96 is pivoted counterclockwise as seen in FIGS. 1 and 2 to elongate the spring 94 and thereby increase the biasing force acting upon the armature 80. Conversely, elevating the screw 100 allows the adjustment lever 96 to pivot clockwise under the action of the spring 94 and thereby reduce the length and the biasing force.

MANUAL OPERATION OF THE BREAKER

In the position shown in full line in FIGS. 1 and 2, the movable contact 20 is in engagement with and completes the circuit between the contact assemblies 12, 14. The action of the toggle springs 44 and of the spring 68 biases the movable contact into the closed circuit position. In the closed circuit or "on" position, the line of action of the toggle springs 44 is to the left of the pivot (not shown) between the upper toggle links 28 and the releasable cradle 24. When the operating handle assembly 22 is moved from the "on" position to the "off" position, the line of action of the toggle springs 44 moves to the right of the pivot (not shown) between the upper toggle links 28 and releasable cradle 24, thus causing the toggle linkage to buckle to the right and the parts to move to a manually actuated "off" position (not shown) wherein the movable contact 20 is moved to the phantom line position shown in FIG. 2. In this manual operation, the contact actuator plates 40 are rotated clockwise about the pivot pin 42 by reason of their connection to the lower toggle links 34 through the pin 38. P As the actuator plates 40 pivot, the roller 62 is engaged by the hook portion of the latch 46 and the latch 46 is moved to the right as seen in FIG. 2, thereby moving the contact operating rod 18 to the "off" position as a result of the engagement provided by the pin 48.

Movement of the operating mechanism of the illustrated center pole to the "off" position will simultaneously produce movement of the operating mechanism of the other poles of the breaker assembly to the "off" position since the contact actuator plates 40 thereof are rigidly tied together by the tie bar 74 extending therebetween. The pivoting of the contact actuator plates 40 in the other pole chambers in the clockwise direction will cause the contact operating rods 18 therein to move to open circuit position.

OPERATION OF THE BREAKER MECHANISM UPON OCCURRENCE OF A HIGH SHORT CIRCUIT CURRENT

As previously indicated, the current flowing through the solenoid coil 32 produces a magnetic force acting upon the primary armature 76 which is carried by the contact operating rod 18. When the short circuit current in any one of the circuit breaker poles reaches a predetermined value, the magnetic force generated by the solenoid coil 32 is sufficient to draw the primary armature 76 thereto at high speed and to open the circuit through movement of the contact operating rod 18 and the movable contact 20 away from the stationary contact assemblies 12, 14. The motion of the contact operating rod 18 is transmitted to the latch 46 by reason of the engagement of the pin 48 therewith. As will be appreciated, the latch 46 rotates in a clockwise position about the pin 52 against the biasing action of the spring 68, thus moving the shoulder 60 below the level of the roller 62. As the roller 62 clears the shoulder 60, the latch 46 slides to the right under the influence of the spring 68 and the magnetic force of the solenoid coil 32 acting upon the armature 76. The roller 62 then seats against the shoulder 58 of the latch 40. In this manner, the operating rod 18 is moved rapidly by magnetic action with minimum inertial resistance of the operating mechanism, thus effecting high speed opening.

As will be readily appreciated, a short circuit current of sufficient magnitude to draw the primary armature 76 to the solenoid 32 and open the contact will also draw the secondary armature 80 towards the solenoid coil 32. This movement will effect pivoting of the latch arm 86 in the center pole and release of the latch member 27 so that the biasing pressure of the automatic operating mechanism therein will pivot the cradle 24, collapsing the toggle mechanism and causing pivoting of the contact actuator plates 40 in the center pole chamber and thereby the contact actuator plates 40 in each of the outer poles since they are connected together by the tie bar 74. As a result, the contact operating rod 18 in each of the poles is moved to open circuit position. If the short circuit current occurs in either of the outer pole chambers, the movement of the secondary armature 80 therein actuates the mechanism of the center pole chamber by relatively simple tie structure which is not illustrated. The secondary armatures 80 in the outer pole chambers each have a trip member (not shown) extending upwardly therefrom which will strike against and pivot a depending arm (not shown) carried by the common pivot pin or shaft 88 which extends through all three poles. As a result, the latch arm 86 in the center pole is pivoted by movement of the secondary armatures 80 in either of the outer poles and the operating mechanism of the center pole will cause pivoting of the contact actuator plates 40 therein and thereby the pivoting of the contact actuator plates 40 in the remaining outer pole.

Thus, high speed opening of the circuit breaker under the solenoid action in any of the pole chambers will effect opening of the contacts in the other pole chambers. In addition, the operating mechanism will be tripped to the trip indicating position, and the operating mechanism may be reengaged with the operating rod 18 for reclosing of the circuit.

OPERATION OF THE BREAKER MECHANISM UPON OCCURRENCE OF A SHORT CIRCUIT CURRENT OF LESSER MAGNITUDE

As will be appreciated, the adjustment mechanism for the tension spring 94 acting upon the secondary armature 80 may be relatively closely adjusted to permit operation of the breaker mechanism upon the occurrence of a short circuit current of lesser magnitude than that required to effect movement of the contact operating rod 18 independently of the operating mechanism. If the short circuit current flowing through the solenoid coil 32 exceeds the calibrated value established by the adjustment of the tension spring 94, the secondary armature 80 will be drawn towards the solenoid coil 32 to effect circuit opening action.

In the center pole of the illustrated breaker assembly which contains the automatic operating mechanism, this movement of the armature 80 will pivot the latch arm 86 in a clockwise direction and release the latch member 27 so that it may pivot in a clockwise direction under the biasing pressure of the toggle springs 44. As a result, the cradle 24 will pivot and the toggle linkage will produce pivoting of the contact actuator plates 40 about their pivot pin 42 in a clockwise direction with resultant movement of the contact operating rod 18 to the open circuit position. As the contact actuator plates 40 of the center pole pivot, the contact actuator plates 40 of the other poles simultaneously pivot because of the connection of the tie bar 74 therebetween, thus effecting opening of the contacts in the outer poles.

In the multipole embodiment of the present invention illustrated, magnetic movement of the secondary armature 80 in either of the outer pole chambers will effect pivoting of the latch arm 86 on the common pivot pin or shaft 88 as hereinbefore described. In this manner, the operating mechanism of the center pole will be tripped and the contacts will be opened in both the center pole chamber and the remaining outer pole chamber.

The movement of the secondary armature 80 inwardly of the solenoid coil 32 will also tend to increase the magnetic force acting upon the primary armature 76. The resultant increased magnetic force may be sufficient to draw the primary armature 76 to the solenoid coil 32 for high speed magnetic action independently of the automatic operating toggle mechanism which is slower in action.

Although the present invention has been illustrated and described with respect to a multipole breaker, it will be readily appreciated that it is particularly adapted to single pole breaker operation. Moreover, in multipole breaker constructions, each of the several poles may include automatic operating mechanism such as that illustrated herein for the center pole chamber.

As will be appreciated, various means may be used to provide the releasable interconnection between the automatic operating mechanism and the contact operating member so long as the connection may be overridden or released upon

development of a magnetic force of predetermined magnitude as a result of a short circuit. Highly advantageous mechanisms are that illustrated herein and those described in the aforementioned Giger U.S. Pat. No. 3,495,198 and Hurtle U.S. Pat. No. 3,483,490.

Similarly, various other manual and automatic operating mechanisms may be employed in accordance with the present invention such as, for example, the manual operating mechanism shown in the aforementioned Hurtle U.S. Pat. No. 3,483,490. When the present invention is utilized in multipole breakers, the interconnection of the several poles may be through the common pivot for the latch as in the illustrated embodiment or other means may be employed such as a sliding rod extending between the secondary armatures through the barrier walls. Other techniques for effecting concurrent operation of the several poles are well known and understood and will be apparent to those having ordinary skill in the art.

In the present invention, the biasing pressure of the spring against which the secondary armature must be moved by the magnetic force of the solenoid coil is varied by pivotal action of the adjustment lever. Other means for varying the length and thereby the tension of such a spring may be employed such as a slide connection extending through the casing, a threaded fastener engaged directly therewith and movable relative to the wall of the casing, etc. In place of an intermediate latch arm acting upon the latch for the cradle, the latch itself may be of sufficient length so as to be engaged with the secondary armature or a flag on the secondary armature may strike a depending portion on the latch to effect pivotal movement thereof.

If so desired, the circuit breaker may also include conventional thermal trip mechanism such as the bimetal strip-type wherein a short circuit of low magnitude extending over a sufficient period of time will produce release of the latch mechanism of the automatic operating mechanism for opening of the contacts. Such devices may employ various means for effecting the releasing action such as by having the bimetallic strip act upon the secondary armature to produce movement thereof towards the solenoid coil or by having it act upon the latch member directly or an element engaged therewith.

Thus, it can be seen from the foregoing detailed specification and drawing that the present invention provides a highly effective electric circuit interrupter which is capable of rapidly opening the contacts therein independently of the manual operating mechanism while concurrently effecting movement of the operating mechanism to the tripped condition. The circuit interrupters of the present invention may be simply and economically constructed and the magnitude of the short circuit current required for tripping of the breaker may be predetermined with a high degree of accuracy.

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

I claim:

1. In an electric circuit interrupter, the combination comprising:

a. a casing;

b. at least one stationary contact in said casing;

c. a movable contact;

d. a contact operating member carrying said movable contact adjacent one end thereof;

e. means mounting said contact operating member for movement of said movable contact into and from contact with said stationary contact between closed and open circuit positions;

f. operating means connected to said operating member for automatically moving said contact operating member from closed to open circuit position;

g. releasable means latching said operating means against said automatic movement;

h. a first armature on said contact operating member adjacent the other end thereof;

i. a solenoid having one end thereof adjacent said first armature, said solenoid generating a magnetic force acting upon said first armature sufficient to draw said contact operating member into open circuit position upon passage of a short circuit current of predetermined magnitude therethrough;

j. a second armature adjacent the other end of said solenoid and attractable thereby; and

k. means mounting said second armature in said casing for movement from a normal position towards said solenoid into a circuit opening position upon passage through said solenoid of a short circuit current of predetermined magnitude, said second armature acting to cause movement of said latching means upon movement of said second armature toward said circuit opening position to release said operating means for automatic operation thereof.

2. The circuit interrupter of claim 1 wherein there is included adjustable biasing means engaged with said second armature and biasing said second armature into said normal position, said biasing means being adjustable to vary the magnetic force required to attract said second armature into circuit opening position.

3. The circuit interrupter of claim 2 wherein sad adjustable biasing means includes an adjustment lever pivotably mounted within said casing, tension spring means connected between said second armature and said adjustment lever, and adjustable means for pivoting said adjustment lever to vary the length of said tension spring means and thereby the biasing pressure exerted thereby upon said second armature.

4. The circuit interrupter of claim 1 wherein there is included an intermediate latching member cooperating with said latching means and operable upon movement of said second armature to release said releasable means for automatic operation of said operating means.

5. The circuit interrupter of claim 4 wherein said intermediate latching member is a latch arm pivotably mounted in said casing at one end and pivotably connected to said second armature at its other end, said latch arm being engaged with said releasable latching means for said operating means in the normal position of said armature, said latch arm releasing said latching means upon movement of said second armature to said circuit opening position to cause said automatic operation of said operating means.

6. The circuit interrupter of claim 5 wherein said releasable means latching said operating means is a pivoted latch held in latched position by engagement with a portion of said intermediate latching member in the normal position of said armature.

7. The circuit interrupter of claim 1 wherein there is included adjustable biasing means engaged with said second armature and biasing said second armature into said normal position, said biasing means being adjustable to vary the magnetic force required to attract said armature into circuit opening position; and wherein there is also included an intermediate latching member cooperating with said latching means and operable upon movement of said second armature to release said releasable means for automatic operation of said operating means.

8. The circuit interrupter of claim 1 wherein said mounting means for said second armature includes a guide member in said casing in which said second armature is slidably seated.

9. The circuit interrupter of claim 1 wherein said operating means includes a pivotable cradle, a toggle mechanism biasing said cradle for pivotal movement upon release of said releasable means, and releasable means connecting said toggle mechanism to said contact operating member for movement thereof into open circuit position upon pivoting of said cradle.

10. The circuit interrupter of claim 9 wherein said connecting means is releasable upon operation of said first armature by said solenoid to permit movement of said contact operating member to open circuit position independently of the operating means.

11. The circuit interrupter of claim 9 wherein said connecting means may be overridden upon operation of said first armature by said solenoid to permit movement of said contact operating member to open circuit independently of the operating means.

12. In an electric circuit interrupter, the combination comprising:

a. a casing;

b. at least one stationary contact in said casing;

c. a movable contact;

d. a contact operating member carrying said movable contact adjacent one end thereof;

e. means mounting said contact operating member for movement of said movable contact into and from contact with said stationary contact between closed and open circuit positions;

f. operating means connected to said operating member for automatically moving said contact operating member from closed to open circuit position; said operating means including a pivotable cradle, a toggle mechanism biasing said cradle for pivotal movement, and releasable means connecting said toggle mechanism to said contact operating member;

g. releasable means latching said operating means against said automatic movement;

h. a first armature on said contact operating member adjacent the other end thereof;

i. a solenoid having one end thereof adjacent said first armature, said solenoid generating a magnetic force acting upon said first armature sufficient to draw said contact operating member into open circuit position upon passage of a short circuit current of predetermined magnitude therethrough;

j. a second armature adjacent the other end of said solenoid and attractable thereby;

k. means mounting said second armature in said casing for movement from a normal position towards said solenoid into a circuit opening position upon passage through said solenoid of a short circuit current of predetermined magnitude;

l. adjustable biasing means engaged with said second armature and biasing said second armature into said normal position, said biasing means being adjustable to vary the magnetic force required to attract said second armature into circuit opening position; and

m. an intermediate latching member cooperating said latching means and operable upon movement of said second armature to release said releasable means for automatic operation of said operating means, said releasable connecting means between said toggle mechanism and said contact operating member permitting movement of said contact operating member into open circuit position upon pivoting of said cradle, said connecting means being releasable upon operation of said first armature by said solenoid coil to permit movement of said contact operating rod to open circuit position independently of the operating means.

13. The circuit interrupter of claim 12 wherein said adjustable biasing means includes an adjustment lever pivotably mounted within said casing, tension spring means connected between said second armature and said adjustment lever, and adjustable means for pivoting said adjustment lever to vary the length of said tension spring means and thereby the biasing pressure exerted thereby upon said second armature.

14. The circuit interrupter of claim 12 wherein said intermediate latching member is a latch arm pivotably mounted in said casing at one end and pivotably connected to said second armature at its other end, said latch arm being engaged with said releasable latching means for said operating means in the normal position of said armature, said latch arm releasing said latching means upon movement of said second armature to said circuit opening position to cause said automatic operation of said operating means.