United States Patent

[11] 3,588,762

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[73] Assignee General Electric Company

[54] CIRCUIT BREAKER WITH SHORT CIRCUIT MAGNETIC TRIPPING MEANS
9 Claims, 7 Drawing Figs.

[52] U.S. Cl. 335/16
[51] Int. Cl. H01h 77/10
[50] Field of Search 335/16, 195, 186; 200/77

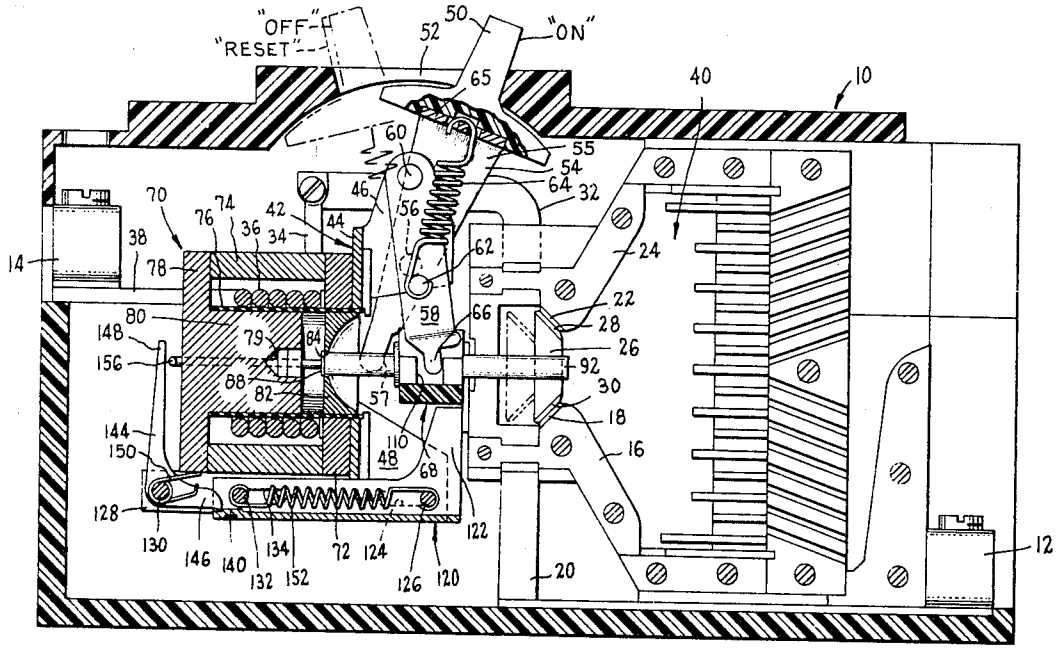
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3,384,845	5/1968	Johnson et al.	335/16
3,384,846	5/1968	Heft	335/16
3,483,490	12/1969	Hurtle	335/16

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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. A coupling member moves the operating member from closed to open circuit position upon release of latching means engaged with a stored energy device which is engageable with the coupling means. 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 position upon passage of a short circuit current of predetermined magnitude therethrough. The coupling member releases the operating member upon movement of the armature toward the open circuit position as the result of solenoid attraction. Most advantageously, the circuit interrupter includes at least two poles, and the movable contact of the second pole is moved to its open circuit position by movement of the coupling member.



2 Sheets-Sheet 1

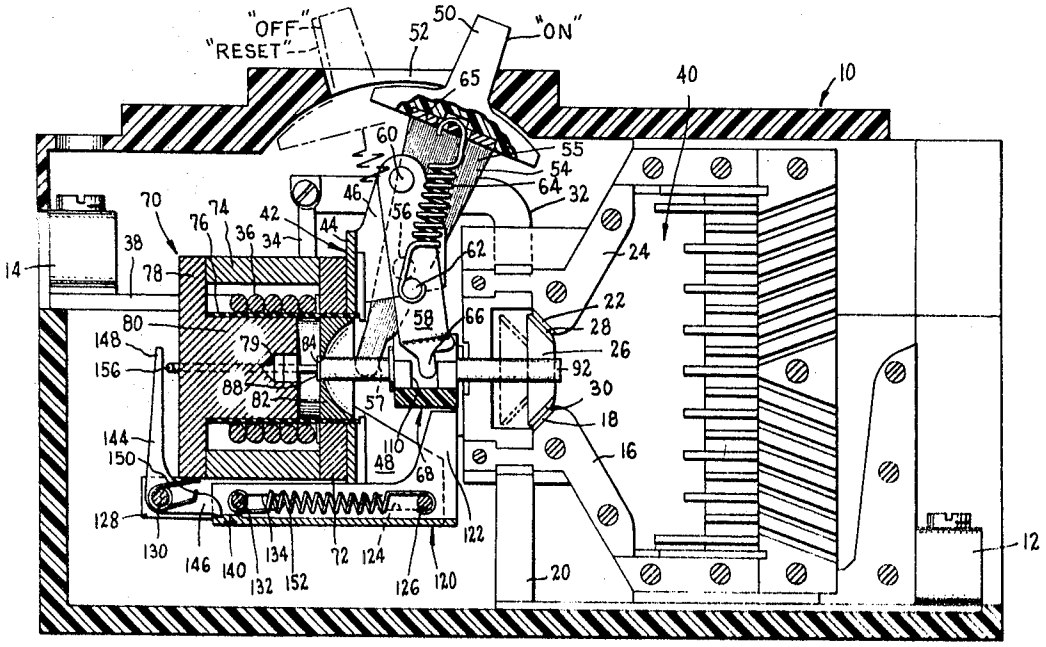


FIG. 1

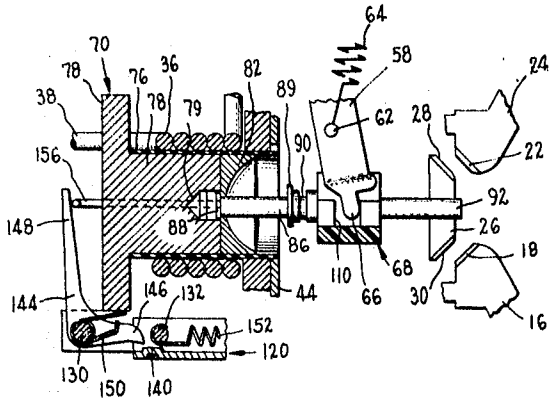


FIG. 6

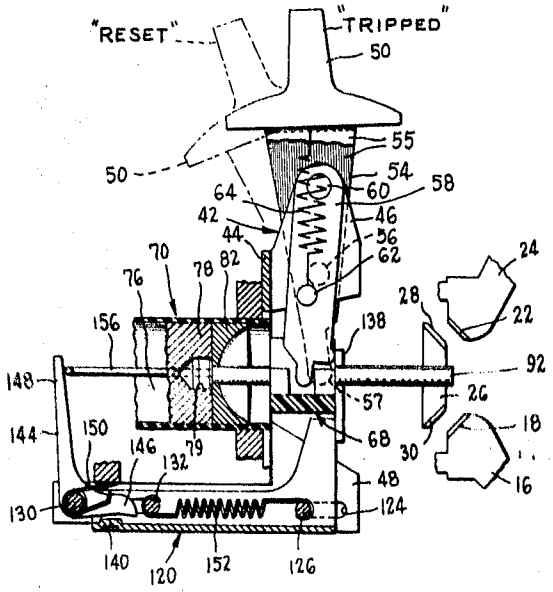


FIG. 7

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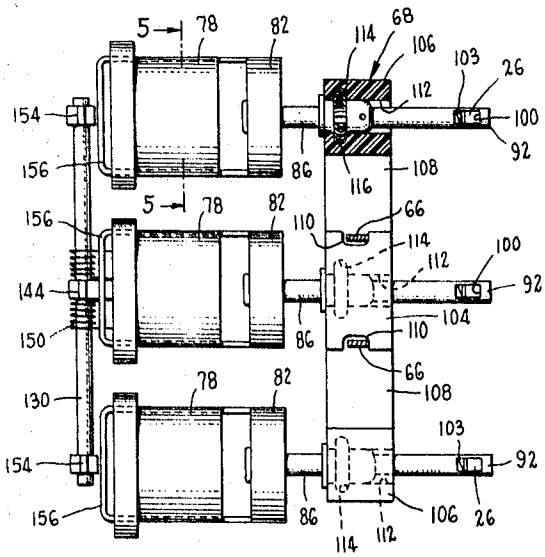


FIG.3

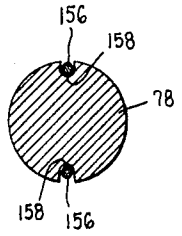


FIG.5

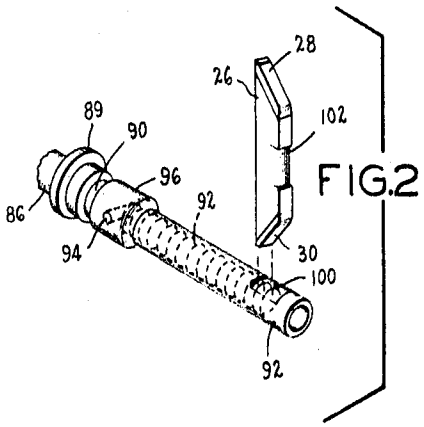


FIG.2

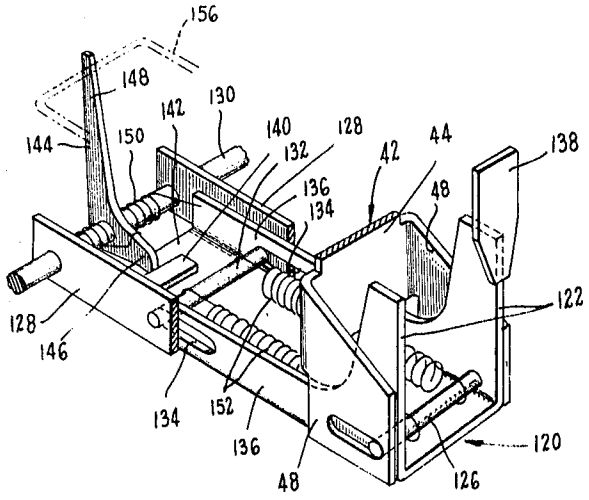


FIG.4

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CIRCUIT BREAKER WITH 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 and 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 disengageable 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 disengageable 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 by action of magnetic forces generated by a short circuit current.

It is also an object of the invention to provide such a circuit interrupter which has a plurality of poles, and in which all poles are opened upon the sensing of a fault in only one of them.

Still another object is to provide such a circuit interrupter which may be simply and economically constructed, which may readily be assembled and disassembled, and which is capable of long lived 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, wherein a first pole assembly comprises a casing that has a stationary contact supported therein, and a contact that is movable into and from contact with the stationary contact between closed and open circuit positions. A contact operating member is movably supported in the casing and carries the movable contact adjacent one end thereof for movement between open and closed circuit positions. On the operating member adjacent its other end is an armature, and a solenoid is supported in the casing with one end thereof adjacent to the armature. The solenoid generates, upon passage therethrough of a short circuit current of predetermined magnitude, a magnetic force sufficient to draw the contact operating member from the closed to the open circuit position.

A coupling member is movably supported in the casing and has means thereon releasably engaged with the operating member for simultaneous movement thereof, and the engaging means releases the operating member upon movement of the armature toward the open circuit position upon occurrence of the magnetic force of predetermined magnitude generated by the short circuit current. A stored energy device is also supported in the casing and is movable between a high potential energy position and a low potential energy position. The stored energy device has means thereon that is engageable with the coupling member to drive the latter therewith in moving from the position of high energy to the position of low energy. Releasable means latches the stored energy device in its high potential energy position, and the armature, in moving to the open circuit position thereof, acts upon the latching means to release the stored energy device for automatic operation thereof.

In the preferred embodiment of the invention, the driving movement of the coupling member resulting from the action of the stored energy device moves it to the open circuit position of the operating member for reestablishing engagement therebetween. Preferably, the pole assembly includes means for manually moving the coupling member independently of the stored energy device to effect movement of the movable contact member between the closed and open circuit positions. The means for manually moving the coupling member includes a handle member projecting outwardly of the casing and a toggle mechanism operatively engaged with the coupling member and handle member. Movement of the coupling by the stored energy device in turn moves the toggle mechanism, thereby moving the handle member to a trip-indicating position. The manual means is engageable with the stored energy device to force it from the low energy position to the high energy position thereof, by manual movement of the handle member to the "reset" or "off" position. The stored energy device may desirably comprise a slidably mounted driver engageable with the coupling member and movable in the direction of the open circuit position of the contact operating member, and biasing means acting thereon. The biasing means exerts a force upon the driver in the high energy position sufficient to rapidly move it and the coupling member to the open circuit position upon release of the latching means.

Most desirably, the operating member in the circuit interrupter is an actuating rod that has a hollow cylindrical end portion with a radial passageway therethrough in which is seated the movable contact. The end portion has an abutment element spaced from the end thereof adjacent to which the movable contact is carried, and a coil spring is compressed between the movable contact and the abutment surface to bias the movable contact within the radial passageway towards the end specified. The radial passageway has an axial length somewhat greater than that of the corresponding portion of the movable contact to permit limited free travel thereof. Most desirably, the actuating rod has a circumferential groove intermediate its ends and the coupling member has a passageway therethrough that is generally circular in cross section, in which the actuating rod is slidably seated. In such a case, the engaging means may comprise a toroidal garter spring secured in the passageway of the coupling member in a plane perpendicular to the axis thereof and in a position to register with an engage within the circumferential groove of the rod in the closed circuit position.

In a particularly preferred embodiment, the circuit interrupter additionally includes a second pole assembly in the casing comprising a stationary contact, a movable contact, a contact operating member, an armature, and a solenoid each comparable to that of the first-mentioned pole assembly. In addition, it includes a movable coupling element that has means thereon releasably engaged with the second contact operating member in a manner comparable to that in which the coupling member of the first-mentioned pole assembly engaged the operating member thereof. The coupling element is rigidly affixed to the coupling member of the first-mentioned pole assembly to move therewith, and the second armature acts upon the latching means in movement thereof to the open circuit position to release the stored energy device for auto-

matic operation thereof. In such an interrupter, the latching means desirably comprises a pivotal latch member, a common pivotally mounted trip rod, and a lever arm. The latch member registers with the solenoid of the first-mentioned pole assembly and engages the stored energy device in the high potential energy position thereof. The common trip rod is pivotally mounted and the latch member is rigidly affixed thereto to pivot therewith. The trip rod also has a portion extending into alignment with the second solenoid, and the lever arm, which registers with the second solenoid, is rigidly affixed to the trip rod to pivot therewith. Each of the armatures of the first-mentioned and second pole assemblies has a transfer member attached to it; the transfer member of the first-mentioned assembly acts upon the latch member and the transfer member of the second assembly acts upon the lever arm to pivot the trip rod and disengage the latch member to release the stored energy device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view through the center pole chamber of a three-pole circuit breaker embodying the present invention, the handle member shown in full line in the "on" position and in phantom lines in the "off" and "reset" positions thereof;

FIG. 2 is a partially exploded perspective view, to an enlarged scale, of the contact end portion of the contact operating rod and the movable contact carried thereby;

FIG. 3 is a plan view, to a reduced scale and partially in section, of the high speed magnetic trip mechanism of the three-pole circuit breaker, with the insulating cores removed from the solenoid assemblies for clarity of illustration;

FIG. 4 is a fragmentary perspective view to an enlarged scale of the stored energy device utilized in the circuit breaker, with the transfer element of the center pole assembly shown in phantom line;

FIG. 5 is a sectional view of the stator and transfer element of an end solenoid assembly along the line 5–5 of FIG. 3;

FIG. 6 is a fragmentary sectional view of the operating mechanism with the armature of the solenoid assembly drawn to the stator and with the trip bar released from the driver; and

FIG. 7 is a similar fragmentary sectional view showing the driver in its sprung position and the handle member in its tripped position, and showing in phantom line the alternate position to which the handle member is moved for resetting of the circuit breaker.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Turning now in detail to the appended drawings, therein illustrated is a three-pole, current-limiting electric circuit breaker embodying the present invention, including a generally box-shaped insulating casing 10. Line terminal 12 and load terminal 14 are supported within the casing 10 (by means not shown), and the line terminal 12 is connected to a first stationary contact support and arc runner member 16 through a terminal strap 20. The support member 16 supports a first stationary contact 18, and a second stationary contact 22 is supported upon a similar contact support and arc runner member 24, that is symmetrically affixed in spaced relation to the member 16 by suitable means (not shown). The stationary contacts 18, 22 are interconnected by a movable wedge contact member 26 having contact surfaces 28, 30 thereon for electrical contact with the stationary contacts 18, 22. A suitable conductor 32 connects the support member 24 to the terminal portion 34 of the solenoid 36, the other terminal 38 of which is electrically connected to the load terminal 14. The parts and connections hereinbefore described define the current path through the center pole of the current breaker, and similar parts defining like paths are provided for each of the two outer poles thereof. An arc extinguishing chamber portion, generally designated by the numeral 40, is provided outwardly of the arc runner members 16, 24 (i.e., on the right-hand side of the circuit breaker as illustrated in FIG. 1); however, it is not described in detail since this portion of the circuit breaker is not essential to the novelty of the present invention.

A generally U-shaped bracket, generally designated by the numeral 42, is secured within the casing 10 (by means not shown), and comprises a web or base 44 having upper and lower legs 46 and 48 projecting outwardly from each side thereof. A manually operable switching mechanism is supported in the upper legs 46, and comprises a handle member 50 projecting through an opening 52 in the top of the casing 10. The handle member 50 is mounted upon a generally U-shaped handle support member 54 having legs 55 which pass outwardly of the upper legs 46 of the bracket 42 and are pivotally mounted thereon by the pivot pins 56. A pair of toggle links 58 pass between the upper leg elements 46, and are pivotally supported thereon adjacent their upper ends by the pivot pins 60. A common connecting pin 62 passes between the toggle links 58, and a coil spring 64 is affixed under tension between the connecting pin 62 and the base 65 of the handle support member 54. The lower ends of the toggle links 58 have nose portions 66 which engage a common cross or drive bar, generally designated by the numeral 68, to be described more fully hereinafter.

It will be apparent that in the "on" position depicted in Fig. 1, the line of force of the spring 64 is to the right of the pivot pins 60 of the toggle links 58, forcing the nose portions 66 and hence the crossbar 68 in that direction (i.e., to the right). Since the contact member 26 is connected to the crossbar 68 (in a manner to be described hereinafter), the contacts 28, 30 and 18, 22 are brought into closed position, thereby connecting the terminals 12, 14. Manually moving the handle member 50 to the left (to the "off" position) brings the line of force of the spring 64 to the left of the pivot pins 60, which in turn shifts the crossbar 68 (through the links 58) and the contact member 26 to the left, thereby disconnecting the contacts 18, 22 and interrupting the circuit. As seen in FIG. 1, the "off" and "reset" positions for this circuit breaker are substantially the same.

For automatic, current-limiting operation, a solenoid assembly, generally designated by the numeral 70, is supported (by means not shown) adjacent the bracket 42. The solenoid assembly 70 includes the coil or solenoid winding 36 previously mentioned, in addition to a housing comprising a circular front wall 72, a cylindrical sidewall 74 and a smaller cylindrical core 76 of insulating material about which the coil 36 extends. The assembly 70 also includes a plug-shaped stator 78 having a cylindrical portion 80 of relatively small cross section inserted into the back end of the core 76, and a generally disc-shaped armature 82 slidably received in the forward end thereof.

The armature 82 has a concentric aperture 84 in which is seated an actuating rod or contact carrier member 86, and the rod 86 has an enlarged head 88 that engages the back of the armature 82. As is best illustrated in FIG. 2, the actuating rod 86 has an intermediate detent collar 96 that has a radial abutment flange 89 adjacent its inner end and a circumferential groove 90 intermediate the length thereof. The rod 86 is hollow to minimize its mass, and a compression spring 98 is seated in the contact end portion 92 thereof with one end of the spring 98 bearing upon the transverse pin 94 through the detent collar, the pin 94 serving as an abutment surface therefor. A pair of radial slots 100 (only one of which is seen) is provided through opposite sides of the shaft 92 adjacent its contact end, into which the contact member 26 is inserted. The contact member 26 has in its forward edge a short channel 102 of a width approximately equal to the outside diameter of the shaft 92, so that when the contact member 26 is inserted through the slots 100 the portion of the shaft 92 adjacent to the contact end of the slots 100 seats within the channel 102. With the forward end of the spring 98 bearing upon the contact member 26 the latter is securely retained in the slots 100; also, as is best seen in FIG. 3, the slots 100 are

dimensioned to provide a short free travel space **103** behind the contact member **26**. This permits the spring **98** to absorb some of the impact that occurs upon engagement of the contact surfaces, and it improves seating of the elements and ensures good electrical contact even after significant wear has occurred therein.

As best seen in FIG. **3**, the crossbar **68** is a unitary elongated member having a relatively wide upstanding central block **104** and relatively narrow upstanding blocks **106** at the ends thereof, one end block **106** being in section to illustrate the interior construction thereof. Channels **108** are formed between the blocks **104, 106** to permit the lower ends **57** of the legs **55** of the handle support member **54** to pass across the drive bar **68**, and short grooves **110** are formed in the side of the central block **104** to seat the nose portions **66** on the ends of the toggle links **58**, whereby the crossbar **68** is actuated. Each of the blocks **104, 106** has a transversely extending passageway **112** in which the detent collar **96** of the actuating assembly is normally seated, and a circumferential groove **114** is provided in the sidewall portions of the blocks **104, 106** defining the passageways **112** therethrough. Toroidal garter springs **116** are seated in the grooves **114**, and engage the actuating rods **86** by seating in the grooves **90** of the detent collars **96** when the rods **86** are in their normal condition of engagement with the crossbar **68**.

As is most clearly illustrated in FIG. **4**, a generally U-shaped slide or driver, generally designated by the numeral **120**, having upwardly extending sidewalls **136** with projecting arm portions **122** at the contact end thereof is mounted under the center solenoid assembly **70** between the lower legs **48** of the bracket **42**. The legs **48** each have an elongated slot **124** (only one of which is seen), in which are slidably engaged the ends of the cross pin **126** extending between the sidewalls **136** and projecting outwardly therefrom. The rear portion of the driver **120** is mounted between elongated side plates **128** which also engage the common trip shaft **130** which is pivotally supported therein. A cross pin **132** is mounted between the side plates **128**, and the driver **120** has elongated slots **134** formed in its upstanding sidewalls **136**, through which the cross pin **132** extends. Each of the projecting arms **122** of the driver **120** has a flag or resetting plate **138** affixed thereto (only one of which is shown for clarity of illustration), and a stop **140** is provided in the base **142** of the driver **120** adjacent the end opposite the contact end.

Affixed on the trip shaft **130** to pivot therewith is an L-shaped trip bar **144** having a nose portion **146** engaged behind the stop **140** and an upwardly projecting arm portion **148**. A coil spring **150** is mounted upon the shaft **130** and has an end portion bearing upon the nose portion **146** of the trip bar **144** to urge it downwardly behind the stop **140**, and a pair of coil springs **152** extend between the cross pins **126, 132**. It will be appreciated that in the position of the driver **120** illustrated in FIG. **4** the springs **152** are loaded under tension and are exerting a rearward force upon the driver **120**, which is thus in a high potential energy position. Force upon the arm portion **148** of the trip bar **144** in a counterclockwise direction to overcome the bearing pressure of the spring **150** will disengage the nose portion **146** from behind the stop **140**, and will permit the driver **120** to be driven rapidly to the left or spring rearwardly in the slots **124, 134** to a position of relatively low potential energy.

As can be seen in FIG. **3**, the common trip shaft **130** extends behind the solenoid assembly (only the stator **78** and armature **82** of which are shown) associated with each of the poles, and it has trip bars **154** secured thereto in alignment behind each of the outer assemblies. The trip bars **154** each have upstanding elements but no nose portions or springs (such as **146** and **150** respectively) associated with them since they do not act upon independent drive assemblies; rather, they actuate the trip bar **144** through the common shaft **130** in the manner described.

The armatures **82** of the solenoid assemblies **70** have mounted upon them generally U-shaped wire rams **156** which, as is seen in FIG. **5**, slide in longitudinal slots **158** extending along the sides of the stators **78**. The base portion of each ram **156** registers with the upper ends of the respective trip bar **144, 154**, so that rearward movement of any of the three armatures **82** toward its cooperating stator **78** pushes the attached ram **156** against the aligned trip bar **144, 154**. This causes the common trip shaft **130** to pivot, thus releasing the driver **120** and allowing its rearward movement.

Automatic operation is illustrated in FIGS. **6** and **7** wherein an overload condition is assumed to have occurred in the circuit through the center pole. The resulting magnetic attraction of the stator **78** rapidly draws the armature **82** against it, and the force upon the head **88** of the actuating rod **86** overrides the grip of the garter spring **116** and dislodges the actuating assembly from the crossbar **68**. In so doing, the contact member **26** is drawn away from the stationary contacts **18, 22**, interrupting the overloaded circuit in a very short time interval after the overload condition is initiated. The forward end of the stator **78** has a small recess **79** formed therein to accommodate the head **88** of the actuating rod **86** when the latter is driven thereinto.

The rearward movement of the armature **82** also pushes the wire ram **156** rearwardly into contact with the arm portion **148** of the trip bar **144**, causing it to pivot with the shaft **130** and release the driver **120**; this is the instantaneous condition depicted in FIG. **6**. The force of the springs **152** propels the driver **120** rearwardly, which in turn causes the resetting plates **138** to force the crossbar **68** in the same direction to the position shown in FIG. **7**. This movement of the crossbar **68** opens the circuits of the other two poles and also causes reengagement of the garter spring **116** in the circumferential groove **90** of the contact actuating rod **86** from which it was displaced, as hereinbefore described. It also moves the handle member **50** to the "tripped" position, which is intermediate of the "off" and "on" positions depicted in FIG. **1**, indicating that a fault had been sensed in the line and the breaker opened. To reset the circuit breaker for subsequent operation, the handle member **50** is simply moved rearwardly to the "reset" position illustrated in phantom line in FIGS. **1** and **7**, and the lower ends **57** of the legs **55** of the handle support member **54** are brought to bear upon the resetting plates **138**. This reloads the springs **152** and latches the driver **120** in its operative position for subsequent operation. The contact members **26** remain in the full "off" position without further movement of the handle member **50**.

Although the concept of the present invention is applicable to single-pole circuit breakers, it will be apparent that the most significant benefits are obtained from its use for multipole (and particularly three-pole) devices. Thus, the primary function of the common crossbar is to interrupt the circuits in the poles other than that in which the fault was sensed, and the recoupling function of the crossbar is of only secondary significance. It should also be appreciated that, in the present structure, just one stored energy device is needed, regardless of the number of pole chambers therein since its design allows actuation of the device by movement of the armature of any pole assembly in which a fault is encountered.

As will be appreciated, the design of the contact operating member may vary from that illustrated herein, although the specific embodiment so described is particularly preferred. Various means may be used to provide the releasable interconnection between the contact operating member and the coupling member, so long as the connection may be overriden or released upon development of a magnetic force of predetermined magnitude as a result of a short circuit. Of course, the interconnection must nevertheless be sufficiently secure to ensure movement of the contact operating member with the coupling member upon movement of the latter, such as during the manual or resetting operation. The structures of the previously mentioned Giger U.S. Pat. No. 3,495,198 and Hurtle U.S. Pat. No. 3,483,490 are illustrative in this regard.

Similarly, the construction of the coupling member may vary from that described herein so long as any alternate design

adequately fulfills the requirements set forth. It should be readily appreciated that although the coupling member may be comprised of a plurality of individual elements rigidly joined together, it will normally be most desirable to fabricate the coupling member as a unitary structure. Furthermore, the latching means for the stored energy device, and the means associated with the armature of the solenoid assembly for actuation thereof, may each vary from the specific construction herein described. A stored energy device different than that illustrated may also be substituted therefor, and an appropriately positioned, spring loaded lever-type of arrangement may prove feasible. Elements other than springs may be utilized to provide stored energy to the device, and it may be desirable to provide means in the circuit breaker for adjustment of such elements to vary the force with which the stored energy device is driven from the high potential energy position thereof.

If so desired, the circuit breaker may include conventional thermal trip mechanism, such as those of the bimetal strip type, wherein a short circuit of low magnitude continuing during a somewhat extended period of time will effect a release of the latching means for movement of the contact operating member. Such devices may rely upon various means for effecting the releasing action; for example, the bimetal strip element may act directly upon the trip bar to produce pivoting thereof in the manner hereinbefore described.

Thus, it can be seen that the present invention provides a novel electric circuit interrupter which is capable of rapidly opening the contacts therein independently of the manual operating mechanism, by the action of magnetic forces generated by a short circuit current. The circuit interrupter may have a plurality of poles, all of which are opened upon the sensing of a fault in only one of them, and it may be simply and economically constructed, readily assembled and disassembled, and capable of long-lived operation.

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

1. In an electric circuit interrupter, a pole assembly comprising:

a. a casing;

b. a stationary contact supported in said casing;

c. a contact movable into and from contact with said stationary contact between closed and open circuit positions;

d. a contact operating member carrying said movable contact adjacent one end thereof for movement thereof between closed and open circuit positions;

e. an armature on said operating member adjacent the other end thereof;

f. a solenoid supported in said casing and having one end thereof adjacent said armature, said solenoid generating, upon passage of a short circuit current of predetermined magnitude therethrough, a magnetic force sufficient to draw said contact operating member from closed to open circuit position;

g. a coupling member movably supported in said casing and having means thereon releasably engaged with said operating member for simultaneous movement thereof, said engaging means releasing said operating member upon movement of said armature toward said open circuit position upon occurrence of magnetic force generated by the short circuit current of predetermined magnitude;

h. a stored energy device supported in said casing and movable between a high potential energy position and a low potential energy position, said device having means thereon engageable with said coupling member to drive said coupling member therewith in moving from said high energy position to said low energy position thereof; and

i. releasable means latching said stored energy device in said high potential energy position, said armature during movement thereof to said open circuit position acting upon said latching means to release said stored energy device for automatic operation thereof.

2. The circuit interrupter of claim 1 wherein said driving movement of said coupling member moves it to the open circuit position of said contact operating member for reestablishing engagement therebetween.

3. The circuit interrupter of claim 1 wherein said pole assembly additionally includes means for manually moving said coupling member independently of said stored energy device to effect movement of said movable contact member between said closed and open circuit positions.

4. The circuit interrupter of claim 3 wherein said manual means includes a handle member projecting outwardly of said casing and a toggle mechanism operatively engaged with said coupling member and handle member, movement of said coupling by said stored energy device in turn moving said toggle mechanism and thereby said handle member to a trip-indicating position, said manual means being engageable with said stored energy device to force said device from said low energy position to said high energy position by manual movement of said handle member to a reset position.

5. The circuit interrupter of claim 1 wherein said stored energy device comprises a slidably mounted driver engageable with said coupling member and movable in the direction of the open circuit position of said contact operating member and biasing means acting on said driver with a force in said high energy position sufficient to move it and said coupling member to the open circuit position rapidly upon release of said latching means.

6. The circuit interrupter of claim 1 wherein said operating member is an actuating rod having a hollow cylindrical contact end portion with a radial passageway therethrough adjacent said one end in which is seated said movable contact, said contact end portion having an abutment element spaced from said one end and a coil spring compressed between said movable contact and abutment surface to bias said movable contact within said radial passageway towards said one end, said radial passageway having an axial length greater than the corresponding portion of said movable contact to permit limited free travel thereof.

7. The circuit interrupter of claim 6 wherein said actuating rod has a circumferential groove intermediate its ends, and wherein said coupling member has a passageway therethrough that is generally circular in cross section in which said rod is slidably seated, said engaging means comprising a toroidal garter spring secured in said passageway in a plane perpendicular to the axis thereof and in a position to register with and engage within said circumferential groove of said rod in said closed circuit position.

8. The circuit interrupter of claim 1 additionally including a second pole assembly in said casing comprising:

a. a stationary contact supported in said casing;

b. a contact movable into and from contact with said second stationary contact between closed and open circuit positions;

c. a contact operating member carrying said second movable contact adjacent one end thereof for movement thereof between closed and open circuit positions;

d. an armature on said second operating member adjacent the other end thereof;

e. a solenoid supported in said casing and having one end thereof adjacent said second armature, said second solenoid generating, upon passage of a short circuit current of predetermined magnitude therethrough, a magnetic force sufficient to draw said second contact operating member from closed to open circuit positions; and

f. a movable coupling element having means thereon releasably engaged with said second operating member for simultaneous movement thereof, said engaging means releasing said operating member upon movement of said second armature upon occurrence of a magnetic force generated by the short circuit current of predetermined magnitude, said coupling element of said second pole assembly being rigidly affixed to said coupling member of said first-mentioned pole assembly to move therewith,

said second armature acting upon said latching means in movement thereof to said open circuit position to release said stored energy device for automatic operation thereof.

9. The interrupter of claim 8 wherein said latching means comprises a pivotal latch member registering with said solenoid of said first mentioned pole assembly and engaging said stored energy device in said high potential energy position thereof, a common pivotally mounted trip rod to which said latch member is rigidly affixed to pivot therewith having a portion extending into alignment with said second solenoid, and a lever arm rigidly affixed to said trip rod for pivoting therewith and registering with said second solenoid, said armatures of said first mentioned and second pole assemblies each having a transfer member attached thereto, the transfer member of said first mentioned pole assembly acting upon said latch member and the transfer member of said second pole assembly acting upon said lever arm to pivot said trip rod and disengage said latch member to release said stored energy device.