June 23, 1970 T. M. COLE 3,517,355

BLOW-OPEN CIRCUIT BREAKER

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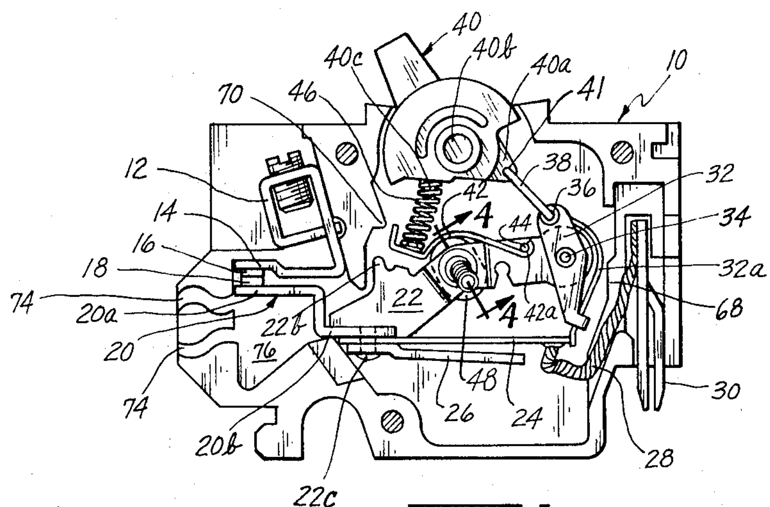

FIG. 1

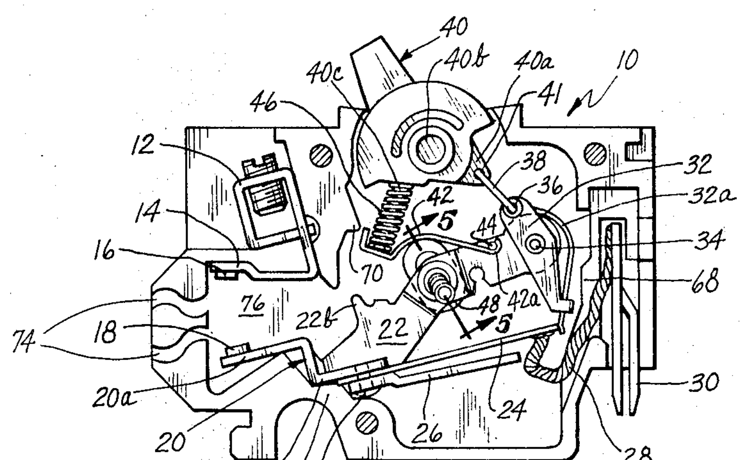

FIG. 2

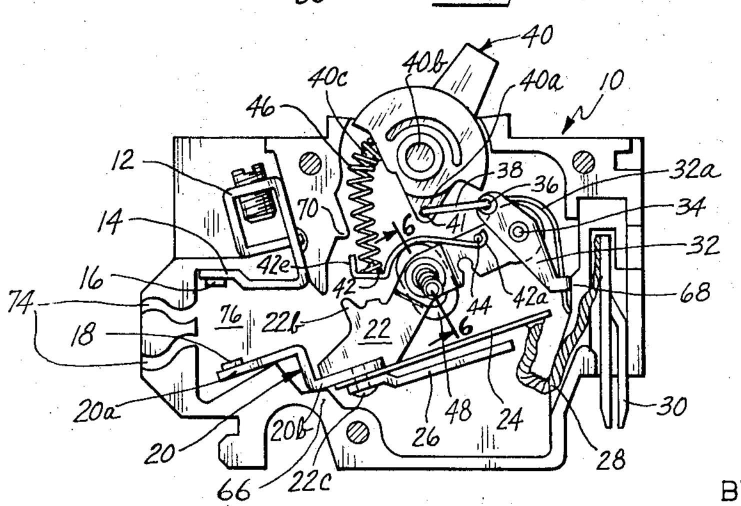

FIG. 3

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BLOW-OPEN CIRCUIT BREAKER

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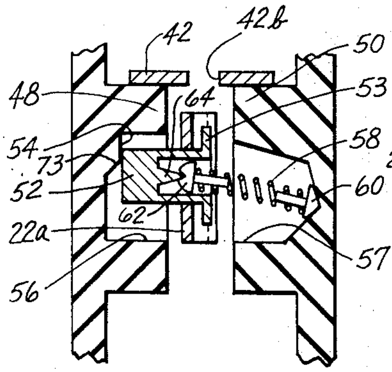

Fig. 4

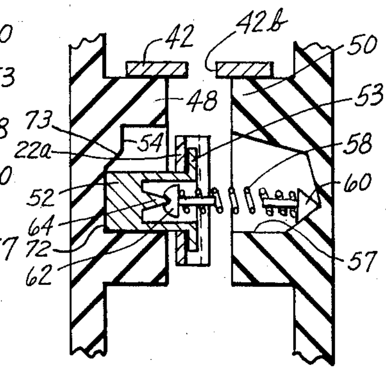

Fig. 5

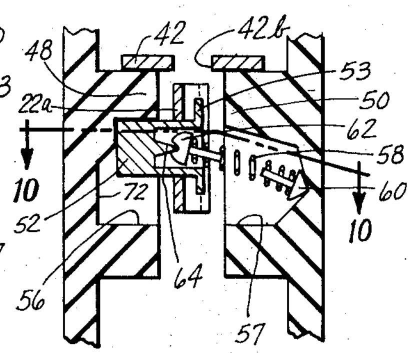

Fig. 6

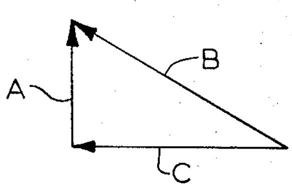

Fig. 7

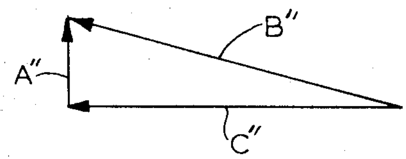

Fig. 8

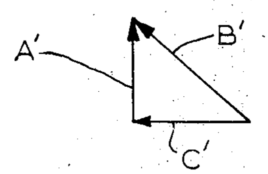

Fig. 9

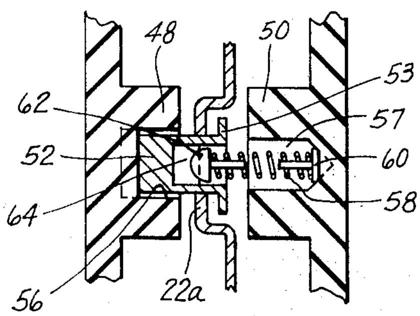

Fig. 10

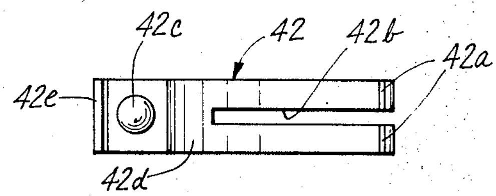

Fig. 11

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3,517,355

BLOW-OPEN CIRCUIT BREAKER

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Filed Mar. 11, 1968, Ser. No. 712,041
Int. Cl. H01h *77/10*
U.S. Cl. 335—16 15 Claims

ABSTRACT OF THE DISCLOSURE

A circuit breaker is made electrodynamically responsive for high-speed opening to interrupt sudden high currents. The circuit breaker has a pivoted contact arm arranged as part of a blow-open current loop. The pivot of the contact arm has a stable normal position in which the contact arm is operable by a manual mechanism for opening and closing the circuit breaker. The pivot is shiftable to another position in which the contact arm is in its fully open current-interrupting position. The shift of the pivot is initiated electrodynamically, by the force in the blow-open current loop. Electrodynamic opening is independent of and unimpeded by the operating mechanism remaining in its "closed" configuration. The foregoing is part of a circuit breaker incorporating the usual trip-free operating mechanism including an overload release provision made for reset both in case of overload release and electrodynamic opening.

The present invention relates to circuit interrupters. The invention is described below in its application to molded-case circuit breakers, but in its broader aspects it applies to a variety of switching apparatus for clearing short-circuits in a bus having high available short-circuit capacity.

Circuit breakers commonly provide both overload protection and short-circuit protection. The usual overload release of a circuit breaker has a first nominal-rating level having an inverse time-current characteristic and an instantaneous release responsive to higher levels of overload. Usual circuit breakers inherently require some minimum time for responding to short circuits, first for the overcurrent release to function and then for the contact-operatiing mechanism to open the contacts. That type of action is too slow where the bus has a very high available short-circuit capacity. An object of the present invention resides in adapting circuit interrupters, especially circuit breakers, to nearly instantaneous response to short-circuits, utilizing a novel electrodynamic arrangement of parts for driving the contacts open suddenly. A commercially important type of circuit breaker to which the present invention is especially applicable has a movable contact arm that carries a current-responsive latch. A manually operable toggle operates the contact arm about a pivot for closing and opening the breaker manually, and the latch releases the breaker automatically in response to an overcurrent. Circuit breakers of this type are shown for example in U.S. Pat. No. 2,681,396 issued June 15, 1954, to Cole et al. Millions of circuit breakers are sold each year in the form shown in FIGS. 7 to 11 of that patent. Those circuit breakers are unusually rapid in their response to short circuits, being readily capable of releasing the overload responsive latch and opening the contacts in case of a short circuit of the 5000 A. level in only little more than one-quarter of a cycle in a 60 Hz. power circuit. However, this fast performance has been found inadequate where the short circuit level is much greater.

An object of the present invention resides in providing an improvement in circuit breakers of that type for opening the contacts electrodynamically and without depend-

ing on release of the overcurrent latch and without allowing time for the overcurrent latch to be released.

A further object resides in modifying a circuit breaker of the type having a moving contact arm that carries an overcurrent latch and is operable about a pivot for opening the contacts, so that in the modified circuit breaker the contact arm is operable electrodynamically to an open position independent of the release of the overcurrent latch. A further object of the invention resides in modifying such a circuit breaker for enabling it to respond electrodynamically to high level short circuits by providing a laterally shiftable pivot for the contact arm. More generally it is an object of the invention to provide a novel current interrupter operable electrodynamically in response to short circuits of high level with a pivot about which a contact arm normally operates for opening and closing the circuit where such pivot is shiftable for high speed electrodynamic opening operation of the contact arm.

The nature of the invention and its further objects and advantages will become more fully apparent from the detailed description below of an illustrative embodiment which is shown in the accompanying drawings. Briefly, this illustrative embodiment of the invention includes a contact arm having a movable contact at one end that cooperates with a stationary contact, a pivot near the center of the contact arm and a pivoted actuator at the opposite end of the contact arm. A current responsive latch for the actuator is also carried by the contact arm. An operating toggle including a pivoted handle and a connecting toggle link is operable from a collapsed condition to an erect condition for driving the contacts from their open position to their closed position. The contact arm operates about the pivot when the circuit breaker is manually opened, as well as when the current responsive latch is released in case of an overcurrent. The current path through the circuit breaker includes a blow-off current loop in the region of the contacts. The pivot is laterally movable from a normal, stable operating location to another stable location when the contact arm is driven open electrodynamically. The electrodynamic opening operation occurs with high speed in response to high level short circuit without awaiting release of the overcurrent latch and without dependence on whether the overcurrent latch is or is not released. The shiftable pivot is biased so as to remain in what may be called its normal position, wherein it pivotally supports the contact arm for manual opening of the circuit breaker and for automatic opening in response to release of the overcurrent latch. After the pivot has been driven to its second stable position in case of electrodynamic opening of the contacts, the pivot can be reset to its normal position by manipulating the operating toggle. This illustrative embodiment of the invention is more fully described below and is shown in the accompanying drawings.

In the drawings:

FIG. 1 is a lateral elevation of a circuit breaker embodying features of the present invention, a side cover being removed to show the internal mechanism, and the contacts being closed;

FIG. 2 is another view of the circuit breaker in FIG. 1 in the condition assumed when the contacts are "blown open" electrodynamically and with the operating handle held in its "on" position;

FIG. 3 is another view of the circuit breaker of FIG. 1 with the parts in their normal position with the contacts open and in condition for a closing operation;

FIGS. 4, 5 and 6 are enlarged fragmentary cross sectional views at the section lines **4—4**, **5—5** and **6—6** in FIGS. 1, 2 and 3, respectively;

FIGS. 7, 8 and 9 are force diagrams representing the action of spring **58** in FIGS. 5, 6 and 7, respectively;

FIG. 10 is an enlarged fragmentary cross-sectional view of the circuit breaker shown in FIGS. 3 and 6 at the plane **10—10** of FIG. 6, a portion thereof being broken away for clarity; and

FIG. 11 is the top plan view of one of component **42** of the circuit breaker of FIGS. 1 through 6.

Referring now to the drawings and in particular to FIG. 1 there is shown one part of a molded case or enclosure **10** formed of molded insulation. A screw terminal **12** of the circuit breaker is fixed between the two halves of the circuit breaker case. Copper strip **14** extends integrally from terminal **12**, and carries contact **16** at its end remote from terminal **12**. Movable contact **18** is carried by copper strip **20** for cooperation with contact **16**. A portion **20***a* of strip **20** extends along and close to strip **14**, these conductors forming a reverse current loop through the contacts. A member **22** of sheet iron has an integral rivet **22***c* extending through copper strip **20**, the "fixed" end of bimetal **24** and soft iron pole piece **26**. Rivet **22***c* rigidly unites parts **20, 22, 24** and **26** and provides a good electrical connection between bimetal **24** and copper strip **20**, a connection that can be further improved by brazing. Strip **20** and member **22** as a unit are called the "contact arm." Flexible conductive braid **28** as of copper is welded to the "movable" end of bimetal **24** remote from rivet **22***c*. The opposite end of braid **28** is welded to plug-in terminal **30** of the circuit breaker. When the circuit breaker is closed (as shown in FIG. 1) a circuit may be traced from terminal **12**, and along parts **14, 16, 18, 20, 24** and **28** to plug-in terminal **30**. Metal member **32**, also called an "actuator" or "bell crank," is mounted on an insulated pivot **34** at the end of member **22** remote from copper strip **20**. An ambient temperature compensating bimetal **32***a* forms part of actuator **32**. One end of bimetal **32***a* is secured about an upper pivot **36** of the actuator and at its lower end, bimetal **32***a* is latched by current-responsive bimetal **24**. A U-shaped link **38**, formed of stiff wire, has its respective legs extending into and forming pivots in member **32** and arm **40***a* of an operating handle **40**. Arm **40***a* and link **38** constitute two links of an operating toggle. Handle **40** is of molded insulation and has integral pivots **40***b* that operate in companion recesses (not shown) in the confronting parts of the molded case **10**. When the circuit breaker is closed, as shown in FIG. 1, knee **41** of toggle **38, 40***a* is slightly above an imaginary line between the centers of pivots **36** and **40***b*. In this condition the toggle is said to be "overset." The knee cannot rise beyond the slightly overset condition shown because handle **40** is arrested against further counterclockwise movement by engagement with casing **10**.

A lever **42** of flexible leaf-spring stock has aligned hook portions **42***a* at opposite sides of a slot **42***b*. Member **22** is received in slot **42***b*, so that the two legs of lever **42** straddle member **22**. Hook portions **42***a* lock with pin **44** that extends through member **22**. A dimple **42***c* at the end of lever **42** remote from hooks **42***a* locates one end of a compression coil spring **46**. The opposite end of the coil spring bears against a small projection **40***c* of the handle. In FIG. 1 compression spring **46** acts along a line slightly above the axis of pivot **40***b*, but in the condition of the parts shown, toggle **38, 40***a* prevents clockwise movement of the handle.

Lever **42** has a curved mid-portion **42***d* that bears against bosses **48** and **50** projecting inward from the inside surfaces of the case. Bosses **48** and **50** act as a fulcrum for lever **42** which converts downward pressure of compression coil spring **46** to upward pressure against pin **44**.

In the closed condition of the circuit breaker illustrated in FIG. 1, members **22, 24** and **32** are locked together as a triangular unit. Upward spring force applied at pin **44** biases the contact arm **20, 22** clockwise about pivot **36** (FIG. 1) and thus provides resilient contact pressure. It is understood that parts **22, 24** and **32**, when latched as a triangular unit, are effectively pivoted at **36**.

As seen in FIG. 10 member **22** has a portion **22***a* that is off-set relative to the rest of member **22**. Off-set portion **22***a* is laterally guided by the end face of boss **48**, and the portions of member **22** adjoining offset **22***a* are guided by the end face of boss **50**, there being a measure of looseness between member **22** and the guide surfaces of bosses **48** and **50**. As seen in FIGS. 4, 5, 6, and 10, a metal cup **52** is slidably received in a hole in portion **22***a* of member **22**. In the condition of FIGS. 1 and 4, a flange **53** of the cup is spaced away from offset **22***a*, and the externally flat closed end of the cup presses against a bearing surface **54** in a recess **56** formed within boss **48**. This recess or slot confines cup **52** to sliding parallel to the plane of the view in FIG. 4, slanting down and to the right, approximately perpendicular to a radius from pivot **36** when located as in FIG. 1. A cavity **57** is formed in the opposite boss **50** of the casing. A compression spring **58** acts against cup **52** to press the bearing end of the cup against the bottom of recess **56**. Spring **58** advantageously has bearing buttons **60** and **62** at its ends. Button **62** is notched so as to receive a rib or fulcrum **64** on the inside of the cup. In the closed condition of the circuit breaker in FIGS. 1 and 4, spring **58** acts along such a prominent slant angle that it applies a substantial component of upward force via cup **52** to the contact arm. This upward force is represented by vector A in FIG. 7. The total force of compression of the spring is represented by vector B. Vector C represents the pressure applied by cup **52** against bearing surface **54** of the molded case. Accordingly, spring **58** and cup **52** apply a substantial amount of bias to contact arm **20, 22** in the contact-closing direction.

The bias of spring **46** applied to pin **44** by lever **42** biases the contact arm upward. This is opposite in one sense to the arrangement in the above-mentioned Pat. 2,681,396, wherein the reset compression spring applies downward bias to the contact arm. The particular mechanism involving spring **46** and lever **42** is shown and claimed in a companion patent application filed herewith, Mar. 11, 1968, Ser No.712,042, by J. J. Oravec, entitled Automatic Circuit Breakers. Other similar circuit breakers in which upward bias is provided on the contact arm are shown in Reissue Pat. 24,388 and Pat. 2,810,048, both issued to P. M. Christensen. The upward bias of spring **46** complements the upward bias of spring **58**.

FIG. 3 shows the parts of the circuit breaker in their open condition, in readiness for the circuit breaker to be closed. As seen there, lever **42** transmits the force of compression spring **46** to pin **44**, the lever operating about the fulcrum represented by bosses **48, 50**. Handle **40** is in its "off" position, remote from the "on" position in FIG. 1. There is a slight clearance between the end of bimetal **24** and the latch end of actuator **32**. The toggle comprising ling **38** and **40***a* of the handle is buckled, the knee being well below an imaginary line between the axes of pivot **40***b* and pivot **36**. A portion **20***b* of conductive strip **20** bears against a fixed stop **66** integral with the molded case.

When handle **40** is initially moved away from the "closed" extreme position in FIG. 1 toward the position in FIG. 3, the toggle starts to collapse. Spring **58** has an initial upward component of force A (FIG. 7) that acts to displace cup **52** and member **22** upward, until the cup reaches the upward limit of cavity **56**. Thereafter portion **20***b* of the contact arm is biased by compression spring **46** to move toward the open condition in FIG. 3. Spring **46** thus acts as a "push-off" spring to open the contacts, driving member **22** counterclockwise about cup **52** as a pivot. At the same time, the line of action of spring **46** is shifted further away from the axis of pivot **40***b*, so that spring **46** strongly biases the handle in the "off" direction.

For closing the circuit breaker, handle **40** is moved away from the position in FIG. 3 toward that in FIG. 1

and erects toggle 38, 40*a*, driving the latched triangular unit 22, 24, 32 clockwise about cup 52 as a pivot until the contacts engage. The toggle is not fully erect at the time of contact engagement and therefore, during the further erecting travel of the toggle links, pivot 36 is driven downward while contact 18 acts as a fulcrum of the contact arm. This motion drives cup 52 downward so as once again to assume the position of FIG. 4.

The circuit breaker shown actually does not close gradually but closes with an abrupt snapping motion due to the cooperation of a hooked portion 42*e* of lever 42 with a shoulder portion 70 in the molded case. Closing motion of the contact arm pushes a portion 22*b* of member 22 against lever 42 which then pushes hook portion 42*e* against shoulder 70. This occurs before the toggle links are erect, and before the contacts touch. Further erecting motion of the toggle shifts cup 52 downward, thereby applying bias of spring 58 to arm 22. This further erecting motion of the toggle also draws pin 44 downward and to the right, pulling hook portion 42*e* to the right and, ultimately, free of shoulder 70. Thereafter the contact-biasing effects of springs 46 and 58 close the contacts with a snap. This snap-closing mechanism involving shoulder 70, lever 42 and spring 46 is claimed in the above-mentioned patent application filed concurrently herewith by J. J. Oravec.

The breaker operates automatically from the closed condition of FIG. 1 to that of FIG. 3 in a manner similar to the manual opening operation described above. The automatic opening is initiated by downward deflection of bimetal 24, to release actuator 32. The bimetal deflects downward in response to the current flowing through it. A moderate persistent overload will cause enough thermal deflection to release actuator 32. A sudden severe overload will produce in core 26 a sufficient flux to attract bimetal 24 and deflect the bimetal magnetically. Such deflection occurs in response to currents of at least 10 times the thermal tripping rating.

Magnetic tripping can result in full contact opening in about ¼ cycle in small commercial circuit breakers of the type in patent 2,681,396, but this is too slow to clear extremely high levels of short-circuit current. If such a circuit breaker were operated to close against a short circuit in a circuit having an available current capacity of the order of 5000 amperes, it is readily capable of opening and interrupting the current. Through refinements, higher interrupting ratings can be realized. By modifying circuit breaker to effect electrodynamic opening of the contacts, a considerable increase in short-circuit interruption capacity can be achieved.

The reverse current loop in conductors 14 and 20*a* of the present circuit breaker produces an instantaneous electrodynamic force that drives contact arm 20, 22 apart at enormous speed, to the position represented in FIG. 2. The handle 40 may be free when the short-circuit occurs or the short-circuit may exist while the breaker is being operated to close the contacts. Here the handle is assumed to be hand-held in the "on" position at the time of the short-circuit. FIG. 2 represents the condition of the parts after occurrence of a short-circuit but before the bimetal 24 has time to deflect downward, and for that reason actuator 32 is shown as being latched. These conditions, of the handle being held "on" and the operating linkage being still latched at the time of the electrodynamic impulse are the most severe set of conditions for the circuit breaker. Handle 40, link 38, and the triangular unit consisting of member 22 and actuator 32 latched by bimetal 24 are all virtually rigid parts and yet they do not interfere with the electrodynamic opening operation of the contact arm. Opening of the circuit breaker electrodynamically does not depend on release of the overcurrent release means. This is because the pivot about which the contact arm swings in a normal contact-opening operation, namely cup 52, is capable of being driven downward against the bias of spring 58. This pivot when shifted, assumes a stable lower position with contact 18 in its extreme open position. Cup 52 shifts downward from bearing surface 54 to a more recessed bearing surface 72, as shown in FIG. 5. At this point there is only a limited upward component of force A″ acting on member 22 (FIG. 8) and this force is prevented from shifting cup 52 upward because of a slant step 73 between the lower bearing surface 72 and the other bearing surface 54 in recess 56. Consequently, where the circuit breaker opens in response to conditions producing the requisite electrodynamic force, the contact arm remains in its open condition without any tendency to reclose after the current has been interrupted.

The present circuit breaker has prominent current-limiting characteristics. This may be attributed in large measure to the high-speed response of the contact arm in opening during the rise of current to levels sufficient to cause electrodynamic separation of the contacts. The achievement of current limitation is important in that the arcing energy that develops during fault-clearing is limited far below the arcing energy that would develop otherwise. By this means, a relatively small circuit breaker is given the capacity of safely interrupting potentially severe short-circuit current surges.

Any suitable configuration of the arc-extinguishing chamber may be used to interrupt the arc between contacts 16 and 18. Two arc vents 74 are illustrated in this embodiment for venting the arcing space or arc chute 76. For minimizing the strain on the case, it is desirable to line the arc chute with a non-gas-evolving material, mica for example.

Following a blow-open operation of contact arm 22, pivot cup 52 is in the position of FIG. 5, and the operating handle 40 has shifted only a little way from the "on" position of FIGS. 1 and 2. The handle does not move appreciably during the sudden opening motion of the contact arm, and once the contact arm has reached the position of FIGS. 2 and 5 and pivot cup 52 has been shifted, the linkage between the contact arm and the handle prevents spring 46 from resetting the handle.

Before the circuit breaker is to be closed once again, pivot 52 has to be reset. This is done by moving handle 40 forcibly to the "off" position of FIG. 3. During this motion, the handle and the connecting linkage act to swing contact arm 22 counterclockwise about portion 20*b* bearing on abutment 66, acting as a pivot in this operation. At one point in the clockwise movement of handle 40 from FIG. 2 to FIG. 3, the force applied to the handle pulls on bell crank 32 via link 38. Counterclockwise rotation of member 32 about its pivot 34 is limited by a guide surface 68 in the two-part casing. As a result, clockwise operation of handle 40 pulls upward on pivot 34 so as to swing member 22 upward. This action results in forcible lifting of cup 52 from the position in FIG. 5 to that in FIG. 6. The shift from the configuration of FIG. 5 to that of FIG. 6 may be accompanied by an elongation of spring 58. The relative compressive forces of that spring in its two conditions of FIG. 5 and FIG. 6 are represented by vector B″ in FIG. 8 and vector B′ in FIG. 9. Incidentally, the shift from the configuration of FIG. 5 to FIG. 6 involves a lifting of off-set portion 22*a* of the contact arm toward the spring lever 42. During this motion, cup 52 is guided laterally by the guide surfaces at the sides of recess 56, FIG. 10, and cup 52 is forced to climb up and across the slant step 73.

The circuit breaker shown in the drawings and described in detail above involves a number of novel features that have both broad and specific advantages. In a broad sense contact arm 20, 22 is operated by a more or less positive acting linkage to drive the contacts closed, the contact arm moving about a pivot in that operation; and because the pivot is shiftable the contact arm can respond to electrodynamic contact opening forces irrespective of the condition of the contact-closing mechanism. Reverse operation of the linkage from the blown-open condition to the normal open circuit condition is effective to reset the pivot to its normal condition. In this aspect of the invention, no mention has been made of the overload release portion of the circuit breaker. However, the laterally shiftable pivot represents a unique arrangement for adapting circuit breakers to electrodynamic operation in response to high-level faults. In particular the laterally shiftable pivot makes possible the electrodynamic opening operation of circuit breakers of the type having a pivoted contact arm that carries an actuator latched by a bimetal or the like, where the actuator is operated by a toggle for closing the contacts. This particular type of circuit breaker has achieved very wide commercial acceptance, so that in adding the electrodynamic contact opening feature to such circuit breakers represents a specific distinctive advance in the art.

The foregoing represents a presently preferred embodiment of the invention in its various aspects, and illustrates both broad and detailed features of novelty. However, it will be appreciated that those skilled in the art will readily adapt the novel features to other applications, and will readily introduce modifications in matters of detail. Consequently, the invention should be construed broadly in accordance with its full spirit and scope.

What is claimed is:

1. A circuit interrupter operable mechanically to make and break a circuit and operable automatically to break the circuit under severe short circuit conditions, said circuit interrupter including a first contact, a contact arm carrying a movable contact and having a pivot, means connected to said contact arm for operating said contact arm about said pivot when the pivot is in a first location for opening and closing the contacts, said pivot being movable between said first location and a second location wherein said contact arm is in its open position in which the contacts are parted amply for interrupting short-circuit currents, means forming a current path through the circuit breaker when closed, including said contacts and at least part of said contact arm and further including a circuit part acting with said part of said contact arm to form an electrodynamic blow-open current loop, and means normally supporting said pivot in said first location, said supporting means being yieldable in response to short circuit electrodynamic forces developed in said blow-open loop by current above predetermined level to allow said pivot to shift to said second location and thereby to allow said contact arm to be moved to said open position without dependence on the configuration of said contact-arm operating means.

2. A circuit interrupter in accordance with claim 1, wherein said pivot supporting means provides stable support for said pivot in each of said locations.

3. A circuit interrupter in accordance with claim 1, wherein said pivot supporting means includes a spring disposed to bias said contact arm in the contact-closing direction when the pivot is in said first location.

4. A circuit interrupter in accordance with claim 1, wherein said pivot supporting means includes a spring disposed to bias said contact arm in the contact-closing direction when the pivot is in said first location, and wherein shifting of said pivot to said second location shifts the line along which the spring acts for at least reducing the contact-closing bias thereof.

5. A circuit interrupter in accordance with claim 1, wherein said pivot supporting means includes a spring disposed to bias said contact arm in the contact-closing direction when the pivot is in said first location, further including a detent for disabling said biasing means from providing contact closing bias when said pivot has been shifted by electrodynamic force to said second location.

6. A circuit interrupter in accordance with claim 1, wherein said pivot includes a cup slidable along a bearing surface opposite to said contact arm, and wherein said supporting means includes a compression coil spring having one end disposed in said cup and acting along a slant line for providing a component of resilient force to said contact arm in the contact closing direction.

7. A circuit interrupter in accordance with claim 6, wherein said operating means includes resilient contact-opening means and wherein said contact arm carries current-responsive latching means releasable to allow opening of the contacts by said contact-opening means.

8. A circuit interrupter in accordance with claim 6, wherein said cup, when moving from said first location to said second location, traverses a surface having an abutment that obstructs return of the cup from said second location to said first location.

9. A circuit interrupter in accordance with claim 8, wherein said means for operating said contact arm has a driving connection to said contact arm and operable in a resetting motion for driving said cup across said abutment from said second location to said first location.

10. A circuit interrupter in accordance with claim 1, wherein said operating means includes overload-responsive contact opening means for driving said contact arm open about said pivot when in said first location.

11. A circuit interrupter in accordance with claim 1, wherein said operating means includes a toggle that is erect when said contacts are closed.

12. A circuit interrupter in accordance with claim 1, wherein said operating means includes resilient contact-opening means and wherein said contact arm carries current-responsive latching means releasable to allow opening of the contacts by said contact-opening means.

13. A circuit interrupter in accordance with claim 12 wherein said operation means includes a toggle operable via said latching means to drive said contacts closed.

14. A circuit interrupter in accordance with claim 1, wherein said means for operating said contact arm about said pivot includes an operating linkage articulated to said contact arm at a point spaced from said pivot by a distance that causes the portion of the contact arm between the pivot and the articulated connection to act as a lever arm.

15. A circuit interrupter in accordance with claim 1, wherein said means for operating said contact arm includes current-responsive latching means carried by said contact arm, an actuator pivoted to said contact arm at a point spaced from said pivot and normally latched by said latching means when the circuit interrupter is closed, and a manually operable toggle connected to said actuator and arranged to become erect when the circuit interrupter is closed, shifting of said pivot to the second location occurring as aforesaid despite the manually operable toggle remaining erect.

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HAROLD BROOME, Assistant Examiner