July 5, 1960 W. H. MIDDENDORF 2,944,128

COUNTER-DIRECTIONALLY RELEASABLE CIRCUIT BREAKER

Filed Feb. 25, 1957 2 Sheets-Sheet 1

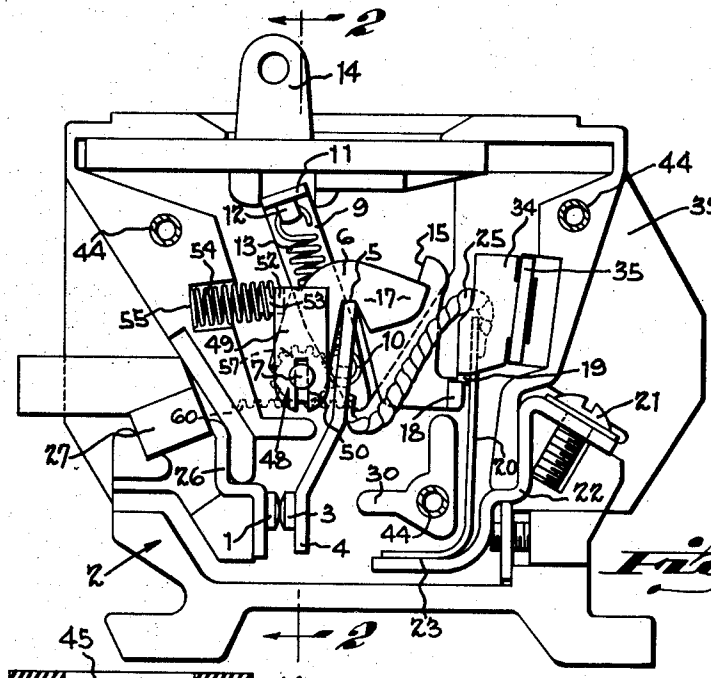



Fig. 1

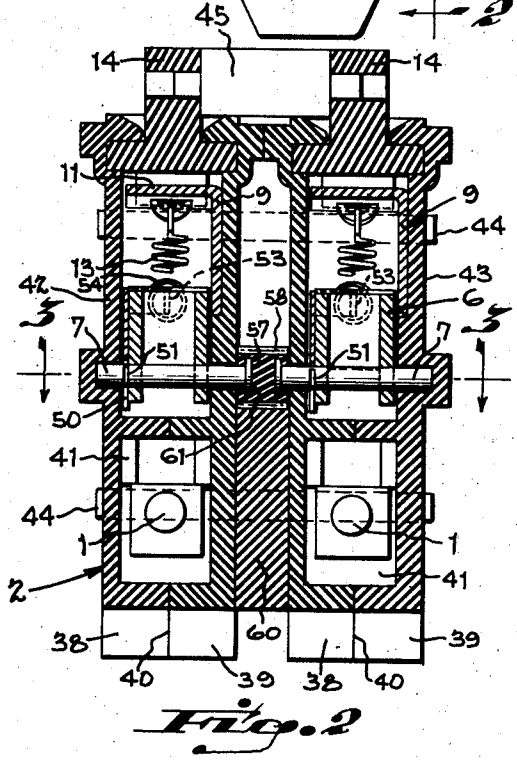



Fig. 2

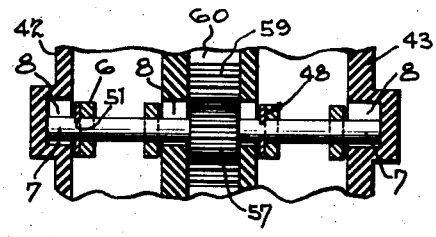



Fig. 3

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COUNTER-DIRECTIONALLY RELEASABLE CIRCUIT BREAKER

Filed Feb. 25, 1957 2 Sheets-Sheet 2

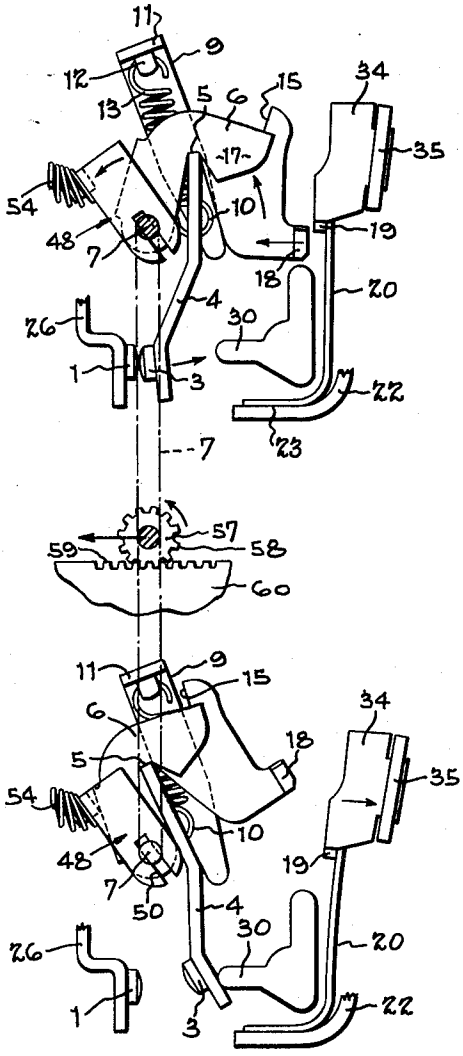



Fig. 4

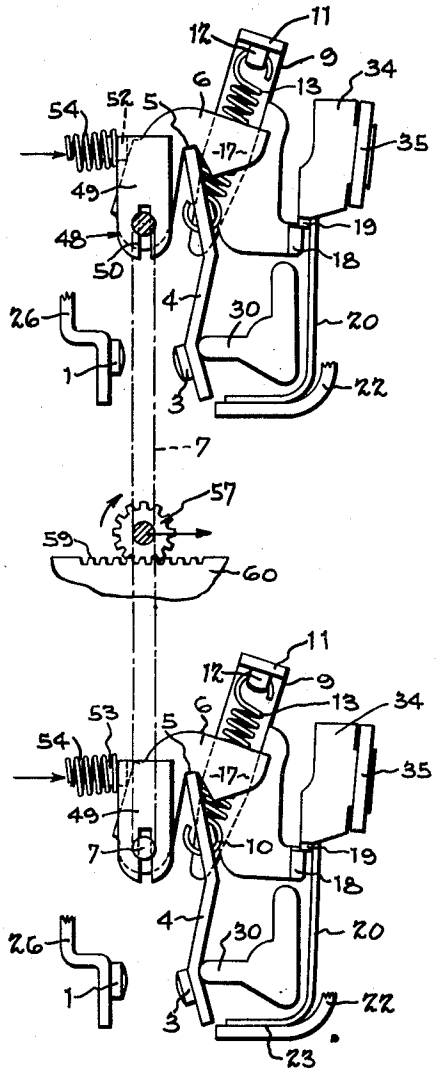



Fig. 5

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2,944,128

# COUNTER-DIRECTIONALLY RELEASABLE CIRCUIT BREAKER

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Filed Feb. 25, 1957, Ser. No. 642,018

15 Claims. (Cl. 200—116)

This invention relates to electric circuit breakers and is directed particularly to a multi-pole circuit breaker comprising a plurality of single pole circuit breaker units, each releasable in consequence of an overload in the circuit which it serves to protect, and a trip device which is common to all of the single pole circuit breakers of the assembly for mechanically effecting the release of all others when any one of the single pole circuit breakers of the assembly is tripped by overload.

The common electric circuit breaker such as is used in household distribution circuits or the like is an automatically operable switch adapted to open a circuit in the event the circuit becomes electrically overloaded, thereby terminating the fire hazard which would otherwise result from over-heating of the circuit conductors. In some instances, it is necessary or desirable for safety reasons to install independently operable circuit breakers in each of the legs of a single or multi-phase circuit so that each leg will be protected individually. For this purpose, so-called multi-pole circuit breakers have been used. However, multi-pole circuit breakers of the type heretofore available have been relatively specialized pieces of equipment which frequently are not readily available, or for which, because of size and shape, special accommodations must be provided at the panelboard. Single pole circuit breakers readily may be installed in each of the legs of a circuit but each will operate independently of the others, whereas it is frequently necessary or desirable for all circuit legs to be opened when any one becomes over-loaded.

A principal objective of this invention has been to provide circuit breakers which are individually adapted for single pole service but which are equally adapted by attachment of a common trip element for service in pairs or in a plurality as a multi-pole circuit breaker wherein each single pole unit, when tripped through electrical overload, will mechanically effect the tripping of the other single pole units and thereby automatically open all legs of the circuit.

A further objective of this invention has been to provide a multi-pole unit comprising single pole circuit breakers which are individually the same as one another as to size and shape, such that the economies of mass production may be realized, but which are adapted for multi-pole cooperation by means of a simple, common trip element, such that multi-pole circuit breakers readily may be provided when necessary by assembly of the single pole units with the common trip device.

Another objective of this invention has been to provide a single pole circuit breaker comprising cooperable latch elements which are normally engaged when the circuit breaker is in a closed-circuit condition but disengageable to cause operation of the circuit breaker to open circuit position, in conjunction with means for moving one of the latch elements in a given direction to unlatched position in response to electrical overload, and means operable from one or more adjacent circuit breakers for moving the other of the latch elements in an opposite



direction to unlatching position independently of circuit conditions prevailing in the circuit breaker.

A still further objective of this invention has been to provide a circuit breaker having cooperable latch elements, one of which is carried or controlled by a current-responsive member operable either thermally or magnetically, or both, and separate means for effecting disengagement of the latch elements independently of the current-responsive member but dependent upon the operation of an adjacent circuit breaker, without moving or bending the current-responsive member and without increasing or changing the normal force under which the cooperable latch elements are engaged. The invention, in particular, contemplates a circuit breaker which is releasable under circuit overload by movement of one latch member in response to current conditions prevailing in the circuit, as afforded by a thermally-responsive bimetal, a magnetically-responsive yoke and armature, or both, and means for independently releasing the circuit breaker regardless of the load condition of the circuit without movement of the other latch member to unlatching position as afforded by the mechanical action which is incidental to the tripping of another circuit breaker. By this construction, the current-responsive latch member is caused to move only when circuit overload requires tripping of the breaker but is otherwise protected against movement which might cause it to become permanently bent or warped and thereby desensitize or decalibrate the circuit breaker. In the past, common trip devices for circuit breakers have been proposed wherein high speed movement of an operating part, which occurs in consequence of release under a spring-actuating force, is utilized forcibly to move the current-responsive latch member to unlatching position, but it has been found that when such blows repeatedly are exerted against the current-responsive release member, it becomes progressively bent or misshapen and the circuit breaker does not respond uniformly to an overload for which it has been set or calibrated.

A still further objective of this invention has been to provide a circuit breaker having a stationary contact, a carrier having a contact cooperable with the stationary contact and movable to effect engagement and disengagement of the stationary and movable contacts, a current-responsive releasable latch for normally holding the carrier in position in which the contacts are engaged, and means rotationally responsive to the tripping of another circuit breaker for releasing the latch by movement of one element thereof in a direction which is opposite to the direction in which the other element of the latch moves to unlatching position in response to circuit overload. In this respect, the present invention contemplates a common trip element in the form of a shaft which is common to all circuit breakers of a multi-pole assembly, means for rotating the shaft about its axis in consequence of tripping of any circuit breaker of the assembly, means for advancing the shaft bodily in consequence of its rotation, and means controlled by shaft advancement for tripping all circuit breakers served by the shaft other than the circuit breaker whose tripping caused the shaft to rotate.

Other objectives and further features of the invention appear in the following detailed description of the drawings in which a typical embodiment of the present invention is disclosed.

In the drawings:

Figure 1 is a sectional elevation of a circuit breaker constructed in accordance with this invention with the parts shown in the circuit-closed position;

Figure 2 is a cross-sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a fragmentary sectional plan view taken on the line 3—3 of Figure 2;

Figures 4 and 5 are diagrammatic views illustrating the relationship of the parts, the direction of movement of some of the parts, and the effect of movement on other parts of a pair of circuit breakers having a common trip element constructed in accordance with this invention, in which views Figure 4 shows one of the circuit breakers in the position in which it has just opened in consequence of an electrical overload and the other of the circuit breakers at the beginning of mechanical release, and Figure 5 shows the relationship of the parts when the circuit breakers are being reset after tripping.

Although the tripping mechanism of the present invention is simple in nature and may be produced at low cost, an understanding of one type of mechanism with which it cooperates is desirable in order to understand the manner in which it functions; therefore, the main operating mechanism of the circuit breaker shown in the drawings is first described, although the manner in which the main operating parts of the circuit breaker function generally does not form a part of the present invention.

The single pole circuit breaker selected to illustrate an embodiment of this invention comprises an operating mechanism of the type shown in Krantz U.S. Patent 1,726,233 wherein a stationary contact **1**, mounted within an electrically insulative casing **2** is served by a movable contact **3** mounted on a pivotally movable arm **4**. The arm **4**, at its end opposite the contact **3**, is pivotally supported in a crotch **5** of a rocker or carrier member **6** which, in turn, is pivotally movable about the axis of a cross shaft **7**, having its ends guided in horizontally elongated slots **8** provided in the side walls of the casing **2**. In conventional constructions, cross shaft **7** has its endwise portions rotatably sustained in bearing recesses formed in the case walls, but for the purposes of the present invention, as subsequently explained, the recesses are horizontally elongated, and at least one extends all the way through the wall of the case in which it is located.

Adjacent one of the side walls of the casing, and to one side of carrier **6**, a lever **9** is pivotally mounted to the adjacent casing wall, as at **10**. The upper end of lever **9** is bent over the carrier **6**, as at **11**, to provide a hook **12** to which one end of a tension spring **13** is attached. The opposite end of the tension spring is connected to arm **4** at a point below crotch **5**, the arm being slotted suitably to clear the spring. The upper end of lever **9** is straddled by depending portions of a handle **14** which is reciprocally mounted at the top of the casing **2**. Spring **13** biases the rocker rotationally about the axis of shaft **7** and the rocker is movable (in counterclockwise direction as seen in Figure 1) independently of the lever **9**, but the rocker has a shoulder **15** which is engageable by the lever **9** to cause return movement of the rocker in the opposite direction.

Rocker **6** is of bifurcated construction, and one of its side arms, **17**, i.e., the one adjacent lever **9** in the structure shown, is bent over as at **18** to form a latching element. This element cooperates with a latching member **19** which projects from a thermally-responsive member or bimetal **20** having its lower end in electrical connection with a circuit terminal **21** through an electrically conductive strap **22** on which the bimetal is supported and to which it is electrically connected as at **23**. A flexible electrical conductor or so-called pigtail **25** extends from the upper portion of bimetal **20** into electrical connection with arm **4**, whereby a conductive path is furnished through arm **4** to the movable contact **3**. Stationary contact **1** is mounted on an electrically conductive strap **26** which, in the structure shown although not necessarily, terminates in a jaw **27** adapted for sliding, frictional electric interconnection with a conductive prong extending from a bus bar or the like. The circuit breaker is installed in the circuit or circuit leg which is to be protected thereby through connection across terminal **21** and jaw **27**.

Since bimetal **20** is in the circuit which is completed through contacts **1** and **3** when they are engaged, the bimetal is thermally responsive to the current magnitude. When heated, as when an overload occurs, the bimetal warps and bends, to the right as seen in Figure 1, thereby causing latch member **19** associated therewith to move to the right. If the overload is of sufficient magnitude, bimetal **20** will move sufficiently for the latching member **19** to be carried to an unlatching position in which it clears the latching member **18** associated with the carrier **6**. Under the influence of spring **13**, the arm **4** bearing against the crotch **5** in the carrier causes the carrier to rotate about the axis of shaft **7** and as the carrier rotates, the upper end of the arm **4** follows the crotch. The arm **4** thereby swings to an open-circuit position in which it is shown at the lower part of Figure 4. In this position, it will be noted that the point of connection of spring **13** to arm **4** has moved to an over-center position with respect to the point of engagement of the arm with the carrier and the spring **13**, therefore, biases the arm to the open position wherein it rests against stop **30** provided on the casing **2**.

By moving handle **14** to the right from the position in which it is shown in Figure 1, after the carrier has been released from latch **19**, lever **9** is caused to bear against stop **15** of the carrier and thereby rotate the carrier about the axis of shaft **7** in a clockwise direction with respect to Figure 1. This lowers latch element **18** to a position where it is re-engageable with latch member **19**. Assuming that bimetal **20** has cooled sufficiently to move from the warped, unlatching position in which it is shown at the lower portion of Figure 4 to the relatively unwarped, latching position in which it is shown in Figure 1, the latch member **19** will then be re-engageable by latch member **18**. This re-engagement may be facilitated by chamfering the approach edge of latch member **18** or **19**, or both, whereby latch member **19** will be cammed away sufficiently to permit the latch member **18** to pass beneath its lower surface for relatching.

During relatching, the spring **13** continues to bias arm **4** against the rocker **6**, but since the force line to the rocker remains on the same side of the pivot point of the arm as that in which it is shown at the upper portion of Figure 5, the arm **4** will remain in the open circuit position after relatching of the rocker. However, handle **14** may then be returned to the position in which it is shown in Figure 1, during which movement the line of force provided by spring upon arm **4** will move relatively to the other side of the pivot point of arm **4**, and the spring will therefore swing arm **4** about its pivot point to swing contact **3** into engagement with contact **1**.

If it is desired to provide means for releasing the carrier **6** magnetically as well as thermally, in order to trip the circuit breaker in event of instantaneous high overload, the bimetal may be equipped with a magnetic yoke **34** which is mechanically cooperable with an armature **35** arranged to effect movement of the bimetal **20** through magnetic attraction and thereby cause displacement of latch member **19** to unlatching position. The armature **35** may either be mounted stationarily in the case or in normally spaced relation to the armature **35**, or other suitable construction may be employed. In the drawing a magnetic release device is shown which conforms to the disclosure of Middendorf U.S. Patent 2,716,679 dated August 30, 1955.

Except as noted, as much of the circuit breaker as has been described up to this point does not form the substance of the present invention, and it will be understood that other types of circuit breaker operating mechanisms may be employed in utilization of the principles which are hereinafter discussed. Also, it will be understood that the case within which the operating parts are housed

may be of any suitable form other than the one disclosed. In the drawing, the case illustrated comprises hollow molded half case sections **38** and **39** which mate with one another at the meeting face **40** to provide a cavity **41** defined by spaced side walls **42** and **43** between which the operating parts of the main circuit mechanism are housed. Single pole circuit breakers arranged in assembly for multi-pole service may be joined together by suitable cross bolts or rivets **44**, and the handles of the assembled circuit breakers may be tied together for movement in unison in the usual manner, such as by cross tie members **45** (Figure 2).

In accordance with the present invention, mechanical release of each circuit breaker in consequence of tripping of another circuit breaker of a multi-pole assembly is accomplished by shifting latch member **18** away from latch member **19** in a direction opposite to the direction in which latch member **19** moves in consequence of circuit overload. To accomplish this result, the shaft **7** of each circuit breaker is equipped with a driver **48**. The driver is in the form of a stamping having a portion **49** residing adjacent carrier **6**, and the lower end of this portion is slotted as at **50** for mating engagement with one or more slots **51** cut in the cross shaft **7** whereby the driver is keyed to the cross shaft. An ear **52** is bent laterally in the path of the carrier from the portion **49** of the driver, and from this ear another portion **53** is bent laterally for guiding reception within one end of a compression spring **54**. The end of the compression spring is seated in a recess **55** formed within a wall of the case **2**. The ear portion **52** of the driver **48** is engageable by that portion of the carrier which is opposite latch member **18** of the carrier. When the circuit breaker is latched, the driver resides in the generally vertical position in which it is shown in Figure 1.

Shaft **7** of each circuit breaker projects through one or both side walls of the circuit breaker into keyed connection with a pinion **57** having teeth **58** on its periphery, or a portion of its periphery, which teeth mate with teeth **59** of a rack member **60** fastened stationarily between the circuit breaker casings and suitably supported by one or both of them or made as an integral part thereof.

The rack member **60** in the form shown may be molded of electrically insulative material and, to avoid any possibility of establishing an electrically conductive path through shaft **7** from one circuit breaker to another, the pinion **57** may be of electrically insulative plastic material or the like within which the ends of the circuit breaker shafts are spaced from one another as shown in Figure 2. Thus, a driving connection from one shaft **7** to the other through the pinion is provided by driver heads **61** formed on the ends of the shaft **7** around which the pinion material is molded. The slotted cavities **8** within which each shaft **7** is disposed permit rotation of the shaft about its own axis but also permit it to move bodily as pinion **57** rolls or walks upon rack **60**. In place of this construction, one or both of the interconnected shafts **7** of an adjacent pair of circuit breakers may carry a pinion arranged within slots **8** for engagement of the teeth thereof with rack teeth formed directly on the slots.

In Figure 4 the operating mechanisms of two adjacent circuit breakers are disclosed, somewhat diagrammatically, in association with the common trip provided by the common shaft and rack and pinion structure. The circuit breaker at the bottom portion of Figure 4 is shown in the condition in which the bimetal **20**, warped by electrical overload, has just released latch **18**. Under the influence of the operating spring **13** the rocker **6** has rotated in counter-clockwise direction to swing arm **4** and thereby separate contact **3** from contact **1**. As the carrier swings after it has been released, it engages the ear **52** of the driver and thereby rotates the driver with it around the axis of shaft **7** against the compression spring **54**. The spring thereby is compressed, and the driver and rocker come to rest in the position in which they are shown in Figure 4.

When the carrier rotates the driver **48**, the driver, in turn, rotates shaft **7** of that circuit breaker and pinion **57** thereby is rotated. Since pinion **57** is engaged with rack **60**, the rotation of the pinion is manifest not only as a rotation of the driver **48** of the associated circuit breaker, i.e., the one shown at the top of Figure 4, but it is manifest as a bodily forward motion of shaft **7** of both circuit breakers, that is, a rolling or walking movement of the shafts, which carries the shafts along slots **8** of the circuit breaker casings. Since the carrier of the circuit breakers are mounted pivotally on shafts **7**, the carriers therefore are shifted bodily in the forward direction, and this movement withdraws latch member **18** of the rocker on the upper circuit breaker which has not been released by electrical overload from latch **19** thereof, whereupon that circuit breaker becomes released. Thus, at the upper part of Figure 4 the parts are shown in the position they occupy after joint shaft rotation has caused the carrier of the upper breaker to move forwardly sufficiently for its latch member **18** to clear latch member **19** and just at the moment when the rocker is commencing to swing to open circuit position.

This movement of latch member **18** to unlatching position is accomplished without any change of the normal latching force. Hence, the bimetal is not stressed or subjected to movement as a result of mechanical unlatching. The compression spring **54** absorbs the momentum of the released carrier or rocker but does not vary the rapidity with which contact **3** departs from contact **1** since the over-center effect of the spring **13** on the arm remains unchanged.

For relatching the circuit breakers, handle **14** is operated in the same manner as for operation of a single pole unit. When pushed in the relatching direction, which is to the right as seen in Figure 1, lever **9** of each circuit breaker engages its rocker and causes it to rotate about the axis of shaft **7**. As soon as the carriers of the circuit breakers move away from the drivers thereof, the drivers follow under the influence of the compression springs **55**, but as the drivers follow, they, in turn, cause rotation of shafts **7**; hence, pinion **57** tracks upon rack **60** and the shafts **7**, therefore, move rearwardly as they rotate. This movement causes the latch members **18** of the rockers to be returned rearwardly to positions in which they are re-engageable with the latch members **19**. The cross tie **45** between the handles of adjacent circuit breakers permits relatching of the circuit breakers to be conducted in unison.

For purposes of description, the present invention has been disclosed in relation to the common tripping of a pair of circuit breakers, but it will readily be understood that as many circuit breakers may be tripped in unison as are necessary to accommodate the poles of a given installation. For example, to serve more than the two circuit breakers which are shown in Figure 2, additional units may be placed in side-by-side relation to those shown, and the only additional provision that is required is extension of the cross shaft of each circuit breaker into connection with the one adjacent to it.

Having described my invention, I claim:

1. A multi-pole circuit breaker comprising stationary contacts, carriers having contact surfaces respectively engageable with said stationary contacts, said carriers being movable to positions in which their contact surfaces are out of engagement with said stationary contacts, means for effecting movement of each carrier to a position in which its contact surface is separated from the stationary contact therefor, releasable latching means for each carrier, for holding the same in position in which its contact surface engages the stationary contact therefor, said means including cooperable members, means for moving one of said members to unlatching position in

event of current overload, means for independently moving the other of said members to unlatching position including a shaft common to all carriers, the said shaft being rotationally responsive to the release of any carrier and means for bodily shifting said shaft in response to rotational movement thereof, and means responsive to the bodily shifting of said shaft for releasing all other of said releasable latch means.

2. A multi-pole circuit breaker comprising, a plurality of fixed contacts, a plurality of movable carriers respectively having surfaces cooperable with said fixed contacts, means respectively biasing said carriers to positions in which their contact surfaces are spaced from said fixed contacts, latching means for each carrier for releasably holding the same in position in which its contact surface engages said fixed contact, each of said latching means including one member movably responsive to current overload and a cooperable member movable with said carrier, a shaft common to all carriers and rotatively responsive to the release of any carrier, and means associated with said shaft for bodily shifting all carriers, thereby to effect release of all other of said latching means through movement of the members movable with said carriers.

3. A multi-pole circuit breaker comprising, a plurality of fixed contacts, a plurality of movable carriers respectively having surfaces cooperable with said fixed contacts, means respectively biasing said carriers to positions in which their contact surfaces are spaced from said fixed contacts, latching means for each carrier for normally holding the same against the influence of said biasing means in the position in which its contact surface engages said fixed contact, said latching means including cooperable elements disengageable from one another by movement of either, one of said elements of each pair being associated with the carrier served by the pair for movement therewith to disengaging position, current responsive means for moving the other of the elements of each pair to disengaging position in consequence of circuit overload, and means common to all of the carriers for bodily shifting them in unison to positions in which the elements associated thereby are in disengaged positions in response to release of any one of said carriers through movement of its current responsive element to disengaging position.

4. A multi-pole circuit breaker comprising, a plurality of fixed contacts, a plurality of carriers having surfaces respectively cooperable with said fixed contacts, means respectively biasing said carriers to positions in which their contact surfaces are spaced from said fixed contacts, a shaft common to all carriers, said shaft being rotationally movable about its axis in response to movement of any carrier under the influence of said biasing means, means for shifting said shaft in a direction lateral to its axis in response to rotational movement of said shaft, current responsive latch means for each carrier normally engageable therewith to hold each carrier in position in which its surface engages the fixed contact therefor, and means actuated through shifting of said shaft for disengaging said latch means.

5. In a multi-pole circuit breaker comprising a plurality of circuit breaker units each of the type comprising a stationary contact, a carrier movable in a plane and having associated therewith a contact engageable and disengageable with the stationary contact in consequence of movement of the carrier to contact-engaging and disengaging positions, means biasing the carrier to contact-disengaging position, a current-responsive control device, the improvement which comprises an axially rotatable trip bar common to all of the circuit breaker units of the plurality and extending lateral to the plane of movement of the carriers thereof, a latch in each circuit breaker unit comprising elements cooperable for holding the carrier thereof in contact-engaging position and separable to respective unlatching positions upon movement of either in a direction away from the other, means for moving one of said elements to its unlatching position by said current-responsive device in response to circuit overload, means for moving the said other of said latch elements to unlatching position in a direction opposite to the movement of said latch element moved by said current responsive device in consequence of rotation of said trip bar, and means for rotating said trip bar in consequence of release of the carrier of any circuit breaker of the plurality, said means comprising, in each circuit breaker unit, an element rotatively connected to said trip bar and rotatively engageable by a carrier thereof during latch-releasing movement of said carrier under the influence of said biasing means.

6. A multi-pole circuit breaker comprising a plurality of circuit breaker units each of the type comprising a stationary contact, a movable carrier having associated therewith a contact engageable and disengageable with the stationary contact in consequence of movement of the carrier to contact-engaging and disengaging positions, means biasing the carrier to contact-disengaging position, a latch for holding the carrier in contact-engaging position, said latch comprising individually movable cooperable elements separable upon movement of either in respectively opposite directions, one of said elements being associated with said carrier thereby being movable to latch-releasing position upon movement of said carrier, a current-responsive control device for moving the other of said elements to its latch-releasing position, an axially rotatable and bodily shiftable trip shaft common to all of the circuit breaker units of the plurality, means including cooperable members for bodily shifting said trip shaft when it is rotated axially, said trip shaft engaging the carriers of the circuit breaker of the plurality and moving said carriers to shift the latch elements associated therewith to their latch-releasing positions upon axial rotation of said trip shaft in one direction and to latch re-engaging position upon rotation in an opposite direction, each circuit breaker unit having a member connected to said trip shaft and positioned in the path of movement of the carrier thereof for effecting axial rotation of said trip shaft when the carrier is moving to contact-disengaging position under the influence of said biasing means, whereby movement of a carrier of any circuit breaker of the plurality, upon release thereof from the latch by said current-responsive device, effects release of the carriers of all other circuit breakers of the plurality through bodily movement of said trip shaft, and means for rotating said trip shaft in a direction opposite to the direction in which it is rotated by a released carrier for relatching the carriers of said circuit breakers.

7. A multi-pole circuit breaker comprising a plurality of circuit breaker units each of the type comprising a stationary contact, a movable carrier having associated therewith a contact engageable and disengageable with the stationary contact in consequence of movement of the carrier to contact-engaging and disengaging positions, means biasing the carrier to contact-disengaging position, a latch for holding the carrier in contact-engaging position, said latch comprising individually movable cooperable elements separable upon movement of either in respectively opposite directions, one of said elements being associated with said carrier thereby being movable to latch-releasing position upon movement of said carrier, a current-responsive control device for moving the other of said elements to its latch-releasing position, an axially rotatable and bodily shiftable trip shaft common to all of the circuit breaker units of the plurality, means including coperable gear-like rack and pinion members for bodily shifting said trip shaft when it is rotated axially, said trip shaft engaging the carriers of the circuit breaker of the plurality and moving said carriers to shift the latch elements associated therewith to their latch-releasing positions upon axial rotation of said trip shaft in one direction and to latch re-engaging position upon rotation in an opposite direction, each circuit breaker unit having

a member connected to said trip shaft and positioned in the path of movement of the carrier thereof for effecting axial rotation of said trip shaft when the carrier is moving to contact-disengaging position under the influence of said biasing means, whereby movement of a carrier of any circuit breaker of the plurality, upon release thereof from the latch by said current-responsive device, effects release of the carriers of all other circuit breakers of the plurality through bodily movement of said trip shaft, and means for rotating said trip shaft in a direction opposite to the direction in which it is rotated by a released carrier for relatching the carriers of said circuit breakers.

8. A multi-pole circuit breaker comprising a plurality of circuit breaker units each of the type comprising a stationary contact, a movable carrier having associated therewith a contact engageable and disengageable with the stationary contact in consequence of movement of the carrier to contact-engaging and disengaging positions, means biasing the carrier to contact-disengaging position, a latch for holding the carrier in contact-engaging position, said latch comprising individually movable cooperable elements separable upon movement of either in diametrically opposite respective directions, one of said elements being mounted on said carrier and being movable therewith to latch-releasing position, a current-responsive control device for moving the other of said elements to its latch-releasing position, an axially rotatable and bodily shiftable trip shaft common to all of the circuit breaker units of the plurality, means including a gear-like member carried by said shaft and a relatively fixed rack-like member cooperable therewith for shifting said trip shaft when it is rotated axially, said trip shaft operatively engaging all of the carriers of the circuit breaker of the plurality and moving said carriers to shift the latch elements thereof to latch-releasing positions upon axial rotation of said trip shaft in one direction and to latch re-engaging position upon axial rotation of said shaft in an opposite direction, each circuit breaker unit having a shaft rotating member connected to said trip shaft and positioned to be engaged by the carrier when the carrier is moving to contact-disengaging position under the influence of said biasing means whereby movement of a carrier of any circuit breaker of the plurality, upon release thereof of the latch therefor by said current-responsive device, effects release of the carriers of all other circuit breakers of the plurality through axial rotation and bodily shifting of said trip shaft, and means for relatching the carriers of said circuit breakers after release thereof.

9. A multi-pole circuit breaker comprising a plurality of circuit breaker units each of the type comprising a stationary contact, a movable carrier having associated therewith a contact engageable and disengageable with the stationary contact in consequence of movement of the carrier to contact-engaging and disengaging positions, means biasing the carrier to contact-disengaging position, a latch for holding the carrier in contact-engaging position, said latch comprising individually movable cooperable elements separable upon movement of either in diametrically opposite respective directions, one of said elements being mounted on said carrier and being movable therewith to latch-releasing position, a current-responsive control device for moving the other of said elements to its latch-releasing position, an axially rotatable and bodily shiftable trip shaft common to all of the circuit breaker units of the plurality, means including a gear-like member carried by said shaft and a relatively fixed rack-like member cooperable therewith for shifting said trip shaft when it is rotated axially, said trip shaft operatively engaging all of the carriers of the circuit breaker of the plurality and moving said carriers to shift the latch elements thereof to latch-releasing positions upon axial rotation of said trip shaft in one direction and to latch re-engaging position upon axial rotation of said shaft in an opposite direction, each circuit breaker unit having a shaft rotating member connected to said trip shaft and positioned to be engaged by the carrier when the carrier is moving to contact-disengaging position under the influence of said biasing means whereby movement of a carrier of any circuit breaker of the plurality, upon release thereof of the latch therefor by said current-responsive device, effects release of the carriers of all other circuit breakers of the plurality through axial rotation and bodily shifting of said trip shaft, spring means biasing said shaft toward axial rotation in a direction opposite to the direction in which it is axially rotated by said carrier, and means for relatching the carriers of said circuit breakers after release thereof.

10. A multi-pole circuit breaker comprising a plurality of circuit breaker units, an axially rotatable and bodily shiftable trip shaft common to all of the circuit breakers of the plurality, each circuit breaker comprising a stationary contact, a carrier pivotally mounted on said trip shaft, each carrier having associated therewith a contact engageable and disengageable with the stationary contact in consequence of pivotal movement of the carrier about the axis of the trip shaft to contact-engaging and disengaging positions, means biasing the carrier of each circuit breaker to contact-disengaging position, a latch for holding the carrier in contact-engaging position, each latch comprising cooperable elements separable to unlatching position upon movement of either in a direction away from the other, one of said latch elements in each circuit breaker being associated with the carrier thereof and movable to unlatching position by movement of the carrier through bodily shifting of said trip shaft, each circuit breaker having a current-responsive control device for moving the other of said latch elements to unlatching position, said shaft having elements thereon positioned respectively engageable by carriers of the circuit breakers when they are unlatched for effecting axial rotation of said shaft, and means for translating the axial rotational movement imparted to said shaft by any such released carrier into a bodily movement of said shaft whereby said shaft moves all other carriers to carry to unlatching positions the latch elements respectively associated therewith.

11. In a multi-pole circuit breaker comprising a plurality of circuit breaker units each of the type comprising rotatable and bodily shiftable trip shaft common to all of the circuit breakers of the plurality, each circuit breaker comprising a stationary contact, a movable carrier having associated therewith a contact engageable and disengageable with the stationary contact in consequence of movement of the carrier to contact-engaging and disengaging positions, means biasing the carrier of each circuit breaker to contact-disengaging position, and a latch for holding the carrier in contact-engaging position, each latch comprising cooperable elements separable upon movement of either in a direction diametrically away from the other, one of said elements in each circuit breaker being associated with the carrier thereof and movable to latch-releasing position by movement of the carrier through shifting of said trip shaft, each circuit breaker having a current-responsive control device for moving the other of said latch elements to latch-releasing position, said shaft having elements positioned respectively in the paths of movement of the carriers of the circuit breakers for effecting rotation of said shaft when the carrier of any circuit breaker is released from said latch and moves under the influence of said biasing means, and means for translating the rotational movement imparted to said shaft by any such carrier into a linear movement whereby said shaft moves the carriers to positions in which the latch elements associated therewith are all shifted to latch-releasing positions, and means for rotating said shaft in an opposite direction thereby to return the latch elements associated with said carriers to latch-engaging position for resetting said circuit breakers.

12. In a multi-pole circuit breaker comprising a plurality of circuit breaker units each of the type comprising a stationary contact, an independently movable carrier having associated therewith a contact engageable and disengageable with the stationary contact in consequence of movement of the carrier to contact-engaging and disengaging positions, means biasing the carrier to contact-disengaging position, and a current-responsive control device, the improvement which comprises an axially rotatable trip bar common to all of the circuit breaker units of the plurality, a latch in each circuit breaker unit for normally holding the carrier thereof in contact-engaging position, said latch comprising cooperable elements separable to respective unlatching positions upon movement of each in a direction away from the other, one of said elements being movable to its unlatching position by said current-responsive device in incidence of circuit overload, the other of said elements in each circuit breaker unit being fixed to its respective carrier, means for moving the said other of said latch elements to its unlatching position in a direction opposite to the movement of said latch element moved by said current responsive device in consequence of rotation of said trip bar, and means for rotating said trip bar in consequence of release of the carrier of any circuit breaker of the plurality, said means comprising an element in each circuit breaker unit connected to said shaft and engageable by a carrier thereof during its movement under the influence of said biasing means.

13. A multi-pole circuit breaker comprising an axially rotatable trip shaft, drivers keyed to said shaft, one for each pole of the multi-pole circuit breaker, means coacting with said shaft for moving it in a direction lateral to its axis as it is rotated axially by any one of said drivers, each pole of the circuit breaker comprising cooperable contacts, a carrier for disengaging one of said contacts from the other, each carrier being in bodily movable association with said trip shaft and being pivotally mounted in position to engage a driver of said trip shaft thereby to cause rotation and consequent lateral displacement of said trip shaft and bodily displacement of all carriers associated therewith, means for biasing each carrier toward pivotal movement to contact-disengaging position, latches respectively holding each of said carriers against pivotal movement under said biasing means, each latch comprising separable elements which are normally engaged when the carrier served thereby is in circuit-closed position, one of said elements of each latch being associated with said carrier served thereby and movable to an unlatching position upon shifting of said carrier in response to lateral movement of said trip shaft, and means respectively responsive to the current traversing each pole of the circuit breaker for moving the other element of each latch to an unlatched position in consequence of circuit overload whereby the release of any carrier of the multi-pole circuit breaker in consequence of its release under circuit overload causes actuation of the driver engageable thereby to rotate said common trip shaft and shift the same laterally to effect movement to unlatching position of the latches on the carriers serving the other poles of the circuit breaker.

14. A multi-pole circuit breaker comprising an axially rotatable trip shaft, drivers keyed to said shaft, one for each pole of the multi-pole circuit breaker, gear and pinion means for moving said shaft in a direction lateral to its axis as it is rotated axially from any one of said drivers, each pole of the circuit breaker comprising cooperable contacts, a carrier for disengaging one of said contacts from the other, each carrier being in bodily movable association with said trip shaft and being pivotally mounted in position to engage a driver of said trip shaft thereby to cause rotation and consequent lateral displacement of said trip shaft and bodily displacement of all carriers associated therewith, means for biasing each carrier toward pivotal movement to contact-disengaging position, latches respectively holding said carriers against pivotal movement under said biasing means, each latch comprising separable elements which are normally engaged when a carrier served thereby is in circuit-closed position, one of said elements of each latch being associated with said carrier served thereby and movable to an unlatching position upon bodily shifting of said carrier in response to lateral movement of said trip shaft, means respectively responsive to the current traversing each pole of the multi-pole circuit breaker for moving the other element of each latch to an unlatched position in consequence of circuit overload, whereby the release of any carrier of the multi-pole circuit breaker in consequence of its release under circuit overload causes actuation of the driver engageable thereby to rotate said common trip shaft and shift the same laterally to effect movement to unlatching position of the latches on the carriers serving the other poles of the circuit breaker, and means for relatching each of said carriers.

15. A multi-pole circuit breaker comprising an axially rotatable trip shaft, drivers keyed to said shaft, one for each pole of the multi-pole circuit breaker, gear and pinion means for moving said shaft in a direction lateral to its axis as it is rotated axially from any one of said drivers, each pole of the circuit breaker comprising cooperable contacts, a carrier for disengaging one of said contacts from the other, each carrier being in bodily movable association with said trip shaft and being pivotally mounted in position to engage a driver of said trip shaft thereby to cause rotation and consequent lateral displacement of said trip shaft and bodily displacement of all carriers associated therewith, means for biasing each carrier toward pivotal movement to contact-disengaging position, latches respectively holding said carriers against pivotal movement under said biasing means, each latch comprising separable elements which are normally engaged when a carrier served thereby is in circuit-closed position, one of said elements of each latch being associated with said carrier served thereby and movable to an unlatching position upon bodily shifting of said carrier in response to lateral movement of said trip shaft, and means respectively responsive to the current traversing each pole of the multi-pole circuit breaker for moving the other element of each latch to an unlatched position in consequence of circuit overload, whereby the release of any carrier of the multi-pole circuit breaker in consequence of its release under circuit overload causes actuation of the driver engageable thereby to rotate said common trip shaft and shift the same laterally to effect movement to unlatching position of the latches on the carriers serving the other poles of the circuit breaker, and means for relatching each of said carriers, said means including spring means for biasing said trip shaft toward rotation in a direction counter to the direction in which it is rotated when any one of its drivers is engaged by a released carrier.

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