March 2, 1965 N. R. BEAUDOIN 3,171,932

MULTIPOLE ELECTRIC CIRCUIT BREAKER WITH COMMON TRIPPING MEANS

Filed May 20, 1963 2 Sheets-Sheet 1

FIG. 1.

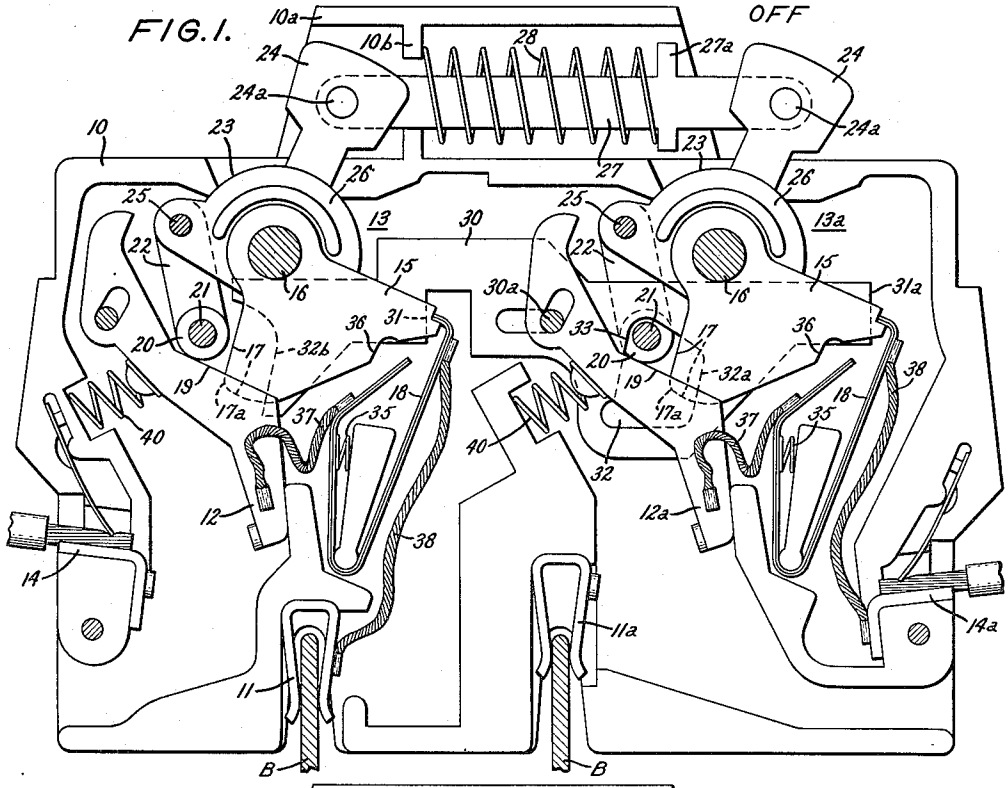
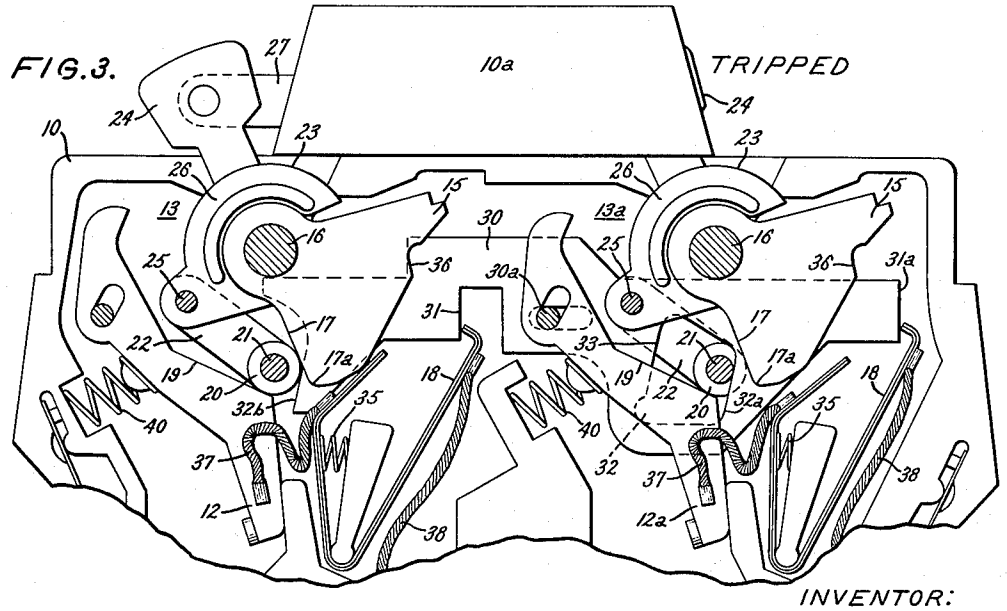


FIG. 3.



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FIG. 2.

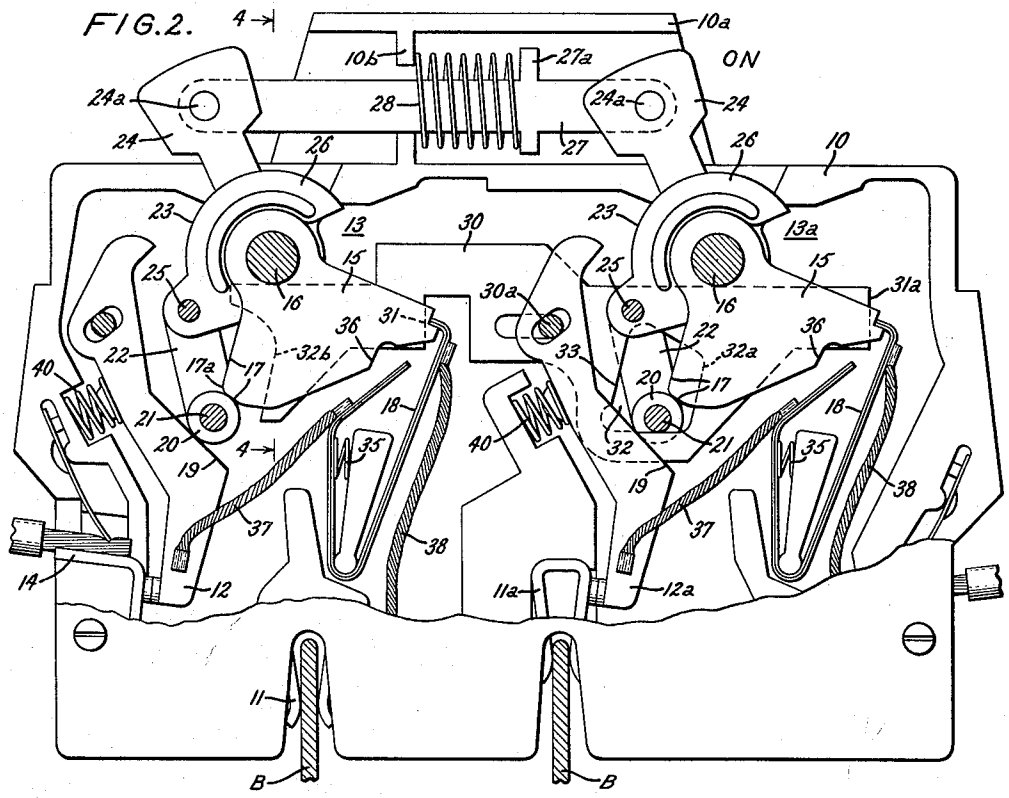
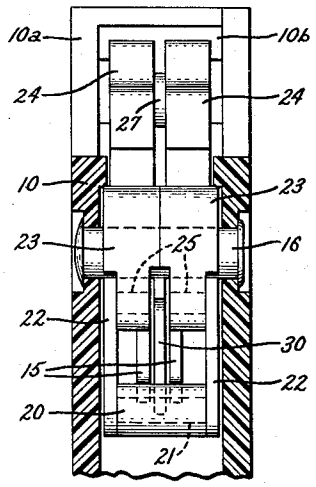


FIG. 4.



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MULTIPOLE ELECTRIC CIRCUIT BREAKER WITH COMMON TRIPPING MEANS

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3 Claims. (Cl. 200—116)

My invention relates to multipole electric circuit breakers, and particularly to interlocked tripping means for current responsively tripped circuit breakers having individual overload tripping elements associated with each pole of the breaker, ie. with each pair of cooperating contact members. This invention is an improvement upon that described and claimed in application S.N. 268,738, filed March 28, 1963, by D. B. Powell and assigned to the same assignee as the present invention.

The invention is especially well adapted for use with small manually operable, current responsively tripped air circuit breakers of the single pole type commonly mounted in multiple arrays for the control of branch lighting and power loads, such as in residential and commercial service entrance load centers, industrial distribution panelboards and the like. Such panelboard circuit breakers are commonly made up with one or more single pole breakers in a single casing and may be utilized separately as single pole branch breakers or in ganged pairs as double pole breakers. When two such circuit breakers are electrically connected for double pole use in a single branch circuit, it is desirable to ensure that both breakers in any one circuit trip in response to actuation of the trip element of either of them. This is true whether or not the manually operating elements of the two breakers are coupled for simultaneous actuation.

As shown in Patent 2,779,881, Thomas, single pole circuit breakers of the foregoing type have been coupled for simultaneous tripping of two breakers which are disposed in side-by-side relation. The interlocking element there disclosed is positioned exteriorly of and between side recessed circuit breaker casings. Ganged breakers of this design thus require special casings the expense of which increases the cost of full line manufacture. Moreover, the lateral casing recess requires an individual breaker design of appreciable thickness module.

In order to simplify and speed the installation of service entrance equipment and reduce cost there has been an increasing use of multiple assemblies consisting of several complete single pole circuit breakers mounted in a single integral casing. It is desirable that such breakers be of a design to provide for either individual or ganged operation with minimum use of special parts. Also, the trend to increasing numbers of branch circuits to meet growing residential and commercial power loads has led to panelboard circuit breaker designs of smaller physical size. Primarily it is desirable to decrease appreciably the thickness dimension of such breakers to permit more circuits in a panelboard of predetermined length. While the thickness module of commercially available circuit breakers of the type shown in the Thomas patent is commonly about one inch, it is now a growing practice to design for one half inch thickness. A circuit breaker of such narrow dimension requires a mechanism of simplified and narrow design and leaves very little space for any lateral interconnection between breakers.

Accordingly it is a general object of my invention to provide improved means for optionally interconnecting the separate operating mechanisms of several single pole electric circuit breakers with a minimum number of special parts.

It is a more particular object of my invention to provide means interior of the casing for interconnecting the operating mechanisms of a pair of circuit breakers disposed in end-to-end or tandem relation in integral or separate casings of extremely narrow proportion relative to requisite mechanical strength and electrical clearance.

It is a specific object of my invention to provide means interior of the casing for interconnecting the trip elements of a pair of electric circuit breakers assembled in end-to-end relation in a single unitary casing and having manually operable wedge type operatnig mechanisms laterally releasable upon current overload.

In carrying out my invention in one preferred embodiment, I provide within a single narrow casing of suitable molded plastic insulating material, a pair of substantially identical single pole electric circuit breakers disposed in essentially co-planar end-to-end or tandem relation. Each circuit breaker includes a pair of separable contacts, a moveable current responsive trip member and manually operable wedging means therebetween. Individual latch members responsive to the current through the respective pairs of contacts normally restrain the trip members against movement but when released permit the trip members against movement but when released permit the trip members to laterally relieve and release the wedge.

To ensure that overload tripping of any one such end-to-end pair of breakers effects like tripping operation of the other, I provide a single flat interlocking bar interiorly of the casing which is positioned to be engaged and moved longitudinally by a part of the manual operating mechanism of either breaker in its trip operation. The driving part of each operating mechanism is one which moves through a distinctive path in automatic trip operation only. The interlocking bar is provided with portions disposed to engage and unlatch the current responsive trip element of either breaker which is itself not released by the overload current. Preferably the manual operating handles of the two breakers are also coupled together and the operating mechanisms are of the trip-free type. By this arrangement the manual handle of either breaker which is separately tripped by overcurrent is held by the other breaker in its "on" position until the second breaker is tripped by the interlock bar. Such handle interconnection ensures reliable operation of the trip interlock even with breaker mechanisms of the automatic reset type.

Further objects and advantages of my invention will be apparent to those skilled in the art from the following detailed specification taken in conjunction with the accompanying drawings in which:

FIG. 1 is a side elevational view of a pair of single pole electric circuit breakers embodying my invention, the breakers being shown in their open circuit position with a side of the casing removed;

FIG. 2 is a side elevational view similar to FIG. 1 showing the same circuit breakers in their circuit closing positions;

FIG. 3 is a side elevational view similar to FIGS. 1 and 2 showing the same circuit breakers in their automatically tripped positions but with the manual handles held against movement, i.e. the "trip free" position; and

FIG. 4 is a fragmentary transverse cross sectional view of one of the circuit breaker mechanism taken along the line 4—4 of FIG. 2.

Referring now to the drawing and particularly to FIGS. 1, 2 and 3, I have illustrated my invention as applied to a small manually operable current responsively tripped electric circuit breaker of the molded case type having a wedge and cam operating mechanism of the kind described and claimed in a co-pending patent application S.N. 242,424 filed on December 5, 1962, by David B. Powell and assigned to the same assignee as the instant application. The thermal latch element of the circuit breaker mechanism illustrated herein is more specifically

described and claimed in a co-pending patent application S.N. 248,293 filed on January 2, 1963, by Klein and Powell and assigned to the same assignee as the instant application.

As illustrated in the drawings, my multipole circuit breaker consists of two individual single pole circuit breaker mechanisms mounted in end-to-end relation in a single narrow and elongated casing **10**. In the drawing one side of the casing has been removed to expose the operating mechanism. In the lower central portion of the casing **10** there are located a pair of line terminal clips **11** and **11***a* adapted to be disposed in clamping relation on a pair of side-by-side flat busbars B. Through a pivoted contact arm **12** of one circuit breaker **13** the line terminal clip **11** is connected to a first load terminal **14** disposed at one end of the casing **10** and serving as a fixed switch contact member. Similarly the line terminal clip **11***a*, serving in this case as the fixed contact member of the other circuit breaker **13***a*, is connected through a pivoted contact arm **12***a* of that circuit breaker to a second load terminal member **14***a* at the opposite end of the casing **10**. The contact arms **12** and **12***a* are each biased to open circuit position by separate springs **40** and actuated to closed position by individual manually operable, current responsively tripped mechanisms of identical structure to like parts of which the same reference numerals will be applied.

Each operating mechanism for manually and automatically moving the separate circuit breaker contact arms **12** and **12***a* between their open circuit and closed circuit positions comprises a releasable tripping member **15**, shown as a flat plate of insulating material loosely pivotally mounted upon a pivot pin **16** and having at its edge adjacent the contact arm **12** a cam surface **17**. The cam surface **17** is formed in two parts providing therebetween an apex point **17***a* with which a cam follower cooperates with an overcenter locking action to be more fully described hereinafter. The releasable tripping member **15** is normally restrained against tripping movement by means of a thermostatic latch member **18** which is preferably of the type described and claimed in the foregoing application S.N. 248,293.

The lateral edge of the contact arm **12** adjacent the normally fixed cam surface **17** constitutes a cooperating cam surface **19** of essentially linear configuration and is disposed to converge toward the sam surface **17** in the open circuit position of the parts as illustrated at FIG. 1. For manual closing and opening operation there is provided a movable wedging roller **20** rotatably mounted upon a pivot pin **21** at the free end of a swinging link **22**. The link **22** is pivotally mounted eccentrically upon a rotary handle member **23** carried by the fixed pivot **16**. The handle member **23** is provided with a radial arm **24** which extends through the upper end wall of the casing **10** to serve as a handle lever. The link **22** is swingably mounted upon an internal arm of the handle **23** by means of a pin **25**. The upper portion of the handle member **23** is provided with an arcuate rim **26**, one end of which serves as an abutment or shoulder to engage the releasable tripping member **15** when released and return it to latched position. The two manual handles **24** are coupled together by a link **27** which is partially enclosed by an upper shroud portion **10***a* of the switch housing. Both handles are biased to "off" or circuit opening position by a spring **28** interposed between a housing abutment **10***b* and a shoulder **27***a* on the link **27**. As described in the foregoing application S.N. 242,424, this operating mechanism is both trip free and automatically resetting.

As previously stated, each of the individual circuit breaker mechanisms mounted in the single casing **10** includes a releasable trip member **15** is pivotally mounted upon the pivot **16** and normally restrained against tripping movement by a current responsive latching member **18**. In order to couple the tripping members for simultaneous operation in the event of overload release of only one of the trip member **15**, I provide an elongated interlock bar **30** mounted for rectilinear sliding movement in the casing **10** and having abutment portions **31**, **31***a* disposed adjacent the two thermal latches **18** to engage and move these latches to releasing position. The interlock bar is slidably mounted upon a fixed pin **30***a* and engages at its upper edge the spaced apart pivot pins **16**. Adjacent the circuit breaker **13***a* the interlock bar **30** is apertured at **32** and the cam roller pin **21** of the breaker **13***a* passes through the aperture. One edge surface **32***a* of aperture **32** is positioned to be engaged by the pin **21** in its tripping movement when the associated trip member **15** is released by the thermal latch **18**. A similar edge surface **32***b* of rod **30** is positioned in like manner with respect to the roller **20** of circuit breaker **13**. Either pin **21** when released in trip operation to strike the surface **32***a* or **32***b* (directly or through the roller **20** as the case may be) acts to drive the rod **30** to latch-releasing position (to the right as shown in the drawing). The rod **30** is freely mounted, i.e. unbiased as to position, and is moved back to a normal position of non-interference with the latches by action of the roller pin **21** (on the breaker **13***a*) in resetting to its "off" or open position. In such resetting action the pin **21** engages the edge surface **33** of aperture **32**.

While it will be evident to those skilled in the art that any desired type of current responsive latch member may be utilized to restrain tripping movement of the trip members **15**, I have shown a thermally responsive latch member in the form of a generally U-shaped bimetallic strip loosely pivotally mounted at its bight and biased to latching position by means of a spring **35**. As more fully described in the foregoing patent application S.N. 248,293, the U-shaped bimetallic latch member **18** is arranged when heated by a predetermined excessive current to increase appreciably the divergence of its two legs and remove its latching leg from engagement with the trip member **15**. This is accomplished by the free leg of the bimetal first engaging an abutment portion **36** of the trip member **15** whereupon it acts as a prop so that further thermal divergence causes unlatching movement of the latching leg. Each bimetallic latch member **18** is rendered current responsive by passing therethrough the current traversing the associated contact arm **12** or **12***a*. For this purpose one leg of each bimetallic latch **18** is connected by means of a flexible connector **37** to the associated contact arm **12** or **12***a* and the other leg of each bimetal is connected through a flexible connector **38** to the other terminal of its associated circuit breaker.

At FIG. 4 I have shown a cross sectional view of one of the circuit breakers of FIGS. 1, 2 and 3 to illustrate that, if desired, the principal operating parts may be made in dual or divided form with the interlock bar **30** centrally located in the casing. As shown in that view, each trip member **15** is comprised of two identical plates one on each side of the bar **30**. Outside the two plates **15** and also mounted on the handle pivot **16** is the divided or two-part handle member **23**, the paired parts being connected by a pin **42***a* through the side-by-side handle levers **24**. The roller pin **21** is carried by a pair of spaced parallel links **22**, and the contact arm **12** is also made up of a pair of spaced apart and connected metal arms.

It will now be evident that in manual operation when the connected handle levers **24** are moved from the position of FIG. 1 to the position of FIG. 2, the swingable actuating links **22** are moved downwardly and the wedging rollers **20** forced between the cam surfaces **17** and **19**, respectively, of the releasable tripping members **15** and the respective movable contact arms **12** and **12***a*. The rollers **20** move overcenter on the apex points **17***a* of the normally fixed cam surfaces **17** and lock the movable contact arms **12** and **12***a* in closed circuit position against the bias of the contact springs **40**, as shown at

FIG. 2. In this position the force of each spring **40** upon the associated contact arms **12** (or **12***a*) is transmitted through the wedging roller or cam follower **20** to the releasable tripping member **15** by pressure against the normally fixed cam surface **17**. This pressure from the contact bias spring serves, in the circuit closing position of the mechanism, to bias the releasable tripping member **15** for counterclockwise movement (as shown in the drawings) to a released or tripping position. Normally the releasable trip members **15** are restrained against such tripping movement by the current responsive latch members **18** so that in manual opening or closing operation the trip member **15** is stationary. It will be evident that manual circuit opening movement for each of the breakers is the reverse of that described above for closing in that clockwise movement of the handle levers **24** raises the swingable links **22** and removes the rollers **20** from locked wedging position between the fixed cam surfaces **17** and the contact arm surfaces **19**.

Assuming now that both of the circuit breakers **13** and **13***a* are in their circuit closing positions as shown at FIG. 2 and are being held manually in that position, the operation upon overload release will be as follows. First let it be further supposed that only one pole of the dual circuit breaker mechanism is affected by excessive overload current and that only one of the bimetallic latch members **18** moves to unlatching position by the thermal action previously described. When that thermal latch is released, for example in the circuit breaker **13**, the associated trip member **15** moves (counterclockwise as shown in the drawing) about its pivot **16** under the influence of the contact spring **40** acting through the contact arm **12** and the wedging roller **20**. Such movement permits the contact arm **12** to move to open circuit position and releases the swingable link **22** and roller **20** for upward movement out of wedging position under the influence of the handle spring **28**. The handles **24** however are momentarily held in "on" position by the unreleased circuit breaker mechanism **13***a* even if not manually held "on" as has been assumed. The release link **22** of circuit breaker **13** is therefore contained to swing counter-clockwise about its pivot **25** (i.e. to "trip free" position, as shown at FIG. 3), so that its roller pin **21** engages the edge surface **32***b* of rod **30** and drives that rod to the right. In moving to the right the rod **30** (at its abutment **31***a*) engages the thermal latch **18** of circuit breaker **13***a* and releases the trip member **15** of that breaker. When the second trip member **15** moves to trip-free position as shown at FIG. 3, both circuit breakers are open. If the handles **24** (assumed held "on") are now released their annular rims **26** engage the upper edges of the trip members **15** and return these members **15** to their normal latched positions awaiting return of the latch members **18**.

In resetting automatically to "off" position under the influence of handle spring **28** the link **22** of circuit breaker **13***a* is raised and moved in a clockwise direction from the position of FIG. 3 to that of FIG. 1. In this movement the roller pin **21** of that breaker engages the edge **33** of aperture **32** in the rod **30** and moves the rod **30** to the left to a position (FIGS. 1 and 2) of non-interference with the latches **18**.

It will now be evident to those skilled in the art that in the event overload current simultaneously affects both of the thermal latch members **18** but does so in different degree, due either to different current values or slightly unequal overload settings, the first circuit breaker mechanism to trip will actuate the interlock bar **30** to mechanically force simultaneous tripping of the other breaker.

While I have illustrated the individual circuit breaker mechanisms within the common casing **10** as having coupled manual operating handles **24** (as shown at FIGS. 1, 2 and 3), it will of course be understood by those skilled in the art that these handles may be independently

operable if desired. If the handles are independent, a thermally released trip member **15** does not ordinarily move fully to its trip-free position before it is engaged and reset by the handle rim **26**. The member **15** moves only enough to release the roller **20**, so that counterclockwise swinging movement of the link **22** will be quite limited. Very close tolerance is then required to obtain adequate movement of rod **30**.

It will also be understood by those skilled in the art that while my invention has particular application to released wedge circuit breaker mechanisms disposed in end-to-end tandem relation, the particular type of operating mechanism is not significant except insofar as it must include some manually operable part movable in automatic tripping operation through a path not transversed in manual operation. If an automatic reset mechanism is used, it is desirable to have it also trip-free in operation and to couple the manual handles together to ensure reliable operation of the trip interlock.

While I have illustrated only a preferred embodiment of my invention by way of illustration, many modifications will occur to those skilled in the art, and I therefore wish to have it understood that I intend in the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

I claim:

1. A pair of electric circuit breakers each including a pair of separable contacts and an individual actuating mechanism therefore having a manually operable handle biased to open circuit position, means mounting said actuating mechanisms in end-to-end substantially coplanar relation, each said mechanism including a wedging member movable through a predetermined path in manual operation and a releasable trip member restraining said wedging member against lateral movement, individual latch means each responsive to excessive current through its associated separable contacts to release the respective wedge member for lateral contact opening movement, a rectilinearly slidable interlocking member having means engageable by each said wedging means in lateral movement and movable thereby to a latch-disengaging position, said interlocking member having portions disposed to engage and move each said latch means to releasing position, whereby current responsive release of either said wedging member effects movement of said interlocking member to release the other said wedging member thereby to open both said circuit breakers substantially simultaneously.

2. A pair of electric circuit breakers each including a pair of separable contacts and a pivotally mounted movable contact arm biased to open circuit position, individual circuit breaker actuating mechanisms each including a manually operable wedging member and a releasable trip member, said trip members restraining said wedging members respectively against lateral movement, separate latch means responsive respectively to excessive current through the associated contacts to release said trip members, common handle means biased to contact opening position and connected to actuate said wedging members, said handle means biasing said trip members when released to latching position, and a rectilinearly slidable interlocking member having means engageable by each said wedging member upon lateral movement thereof to move said interlocking member to a latch-disengaging position, said interlocking member having portions disposed to engage and move each said latch means to releasing position, whereby current responsive unlatching of either said trip member effects movement of said interlocking member to unlatch the other said trip member thereby to open both said circuit breakers substantially simultaneously.

3. A multipole circuit breaker comprising a thin elongated flat casing, a pair of individual circuit breaker mechanisms mounted within said casing in end-to-end substantially co-planar relation and each comprising a pair

of separable contacts including a flat blade-like movable contact arm biased to open circuit position, each said circuit breaker mechanism including also a movably mounted flat trip member having an aperture therein and a cam surface on one edge thereof, manually operable wedge means movable between said contact arm and said cam surface for manually opening and closing said contacts, said manually operable means including common handle means biased to "off" position and arranged to engage and automatically return said trip members to latching position, separate latch means restraining said trip members against circuit-opening movement and responsive respectively to excessive current through the associated contact to release said trip members, said trip members when released laterally relieving said wedge means, and a flat elongated interlocking bar mounted for rectilinear sliding movement within said casing and including means disposed for driving engagement by either of said wedge means when laterally relieved, said interlocking bar having portions disposed to engage and mechanically release each said latch means.

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