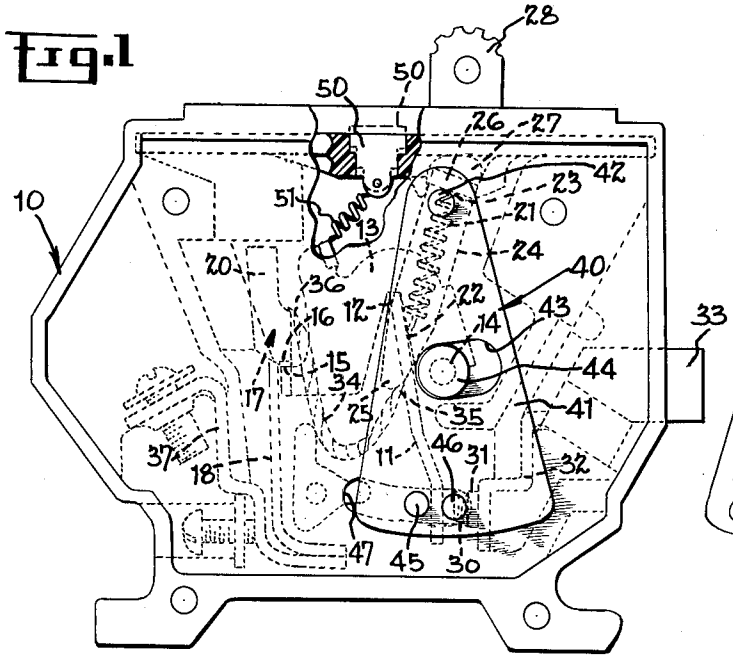
March 28, 1961 W. H. MIDDENDORF 2,977,444

COMMON TRIP INTERLOCK

Filed Aug. 25, 1958

Fig. 1



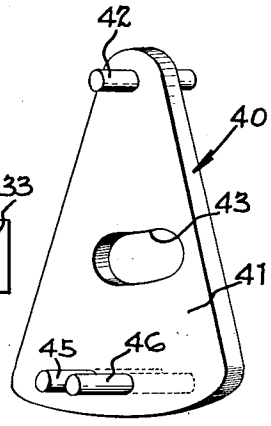


Fig. 2

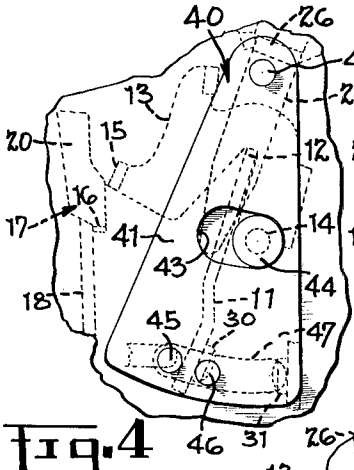


Fig. 4

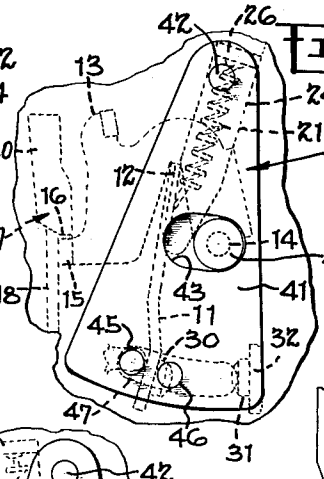


Fig. 5

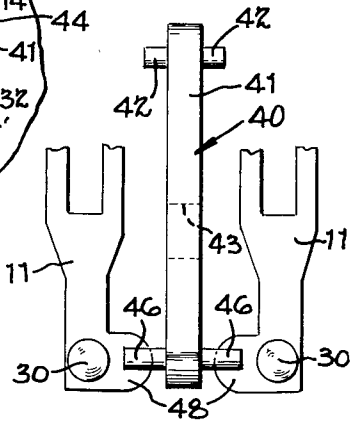


Fig. 3

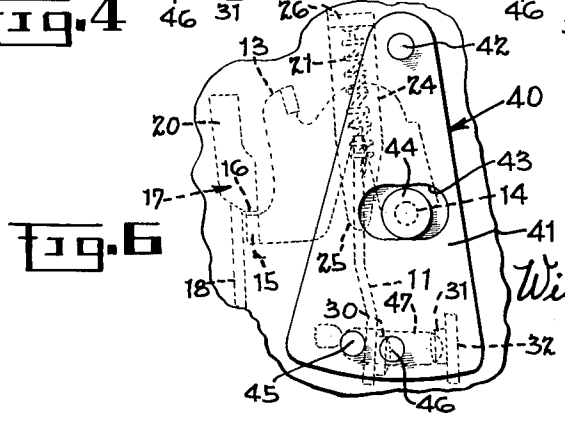


Fig. 6

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COMMON TRIP INTERLOCK

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6 Claims. (Cl. 200—116)

This invention relates to multi-pole circuit breakers and more particularly to an interlock design for multi-pole circuit breakers by which single pole circuit breakers may be adapted for multi-pole operation with simultaneous trripping of all circuit breakers when fault occurs in the circuit of any one circuit breaker.

The invention is directed to circuit breakers of the type having a movable contact bar associated with a carrier in which opening of contacts in response to current overload is effected by unlatching the carrier and its associated current responsive member followed by movement of the carrier which, in turn, carries the contact bar.

In prior art designs of multi-pole circuit breaker operation with breakers of this general type, the multi-pole operation has been effected by engagement of one of the latch members, that is, the current-responsive member or the carrier, by some common trip device. This operation inflicts a repeated hammering on critical latch elements. Such continuous impact loading of these elements tends to alter their physical dimensions and consequently their calibration so that in time they no longer operate to open their respective circuits at their rated current overload.

The present invention eliminates the disadvantages of the prior common trip systems for circuit breakers by providing a common trip interlock in which the contacts of a circuit breaker adjoining the breaker tripped through overload are opened without disturbing the latch mechanism of the adjoining circuit breakers.

It has been an objective of the invention to provide a common trip interlock for multi-pole circuit breaker operation in which the interlock is simple in construction and operation and is suitable for use with certain existing circuit breakers without significant modification of the existing circuit breaker structure.

It has been another objective of an invention to provide a common trip interlock for multi-pole circuit breaker operation in which the contact carrying bars of the circuit breakers are interconnected mechanically so that the force applied to one contact bar during tripping is sufficient to carry the other contact bar to an open position.

It has been still another objective of the invention to provide a common trip interlock for multi-pole circuit breaker operation in which the contact bars of adjoining circuit breakers are interconnected in such a manner as to provide a leverage system by which the force of a contact bar in a tripped circuit breaker is approximately twice the force resulting in the opening of a contact bar on the adjoining circuit breaker whereby two or three circuit breakers may be ganged together for interlock multi-pole operation.

It has been still another objective of the invention to provide a common trip interlock for multi-pole circuit breaker operation in which the contact bars of adjoining circuit breakers are mechanically interconnected by insulating material which projects transversely from a plate

pivotally mounted for movement between adjoining breakers to stabilize the interlocked action of adjoining contact bars.

It has been still another objective of the invention to provide a common trip interlock for multi-pole circuit breaker operation as described in the preceding paragraph in which the pivotally mounted plate is provided with pairs of studs projecting transversely from the plate into the adjoining circuit breakers, the contact bars of the adjoining breakers being embraced by studs of each pair whereby the movement of one contact bar is transmitted in a unitary manner through the interlock plate to the adjoining contact bar.

It has been still another objective of the invention to provide a common trip interlock system for multi-pole circuit breaker operation in which indicia means are provided for indicating an unlatched, tripped circuit breaker, the indicia means being inoperative in the absence of unlatching whereby the specific electrical line on which fault or overload occurs in a multi-pole operation may be readily detected by comparing the condition of the indicia means on the respective circuit breakers.

These and other objectives of the invention will be more readily apparent from the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a side elevational view of a circuit breaker constructed in accordance with the present invention;

Fig. 2 is a perspective view of an interlock;

Fig. 3 is a fragmentary end elevational view illustrating the co-operation between the interlock and adjoining contact bars; and

Figs. 4, 5 and 6 are fragmentary side elevational views showing the stages of operation of the interlock.

The styles of circuit breakers to which the invention may be applied are many. There is, however, an important common structural characteristic which must be found in the circuit breaker which is a design by which contacts may be opened without disturbing the current responsive latch mechanism. This characteristic is found in circuit breakers of the type having a contact bar movably mounted with respect to a carrier, the carrier being provided with latch means through which the circuit breaker operation is effected. In circuit breaker structures of this type, the contact bar can be freely moved to open the contacts without disturbing the latched condition of the carrier. A circuit breaker of this type is shown in Fig. 1.

The operating elements of the circuit breaker are contained within a casing **10** and include a contact bar **11** pivotally mounted at its upper end **12** in a carrier or rocker **13**. The carrier **13** is pivoted to the casing for movement about an axis indicated at **14**. A portion of the carrier remote from the pivot axis **14** has a latch surface **15** cooperating with a latch abutment **16** on a current responsive element **17**. The current responsive element may be of the type having a bimetal as at **18** or may be operated by magnetic attraction of a magnetic armature indicated at **20**. The magnetic operation may be of the type illustrated in my Patent 2,716,679.

The carrier **13** is biased for clockwise movement as viewed in Fig. 1 by a spring **21** connected at its lower end **22** to the contact bar **11** and at its upper end **23** to an operating handle lever **24**. The operating handle lever is pivoted at its lower end **25** to the casing and is received at its upper end **26** by a recess **27** in an operating handle **28**. The operating handle **28** is mounted for sliding movement in the top of the casing **10** to effect the resetting of the circuit breaker following tripping.

The contact bar carries a movable contact **30** which is engageable with a fixed contact **31** mounted on an electrically conductive strap **32** which in turn is connected to

the jaws 33 of a terminal connector of the type which engages a blade of common bus. The circuit through the contacts is completed by a pigtail 34 which connects the contact bar at 35 to the current responsive member at 36. The current responsive member is connected to a solderless terminal connector 37.

The elements of the circuit breaker thus described are well known and form no part of the present invention except in so far as they co-operate with the common trip interlock to be described below.

The elements of Fig. 1 are shown in the latched, contact closed position. In this position the spring 21 biases the contact bar 11 in a counterclockwise direction about its pivoted end 12 so as to urge the movable contact 30 into engagement with the fixed contact 31. As indicated above, the carrier 13 is biased by the same spring in a clockwise direction but is normally prevented from pivoting from the engagement of its latch surface 15 with the latch abutment 16 on the current responsive member. When overload occurs bringing the latch abutment 16 out of engagement with the latch surface 15, the spring will snap the carrier clockwise thereby swinging the contact bar counterclockwise and bringing the movable contact 30 out of engagement with the fixed contact 31. The condition of the elements will then be as shown in Fig. 4.

The circuit breaker can be reset by first shifting the operating handle 28 toward the left. This movement causes the operating handle lever 24 to engage the carrier 13 and to swing the carrier back to latched position. Return of the operating handle 28 to the position shown in Fig. 1 snaps the contact bar 11 to contact closed position through the over center action of spring 21 which passes from the left to the right over the pivoted end 12 of the contact bar.

Common trip interlock

When it is desired to use two or three circuit breakers of the type described and shown in Fig. 1 for multi-pole operation, the circuit breakers are mounted side-by-side and their operating handles 28 are ganged together by suitable means for unitary movement. Common tripping of the circuit breakers is provided by the interlock 40 shown in Fig. 2. The interlock 40 includes a generally triangularly shaped plate 41 having a pivot pin 42 projecting transversely from the plan of the plate. The pin 42 will be received in holes suitably formed in the side walls of the adjoining circuit breakers for the pivotal mounting of the plate with respect to the circuit breakers. The plate has a slot 43 sufficiently large to clear a projection 44 (Fig. 1) forming part of the side wall of the casing. The slot 43 will of course be unnecessary when the invention is used with a breaker having a casing style differing from that of the illustrated breaker. The lower end of the plate has two studs 45 and 46 projecting through a slot 47 formed in the side wall of each casing. As shown in Fig. 3, the studs embrace a transverse projection 48 on each contact bar.

It should be understood that the specific means for interconnecting the adjoining contact bars is subject to considerable variation without departing from the scope of the present invention. However, the preferred common trip structure is as shown in the drawings in which the studs 45 and 46 tie the contact bars together for unitary operation and in which the tie is prevented from twisting by the interposition of the plate 41 which is pivoted with respect to the breaker casings. In the absence of the plate 41 movement of one contact bar might not be completely transmitted to the other contact bar because of the inherent resilience of any tying structure which would not permit a perfectly rigid unitary operation. This particular problem is magnified by the fact that the tie must be of insulating material whereby a perfectly rigid bond between the tie and the contact bar cannot be effected. Thus it can be appreciated that the plate 41 performs the dual function of stabilizing, that is, resisting the twisting of the tie, and supporting the tie between the contact bars thereby eliminating the necessity of developing means to bond the tie to each of the contact bars.

Operation

The operation of the invention can be best understood by reference Figs. 1, 4, 5 and 6. When a breaker of the multi-pole assembly is tripped through line fault or overload, the carrier 13 will pivot to the position shown in Fig. 4 carrying the contact bar 11 with it as illustrated. The projection 48 of the contact bar of the tripped breaker will bear against the stud 45 of the interlock and pivot the interlock on its pivot pin 42. The pivotal movement of the interlock causes the stud 46 to bear against the projection 48 on the contact bar 11 of the adjoining breaker and will swing only the contact bar of the adjoining breaker into contacts open position. This position is illustrated by Fig. 5 which is a view of a circuit breaker adjoining the tripped breaker of Fig. 4. By comparing Figs. 4 and 5 it can be observed that the contact bars of both breakers have been moved to a contact open position but only the carrier of the breaker of Fig. 4 has been pivoted to an unlatched position. The carrier of the adjoining breaker, as illustrated in Fig. 5, remains undisturbed in its latched position.

Fig. 6 is an illustration of an intermediate position of the operating element when the circuit breaker is being reset. The operating handle has been moved to the left to latch the carrier and, in Fig. 6, is moving toward the right to snap the contact bar 11 of all circuit breakers to contact closed position. When the contact bar moves to contact closed position, all contact bars of adjoining breakers will move simultaneously and will carry the interlock to the position shown in Fig. 1 through the engagement of the contact bar projections 48 with the interlock studs 40.

Trip indicator

Each circuit breaker may have a small trip indicator 50 slidably mounted in te operating handle and connected by a small spring 51 to the carrier 13. When the trip indicator is in the position shown in full lines in Fig. 1 the carrier is in its latched position. When the carrier becomes unlatched and pivots clockwise to the position of Fig. 4, the carrier will engage the indicator pushing the indicator upwardly to the broken line position. In the broken line position, the indicator projects above the surface of the operating handle indicating the unlatched condition of the carrier and the fact that the breaker has been tripped in response to current overload.

It will be appreciated by comparing the carrier position Figs. 4 and 5, that only the carrier of the breaker which has become overloaded has moved to an unlatched position and as a consequence the trip indicator of only the breaker having the unlatched carrier will be above the surface handle to indicate the tripped condition. However, the contacts on all the breakers will open through the action of the common trip interlock. The person whose duty it is to locate and remedy the fault which caused the tripping of the breakers can immediately identify the line on which the fault occurred by examining the trip indicator.

In a general manner, while there has been disclosed in the above description, what is deemed to be the most practical and efficient embodiment of the invention, it should be well understood that the invention is not limited to such embodiment as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

Having described my invention, I claim:

1. A common trip interlock for at least two adjacent circuit breakers, each said circuit breaker having a carrier, current responsive latch means associated with said

carrier, a contact bar mounted on said carrier and movable between "on" and "off" positions, said interlock comprising: a plate pivotally mounted between said breakers, a pair of studs projecting from each side of said plate into the adjoining breakers, said studs being disposed on each side of each contact bar to provide unitary movement of said contact bars and plate, whereby tripping movement of one contact bar will be transmitted by said plate to the adjoining contact bar.

2. A common trip interlock for at least two adjacent circuit breakers, each said circuit breaker having a carrier, current responsive latch means associated with said carrier, a contact bar mounted on said carrier and movable between "on" and "off" positions, said interlock comprising: a plate pivotally mounted between said breakers, a pair of studs projecting from each side of said plate into the adjoining breakers, said studs being disposed on each side of each contact bar to provide unitary movement of said conatct bars and plate, whereby tripping movement of one contact bar of a tripped breaker will be transmitted by said plate to the contact bar of the adjoining breaker without disturbing the latched condition of its carrier, and trip indicator means associated with each breaker and actuated only by an unlatched carrier, whereby the circuit breaker operated in response to overload current may be easily detected.

3. A common trip interlock for at least two adjacent circuit breakers, each said circuit breaker having a carrier, current responsive latch means associated with said carrier, a contact bar mounted on said carrier and movable between "on" and "off" positions, and spring means for maintaining said contact bar in "on" position and operable to swing said contact bar to "off" position upon unlatching of its carrier said interlock comprising: a plate pivotally mounted between said breakers, a pair of studs projecting from each side of said plate into the adjoining breakers, said studs being disposed on each side of each contact bar to provide unitary movement of said contact bars and plate, whereby the spring force on the contact bar of a "tripped" breaker will be transmitted by said plate to the adjoining contact bar to move said adjoining contact bar to "off" position without disturbing the latched condition of the adjoining carrier.

4. An interlock according to claim 3 in which the described elements and their points of connection are interrelated to provide a force on the adjoining contact bar approximately twice that which its spring exerts to maintain the adjoining contact bar in "on" position.

5. A common trip interlock for at least two adjacent circuit breakers, each said circuit breaker having a contact bar movable between "on" and "off" positions, said interlock comprising: a plate movably mounted between said breakers, a pair of studs projecting from each side of said plate and embracing respective contact bars for unitary movement to "on" and "off" positions of said contact bars.

6. A common trip interlock for at least two adjacent circuit breakers; each said circuit breaker having a carrier movable between a "latched" position and a "tripped" position, a current responsive latch for maintaining said carrier in "latched" position, a contact carrying bar mounted on said carrier and movable with respect to said carrier between "on" and "off" positions, and spring means for maintaining said contact bar in "on" position and operable to swing said contact bar to "off" position upon unlatching of its carrier; said interlock comprising electrically insulative means interconnecting said contact bars for unitary movement, whereby upon tripping of a carrier of one breaker due to overload, the spring means of the tripped carrier will swing the contact bars of all breakers to "off" position without unlatching the adjoining carrier.

References Cited in the file of this patent

UNITED STATES PATENTS

1,952,632	Sachs	Mar. 27, 1934
2,094,965	Sacks	Oct. 5, 1937
2,166,555	Rowe	July 18, 1939
2,306,235	Walle	Dec. 22, 1942
2,318,085	Leonard	May 4, 1943
2,678,359	Brumfield	May 11, 1954
2,779,831	Thomas	Jan. 29, 1957
2,797,277	Dorfman et al.	June 25, 1957
2,813,168	Mascioli et al.	Nov. 12, 1957
2,816,987	Hagdahl	Dec. 17, 1957
2,824,191	Christensen	Feb. 18, 1958

FOREIGN PATENTS

563,528	Great Britain	Aug. 18, 1944