

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,097,229



1,097,229

Date of Application and filing Complete Specification: June 15, 1966.

No. 26670/66

Application made in United States of America (No. 477393) on August 5, 1965.

Complete Specification Published: January 3, 1968.

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Index at Acceptance:—H2 B (1L2B, 1L5, 1L6X1, 1L7B1, 1L7B6, 1L13, 2A5A2, 2B3, 2B7, 2B8, 2B9, 2C10).

Int. Cl.:—H 01 h 71/10.

COMPLETE SPECIFICATION

Improvements in Multiple Circuit Breaker Assembly with Common Tripping

We, GENERAL ELECTRIC COMPANY, residing at 1 River Road, Schenectady 5, New York, United States of America; a corporation organized and existing under the laws of the State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to multiple electric circuit breakers, and more particularly to multiple circuit breakers made up of individually housed circuit breaker "pole units", each having its own operating and tripping mechanism, and means for causing tripping of all such pole units of a given assembly when one unit trips.

Electric circuit breakers of the type described include, in each pole unit, a releasable member which is normally held by a latch member and biased toward tripped position. When released by the latch member, the releasable member causes automatic opening of the contacts of that particular pole unit. In order to cause automatic opening of adjacent pole units which form an operative assembly, a common trip bar is used, extending through the casings of all pole units. The releasable member of each pole is provided with a projection which strikes the common trip bar when the releasable member is released, and rotates it. Rotation of the common trip bar, in turn causes releasing movement of latch members of adjacent poles.

The operating mechanism used in such circuit breakers is usually of the over-center spring type. In such mechanisms, when tripping occurs, there is a limited amount of force acting on the releasable member tending to move it toward tripped position. If the releasable member engages

the common trip member too soon in its tripping movement, it may be prevented from moving far enough to open the contacts of the circuit breaker.

In addition, the latch member of each of these circuit breakers commonly includes a magnetic means for causing tripping, with a relatively small air gap. The size of the air gap limits the movement of the latch member in tripping direction. Thus the common trip bar can move such latch members only a limited distance before its travel is arrested. If the circuit breaker contacts have not opened by such time, their opening movement may be prevented. In addition, normal manufacturing variations or tolerances have a substantial effect on the loading of the releasable member of the initiating pole unit, requiring extremely accurate manufacturing assembly operations and testing procedures. This adds substantially to the cost of manufacture of such circuit breakers.

It is an object of the present invention to provide a multiple circuit breaker of the type described in which movement of the releasable member of the initiating pole is not obstructed in its early travel by the loading of latch forces of adjacent circuit breakers. It is another object of the invention to provide a multiple circuit breaker of the type referred to in which the dimensional relationship of the parts is not extremely critical, thereby greatly facilitating the assembly and testing of such circuit breakers.

It is another object of the invention to provide a multiple circuit breaker of the type described in which the parts are not sensitive to the accumulation of manufacturing variations or tolerances.

According to the present invention there is provided a multiple circuit breaker

[Price 4s. 6d.]

assembly comprising a pair of circuit breaker pole units, supporting means for supporting said pole units in closely-spaced side-by-side relation, each of said pole units comprising a stationary contact, a movable contact, manually operable mechanism for moving said movable contact between open and closed circuit positions with respect to said stationary contact, said manually operable mechanism including a member releasable to cause automatic opening of said contacts, a latch member normally restraining said releasable member, each of said pole units further comprising a latch actuating member, common trip assembly interconnecting said latch actuating members of said pole units and causing simultaneous movement thereof, a part of the releasable member of one of said pole units engaging said latch actuating member of said one pole unit upon release of said releasable member and causing movement of said latch actuating member, said movement of said latch actuating member of said one pole unit being transmitted to said latch actuating member of the other of said pole units by said common trip assembly and moving said latch actuating member into engagement with said latch member of said other pole unit and causing release of said releasable member of said other pole unit, each of said latch members comprising a first rigid portion, and a second resilient portion, said resilient portion being resiliently movable by said latch actuating member in releasing direction with respect to said rigid portion.

The invention will be more fully understood from the following detailed description, and its scope will be pointed out in the appended claims.

In the drawings,

Figure 1 is a side elevation view of an electric circuit breaker incorporating the invention, the side nearest the observer being removed to show the parts, the parts being shown in the normal "off" condition;

Figure 2 is a fragmentary view showing portions of the mechanism of the circuit breaker of Figure 1, the parts being shown in "tripped" condition;

Figure 3 is a perspective view of a multi-pole circuit breaker assembly incorporating the invention;

Figure 4 is an exploded view of the circuit breaker assembly of Figure 3, showing particularly the common trip bar assembly;

Figure 5 is an exploded perspective view showing portions of the multi-pole circuit breaker assembly of Figure 3;

Figure 5A is perspective view of one of the elements of the common trip assembly of the multi-pole circuit breaker assembly of Figure 3;

Figures 6, 7, and 8, are fragmentary views

of another embodiment of the invention.

Referring to the drawings, the invention is shown as incorporated in an electric circuit breaker comprising a generally rectangular insulating casing including a body portion 10 having recesses and supporting formations to carry the parts. A cover 10' is also provided to close the open side of the casing (see Figure 3). The invention is shown as used in conjunction with a circuit breaker operating mechanism including manually operable handle member 11 which is pivotally supported in the casing 10 and cover (not shown) by means of oppositely extending integral hub portions 12. The handle 11 includes a pair of spaced depending extensions 13 straddling a generally planar releasable member 14 which is pivotally supported in the casing and cover by means of a pivot pin 15. A movable contact arm 16 carries movable contact 17 on its lower end and has its upper end bifurcated to provide a pair of spaced leg portions 18 by which the contact arm 16 is pivotally supported on the depending portions 13 of the handle 11 at pivot bearings 19. A tension-type operating spring 20 is connected between the contact arm 16 and a hole 21 of the releasable member 14. A stationary contact 4 is carried by a projecting tang 5 of a socket member 6 which is adapted to receive a blade-type contact member, not shown, by plug-in frictional engagement.

Motion of the handle 11 between "on" and "off" positions as indicated in Figure 1 moves the pivot point 19 of the contact arm 16 back and forth across the line of action of the tension spring 20 to move the contact arm 16 between open and closed circuit positions as indicated in solid and dotted lines respectively in Figure 1 with a snap action.

The releasable member 14 is normally supported in the position shown in Figure 1 by latch means to be described. When the member 14 is released by such latch means, the tension spring 20, pulling downwardly on the releasable member 14 at the hole 21, rotates the releasable member 14 clockwise about its pivotal support 15, moving the upper end of the spring to the right as viewed across the pivotal support 19 of the contact arm 16. This reverses the bias of the tension spring 20 on the contact arm 16 and moves it to open circuit position. This action takes place even though the handle 11 may be manually held in the "on" position. The parts moving to "tripped" position as shown in Figure 2.

In order to reset the mechanism following tripping, the handle 11 is rotated to the "off" position, during which motion, the depending extensions 13 engage opposite end portions of a reset pin 23 carried by the

releasable member 14 and move it counterclockwise to its relatched position.

The releasable member 14 is held in its normal or latched position by a combined
 5 armature-latch member 24 which is pivotally supported in the casing on integral pivot lugs 25. The armature-latch member 24 is biased clockwise about its pivotal support 25 in a latching direction by means of a compression spring 26 trapped in the casing.
 10 The armature-latch member 24 includes an integral outwardly bent latch portion 27 which engages the end 28 of the releasable member 14 as shown in Figure 1. A lower
 15 end portion 29 of the armature-latch member 24 is return-bent and is positioned to be engaged by the lower or movable end of an elongated bimetallic strip 30, the other end of which is fixedly attached to one end 32
 20 of a terminal strap 33. The terminal strap 33 is mounted on the insulating base 10 by a mounting screw 34, and carries a wire-connecting means 36 at its outer end.

A generally U-shaped magnetic field piece
 25 37 is rigidly attached to the bimetallic strip 30 adjacent its movable end. The bimetallic strip 30 is connected by a flexible conductor 38 to the movable contact arm 16. The current path through the circuit breaker therefore is from the terminal 36 through the
 30 conducting terminal strap 33 to the bimetallic strip 30, to the flexible conductor 38, to the movable contact arm 16, the movable contact 17, the stationary contact 4 and
 35 finally to the line terminal or socket 6.

The operation of the trip mechanism is as follows. The flow of excess current through the bimetallic strip 30 generates heat therein which causes the strip 30 to
 40 warp so as to move the lower end thereof to the right as viewed in Figure 1. The lower end of the bimetallic strip 30 engages the return-bent end portion 29 of the armature-latch member 24, rotating it counter-
 45 clockwise about its pivot and withdrawing the latch member 27 from the releasable member 14.

Magnetic tripping occurs upon the passage of sufficient current through the bimetallic
 50 strip 30, which energizes the magnetic field piece 37, causing it to attract the armature-latch member 24 to it, withdrawing the latch member 27 in a similar manner.

In accordance with the invention, the circuit breaker unit just described is adapted
 55 to be used to provide two, three or more multi-pole circuit breakers having common tripping means.

60 MULTI-POLE ASSEMBLY AND COMMON TRIPPING MEANS

In Figure 3, there is shown a two-pole circuit breaker comprising two single pole
 units 10A and 10B. Each of the circuit breaker units 10A and 10B is constructed as
 65 shown in Figure 1. For the purpose of

facilitating common tripping action in a manner to be described, however, latch
 actuating member 40 is provided, (Fig. 5A), of insulating material, pivotally supported
 in the casing by means of integral trunnions
 70 41. The latch actuating member 40 also includes a rectangular hole 42 extending transversely therethrough, and a cam surface 43.

The latch actuating members 40A, 40B, of each of the breakers 10A and 10B are
 75 interconnected by a common trip bar 44 as shown particularly in Figs. 4 and 5, which extends through holes 45A and 45B cut in the adjacent side walls of the breakers 10A
 80 and 10B. The operating mechanism of each of the breakers 10A and 10B, is as shown in Figure 2 (shown in the tripped position).

For the purpose of cooperating with the latch actuating member in a manner to be
 described, the armature-latch member 24 is
 85 provided with a rectangular cut-out or window 24A, and an elongated resilient spring strip 45, as shown particularly in Figure 5. The spring strip 45 is attached to the armature-latch member 24 by suitable means,
 90 such as by welding or riveting. The armature-latch member 24 includes an upwardly-directed integral lug portion 24B extending upwardly from the lower edge of the window 24A, against which the lower end of
 95 the spring strip 45 is biased as a stop. The lug portion 24B also acts as a stop, to limit the clockwise rotation of the latch actuating member 40. For the purpose of cooperating with the common latch actuating member
 100 40, the releasable member 14 includes a shoulder portion 14A, see Figures 1 and 2.

The operation of the invention will be understood first by reference to Figures 1
 and 2. In Figure 1, the mechanism is shown
 105 in normal "off" condition. The "on" condition of the contact is shown in dotted lines. Upon release of the releasable member 14 of one pole unit mechanism, such as by
 110 movement of the bimetallic strip to the right as viewed, moving the armature-latch member to the right, the releasable member 14 is moved clockwise about its pivot 15 to
 cause automatic opening of the contact as
 115 previously described. As the releasable member 14 rotates clockwise, the shoulder 14A engages the cam surface 43 of the latch actuating member 40B and rotates
 the latch actuating member 40B counter-
 120 clockwise about its pivotal supports 41, as shown in Figure 2. Rotation of the latch actuating member 40B counterclockwise carries with it the common trip bar 44, which in turn causes similar counterclock-
 125 wise rotation of the adjacent common latch actuating member 40A. When the latch actuating member 40A is rotated in this manner, a projecting portion thereof 43A acts on the resilient strip member 45 to
 130 cause rotation of the armature-latch mem-

ber of the adjacent breaker to cause it to trip. By this means, tripping of both poles of the two pole breaker is assured when either pole trips.

- 5 It will be observed that the gap between the armature-latch member 24 and the magnetic field piece 37, as shown in Figure 1, is relatively small. Also, it will be observed that rotation of the armature-latch member in counterclockwise direction about its pivotal supports 25 is limited by its engagement with the field piece 37. This in turn limits the amount of rotation permitted the latch actuating member 40. Ordinarily, 10 therefor, the latch actuating member 40 could not rotate in its tripping direction more than the amount permitted by the travel of the armature-latch member 24. Since tripping of the adjacent circuit breaker 15 requires adequate movement of the common trip members, extremely critical adjustment and spacing are ordinarily required to obtain such common tripping. In accordance with the present invention, however, 20 the use of the resilient strip 45 permits the latch actuating member 40 to rotate in tripping direction a total amount greater than that which otherwise would be permitted by the armature-latch member 24. Thus, for example, as shown in Figure 2, 30 after the armature-latch member 24 has engaged the pole of the field piece 37, the latch actuating member 40 can continue to rotate, by the resilient movement of the end of the spring strip 45 with respect to the armature-latch member 24. 35

- This arrangement also ensures that the trip-initiating breaker mechanism will be able to complete its own tripping operation. It will be observed, for example, that with 40 an extremely small magnetic air gap, rotation of the releasable member 14 clockwise about its pivotal support 15 might possibly be impeded by engagement of armature-latch member 24 with the field piece 37, which in turn blocks movement of the latch actuating member 40 and the releasable member 14. Since the resilient strip 45 moves with respect to the latch 24, however, 45 the latch member 40 is free to rotate to a further extent, thereby assuring tripping of the adjacent breaker. 50

- It will be understood that it is immaterial which of the two breakers initiates the common tripping operation, the functioning of 55 the adjacent breaker being as described above.

- In Figures 6-8 there is shown another embodiment of the invention in this form 60 of the invention, the resilient strip 145 includes a latch projection 145A, and the member 124 operates only as an armature member. The armature member 124 is also extended at the lower end and return-bent 65 at 129 to provide an engagement with the

bimetallic strip 130. The operation of this form of the invention is similar to that previously described, and is clearly shown in Figures 6 and 7.

WHAT WE CLAIM IS:—

1. A multiple circuit breaker assembly 70 comprising a pair of circuit breaker pole units, supporting means for supporting said pole units in closely-spaced side-by-side relation, each of said pole units comprising 75 a stationary contact, a movable contact, manually operable mechanism for moving said movable contact between open and closed circuit positions with respect to said stationary contact, said manually operable 80 mechanism including a member releasable to cause automatic opening of said contacts, a latch member normally restraining said releasable member, each of said pole units further comprising a latch actuating member, 85 common trip assembly interconnecting said latch actuating members of said pole units and causing simultaneous movement thereof, a part of the releasable member of one of said pole units engaging said latch 90 actuating member of said one pole unit upon release of said releasable member and causing movement of said latch actuating member, said movement of said latch actuating member of said one pole unit being 95 transmitted to said latch actuating member of the other of said pole units by said common trip assembly and moving said latch actuating member into engagement with said latch member of said other pole unit and 100 causing release of said releasable member of said other pole unit, each of said latch members comprising a first rigid portion, and a second resilient portion, said resilient portion being resiliently movable by said latch actuating member in releasing direction 105 with respect to said rigid portion.

2. A multiple circuit breaker assembly as claimed in claim 1, characterized in that 110 each of said rigid portions of said latch members includes a generally rectangular cut-out and said resilient portion comprises a resilient strip extending across at least part of said cut-out at one side of said latch member and being further characterized in 115 that said rigid portion also includes an integral lug portion projecting into the general area of said cut-out and acting as a stop for said resilient strip and also as a stop for movement of said latch actuating 120 member in at least one direction.

3. A multiple circuit breaker assembly as claimed in claims 1 and 2, characterized in that said latch members of each of said pole units comprises elongated members 125 pivotally supported in said pole units respectively at one end and having a latch surface adjacent the other end and said latch actuating members each comprise a member pivotally supported near said 130

ber of the adjacent breaker to cause it to trip. By this means, tripping of both poles of the two pole breaker is assured when either pole trips.

5 It will be observed that the gap between the armature-latch member 24 and the magnetic field piece 37, as shown in Figure 1, is relatively small. Also, it will be observed that rotation of the armature-latch member in counterclockwise direction about its pivotal supports 25 is limited by its engagement with the field piece 37. This in turn limits the amount of rotation permitted the latch actuating member 40. Ordinarily, 10 therefore, the latch actuating member 40 could not rotate in its tripping direction more than the amount permitted by the travel of the armature-latch member 24. Since tripping of the adjacent circuit breaker requires adequate movement of the common trip members, extremely critical adjustment and spacing are ordinarily required to obtain such common tripping. In accordance with the present invention, however, 25 the use of the resilient strip 45 permits the latch actuating member 40 to rotate in tripping direction a total amount greater than that which otherwise would be permitted by the armature-latch member 24. Thus, for example, as shown in Figure 2, after the armature-latch member 24 has engaged the pole of the field piece 37, the latch actuating member 40 can continue to rotate, by the resilient movement of the 35 end of the spring strip 45 with respect to the armature-latch member 24.

This arrangement also ensures that the trip-initiating breaker mechanism will be able to complete its own tripping operation. 40 It will be observed, for example, that with an extremely small magnetic air gap, rotation of the releasable member 14 clockwise about its pivotal support 15 might possibly be impeded by engagement of armature-latch member 24 with the field piece 37, which in turn blocks movement of the latch actuating member 40 and the releasable member 14. Since the resilient strip 45 moves with respect to the latch 24, however, the latch member 40 is free to rotate to a further extent, thereby assuring tripping of the adjacent breaker. 45

It will be understood that it is immaterial which of the two breakers initiates the common tripping operation, the functioning of the adjacent breaker being as described above. 55

In Figures 6-8 there is shown another embodiment of the invention in this form 60 of the invention, the resilient strip 145 includes a latch projection 145A, and the member 124 operates only as an armature member. The armature member 124 is also extended at the lower end and return-bent 65 at 129 to provide an engagement with the

bimetallic strip 130. The operation of this form of the invention is similar to that previously described, and is clearly shown in Figures 6 and 7.

WHAT WE CLAIM IS:—

70 1. A multiple circuit breaker assembly comprising a pair of circuit breaker pole units, supporting means for supporting said pole units in closely-spaced side-by-side relation, each of said pole units comprising 75 a stationary contact, a movable contact, manually operable mechanism for moving said movable contact between open and closed circuit positions with respect to said stationary contact, said manually operable 80 mechanism including a member releasable to cause automatic opening of said contacts; a latch member normally restraining said releasable member, each of said pole units 85 further comprising a latch actuating member, common trip assembly interconnecting said latch actuating members of said pole units and causing simultaneous movement thereof, a part of the releasable member of one of said pole units engaging said latch 90 actuating member of said one pole unit upon release of said releasable member and causing movement of said latch actuating member, said movement of said latch actuating member of said one pole unit being 95 transmitted to said latch actuating member of the other of said pole units by said common trip assembly and moving said latch actuating member into engagement with said latch member of said other pole unit and causing release of said releasable member 100 of said other pole unit, each of said latch members comprising a first rigid portion, and a second resilient portion, said resilient portion being resiliently movable by said 105 latch actuating member in releasing direction with respect to said rigid portion.

2. A multiple circuit breaker assembly as claimed in claim 1, characterized in that each of said rigid portions of said latch 110 members includes a generally rectangular cut-out and said resilient portion comprises a resilient strip extending across at least part of said cut-out at one side of said latch member and being further characterized in 115 that said rigid portion also includes an integral lug portion projecting into the general area of said cut-out and acting as a stop for said resilient strip and also as a stop for movement of said latch actuating 120 member in at least one direction.

3. A multiple circuit breaker assembly as claimed in claims 1 and 2, characterized in that said latch members of each of said pole units comprises elongated members 125 pivotally supported in said pole units respectively at one end and having a latch surface adjacent the other end and said latch actuating members each comprise a member pivotally supported near said 130



pivotal support of said latch member and including a portion engaging said resilient portion of said latch member at a point substantially midway between said ends of each latch member.

claimed in any one of the preceding claims, substantially as described with reference to the accompanying drawings.

POTTS & CO.

4. A multiple circuit breaker assembly as

Berwick-upon-Tweed: Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd.—1967
Published at the Patent Office, 25 Southampton Buildings, London, W.C.2 from which copies may be obtained

