Nov. 29, 1966 K. W. KLEIN 3,288,965

MULTIPLE CIRCUIT BREAKER ASSEMBLY WITH COMMON TRIPPING

Filed Aug. 5, 1965

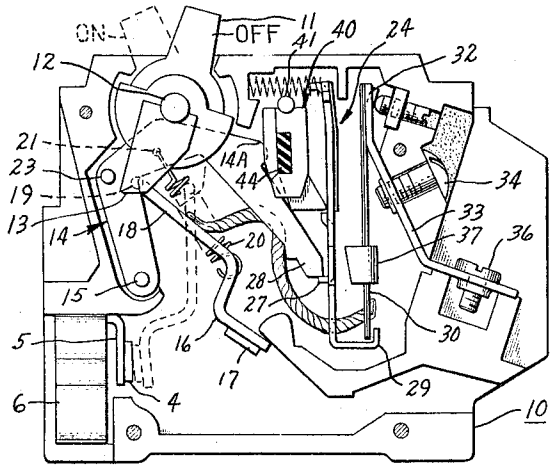


FIG. 1

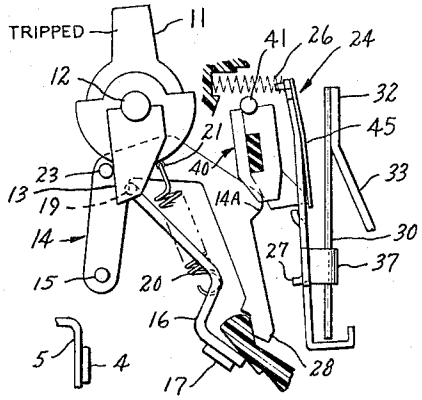


FIG. 2

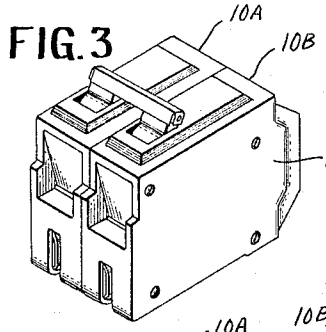


FIG. 3

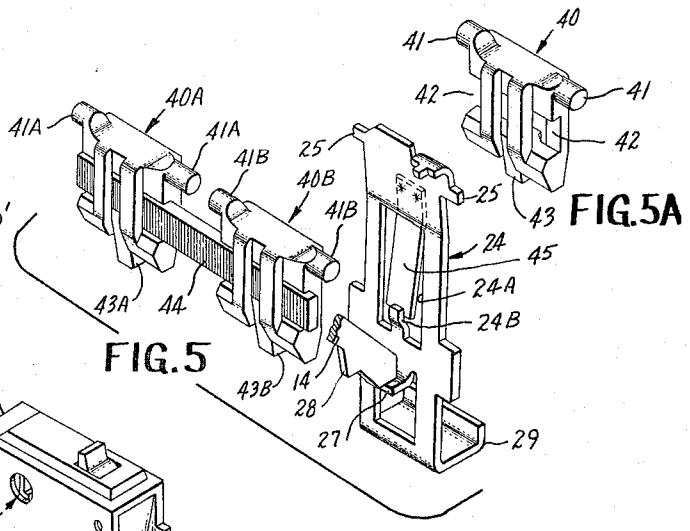


FIG. 5

FIG. 5A

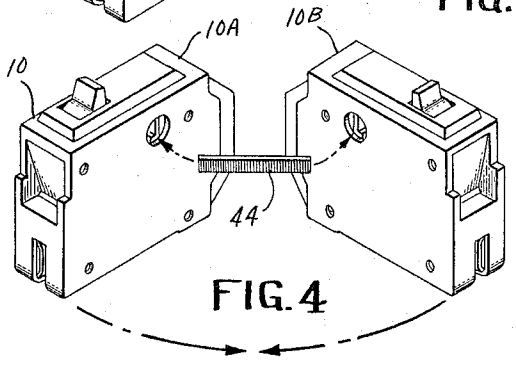


FIG. 4

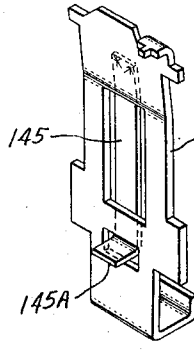


FIG. 8

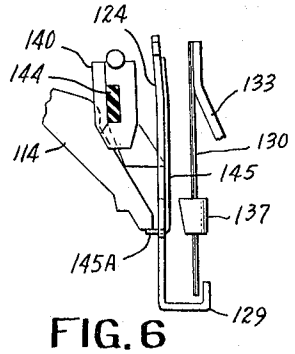


FIG. 6

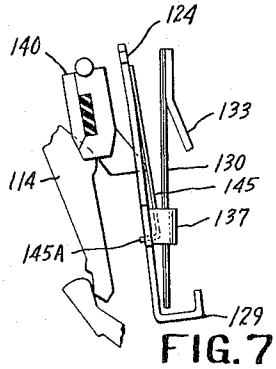


FIG. 7

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MULTIPLE CIRCUIT BREAKER ASSEMBLY WITH COMMON TRIPPING

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1 Claim. (Cl. 200—116)

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.

In accordance with the invention, a multiple circuit breaker assembly is provided including at least two circuit breaker units or "pole," each including a mechanism having a releasable member which is biased toward tripping position, and latch means normally restraining the releasable member. A common trip bar is also provided extending between the two poles of the circuit breaker.

Means is also provided at each pole of the circuit breaker whereby rotation of the common trip bar causes movement of the latch member of that particular pole. In accordance with the invention, the latch member at each pole includes a resilient member which is engaged by the member movable by the common trip bar so that force is stored in the resilient member which operates to move the latch member to trip position when the accumulated force is sufficient. This allows for considerable variation in the dimensional relationship of the parts and yet does not present any positive obstacle to motion of the parts to trip position.

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

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 rest 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 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. 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 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** 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 **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 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 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 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 counterclockwise 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 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 to be used singly, or in multiples of two, three or more to provide two, three or more multi-pole-circuit breakers having common tripping means.

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 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 **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 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** 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 **24** is 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, such as by welding or riveting. The armature-latch member **24** includes an upwardly-directed integral lug portion **24B** extending upwardly from the lower ledge of the window **24A**, against which the lower end of 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 **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 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 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 previously described. As the releasable member **14** rotates clockwise, the shoulder **14A** engages the cam surface **43** of the latch actuating member **40** and rotates the latch actuating member **40** counterclockwise about its pivotal supports **41**, as shown in FIGURE 2. Rotation of the latch actuating member **40** counterclockwise carries with it the common trip bar **44**, which in turn causes similar counterclockwise 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 cause rotation of the armature-latch member of the adjacent breaker to cause it to trip. By this means, tripping of both poles the two pole breaker is assured when either pole trips.

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, 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 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, 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 end of the spring strip **45** with respect to the armature-latch member **24**.

This arrangement also insures that the trip-initiating breaker mechanism will be able to complete its own tripping operation. 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 arma-

ture-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 member **24**, however, the latch member **40** is free to rotate to a further extent, thereby assuring tripping of the adjacent breaker.

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.

In FIGURES 6–8 there is shown another embodiment of the invention in this form 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 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.

While the invention has been shown in only two embodiments, it will be readily appreciated that many modifications thereof may readily be made, and it is therefore intended by the appended claim to cover all such modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

A multiple circuit breaker assembly comprising:

(a) a pair of circuit breaker pole units;

(b) means supporting said pole units in closely-spaced side-by-side relation;

(c) each of said pole units comprising a stationary contact, a movable contact, and manually operable mechanism for moving said movable contact between open and closed circuit positions with respect to said stationary contacts;

(d) said manually operable mechanism including a member releasable to cause automatic opening of said contacts;

(e) a latch member normally restraining said releasable member;

(f) each of said pole units further comprising a latch actuating member;

(g) common trip means interconnecting said latch actuating members of said pole units and causing simultaneous movement thereof;

(h) means carried by said 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;

(i) 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 means 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;

(j) 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;

(k) each of said rigid portions of said latch members including a generally rectangular cut-out and said resilient portion comprising a resilient strip extending across at least part of said cut-out at one side of said latch member, said rigid portion further including 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 member in at least one direction.

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BERNARD A. GILHEANY, *Primary Examiner.*