Oct. 3, 1961 J. DE TORRE 3,003,046

CIRCUIT BREAKER

Filed Oct. 26, 1959 2 Sheets-Sheet 1

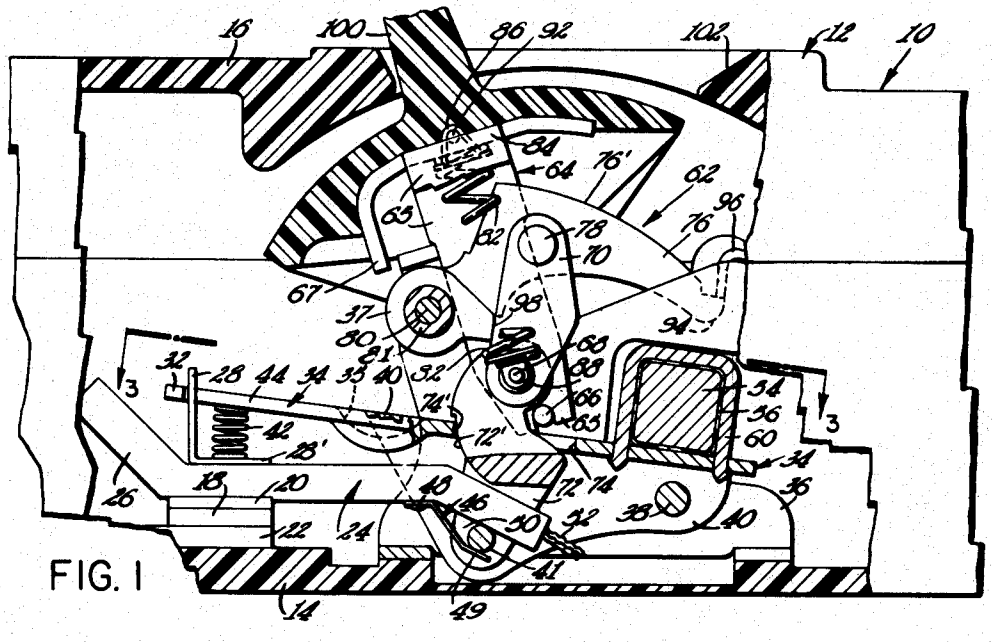

FIG. 1

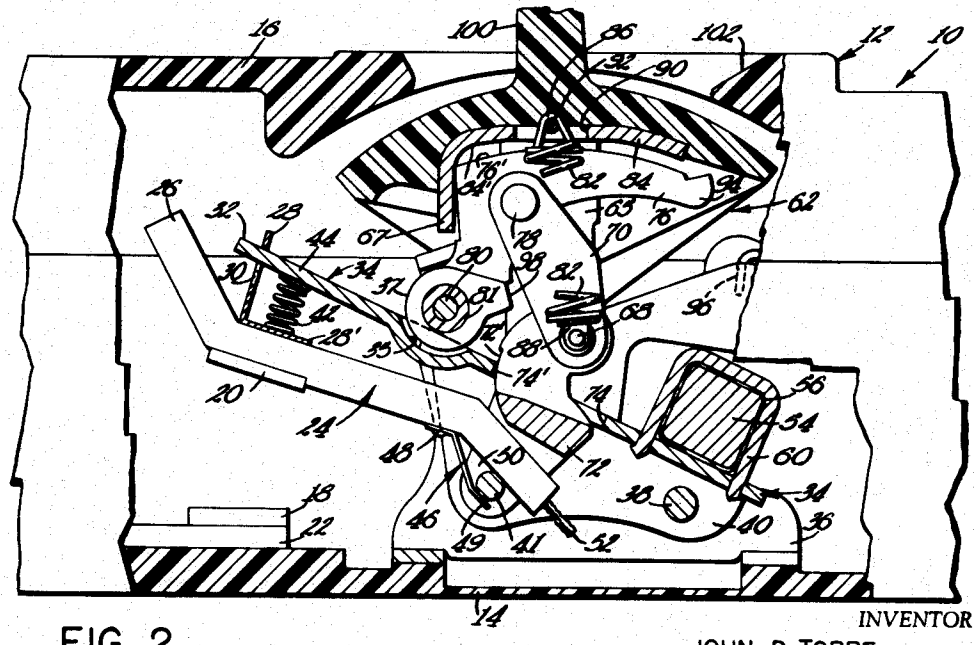

FIG. 2

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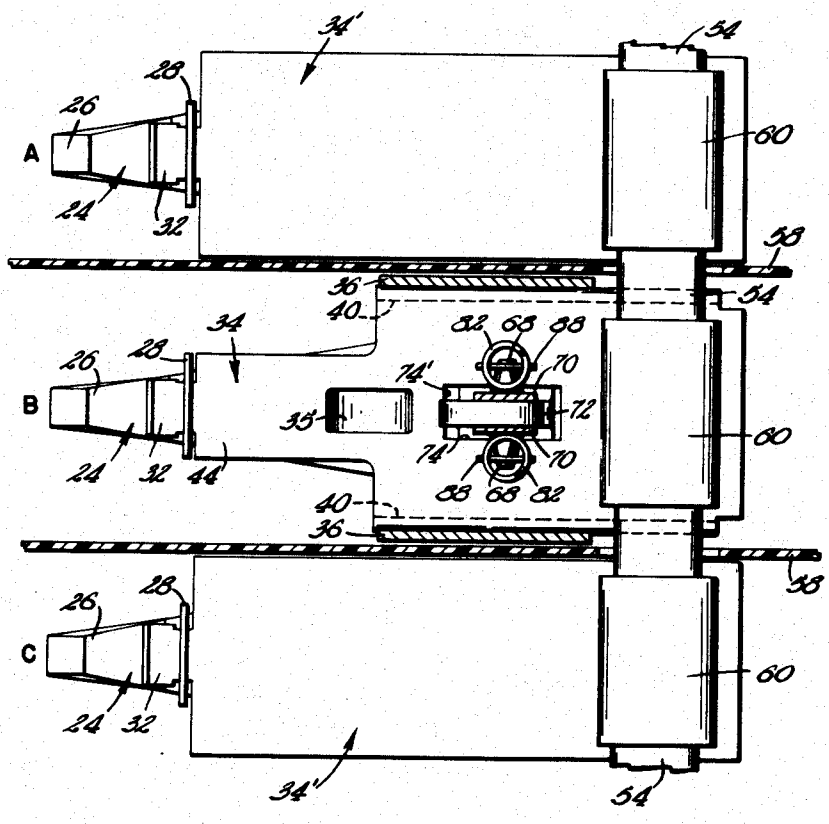

FIG. 3

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CIRCUIT BREAKER

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This invention relates generally to a circuit breaker and, more particularly, to a circuit breaker having improved operating mechanism. The circuit breaker is manually operable to open or close the circuit and is automatically operable to open the circuit upon the occurrence of an overload or short circuit condition.

One object of the present invention is the provision of improved circuit breaker operating mechanism which obviates the possibility of binding in an inoperative condition under prescribed conditions, i.e. when the breaker is tripped on overload or short circuit conditions and the operating handle is forcibly held in the "on" position. Under these prescribed conditions it was heretofore possible for a wedging action to take place between the releasable cradle and the operating lever resulting in binding of the operating mechanism. Pursuant to the above object of the present invention a novel arrangement and organization of the operating mechanism is provided which limits the extent of toggle movement tending to straighten the same.

Another important object and feature of the present invention is the provision of an improved operating mechanism of the aforenoted character in which the contact member carriers are completely free to move to their full open position on breaker tripping to thereby eliminate the possibility of failure to interrupt a short-circuit arc, there being eliminated a frictional engagement between the releasable cradle and the toggle mechanism that characterized certain prior art devices as the mechanism thereof shifted from the full "on" position to the "tripped" position. There is a complete absence of restraint of the toggle mechanism of the present invention on the contact arms as the latter move in an opening direction to thereby permit free and full opening of the contact arms when required.

Another feature of the present invention pursuant to the aforenoted construction, resides in the inherent strengthening of the center contact arm carrier, in a multipole application with the operating mechanism disposed at the center pole. This construction is of substantial advantage in rendering the center pole dimensionally and structurally more symmetrical relative to the outside poles.

Yet another object of the present invention is the provision of generally improved, simplified and foolproof circircuit breaker operating mechanism which is eminently suitable in the accomplishment of the intended purposes herein.

The illustrative embodiment of the invention, which has been outlined above as incorporating certain novel features forming part of the invention, is more fully described in the remainder of this specification, from which further novel features and objects and advantages will become apparent. In the following description reference is made to the accompanying drawings forming part of this disclosure, in which drawings:

FIG. 1 is a fragmentary vertical longitudinal sectional view through the center pole of a three-pole circuit breaker formed according to the present invention, the breaker being shown in the "on" or closed position;

FIG. 2 is a view similar to FIG. 1 with the breaker shown in the "tripped" open position; and

FIG. 3 is a top plan view thereof, taken along the line 3—3 of FIG. 1.

Referring to the drawings, there is shown a three-pole

circuit breaker 10 comprising a casing 12 of molded insulating material divided into three compartments A, B and C corresponding to the three poles of the breaker. The casing 12 includes a base 14 on which the components of the breaker mechanism are mounted and a cover 16 which is secured to the base and cooperates therewith to form an enclosing housing for the breaker mechanism.

The circuit breaker is provided at each pole with an associated pair of stationary and movable contacts 18 and 20, respectively, the contact 18 being carried by conductor 22 which is suitably secured to base 14 and the contact 20 being carried by the moving contact member 24. The moving contact assembly for the several poles is the same, except in the respects to be described in detail hereinafter, and accordingly the moving contact assembly for the center pole B only will be now described. The moving contact member 24, which is formed of a good conducting material, has an upwardly turned outer end 26 which defines an arc runner. Fixedly secured to the upper surface of contact member 24 and upstanding therefrom is an angle bracket 28 having a T-shaped slot 30 through which extends the T-shaped end portion 32 of the contact member carrier 34.

Secured to the base 14 is a generally U-shaped frame 36 which supports the operating mechanism 62 of the breaker, said frame pivotally mounting carrier 34 at pivot 38. The carrier 34 is channel shaped and includes depending flanges 40 which mount a transverse pin 41. A coil spring 42 is compressed between the part 44 of carrier 34 and the base 28' of the angle bracket 28 to provide the requisite contact pressure in the closed position of the breaker. An angle bracket 46 is secured to the underside of the contact member 24 by rivets 48, said bracket having an offset portion 49 which in conjunction with the contact member defines a slot 50 for the transverse pin 41. Thus the portion 49 extends beneath the pin 41. One end of a flexible conductor 52 is electrically and mechanically connected to the contact member 24 with the opposite end thereof being in circuit with a terminal (not shown) at the right hand end of the breaker.

The movable contact members 24 are rigidly interconnected for conjoint movement by a tie bar 54 enclosed in insulation 56 which extends across all of the poles of the breaker through the compartment barriers 58. The tie bar 54 is suitably secured to the contact members by coupling brackets 60. The coupled contact members are pivotally movable between circuit "open" and "closed" positions by the operating mechanism 62, now to be described, which is disposed at the center pole and supported by frame 36.

The operating mechanism 62 is of the overcenter spring quick make and break type and comprises a U-shaped actuating member 64 having legs 65 which are pivotally mounted on frame 36 by pivot pins 66. The operating mechanism is of the trip-free type so that the contacts of the breaker will automatically open on overload conditions irrespective of the position of handle 100. The toggle includes a knee pin 68 which interconnects the pair of links 70 and the T-shaped toggle member 72 which extends through a slot 74 in the contact member carrier, said toggle member being pivotally secured to the contact member carrier by pin 41. The toggle links 70 at the opposite end are pivotally connected to a releasable cradle 76 by pivot pin 78, the cradle being pivotally mounted on a shaft 80 carried by frame 36. A pair of tension springs 82 extend under tension between knee pin 68 and the bight part 84 of the actuating member 64. More particularly, each spring has end fittings 86 and 88 which are secured to member 64 and pin 68, respectively, the fitting 86 extending through an elon-

gated slot 90 in part 84 and being pinned in position by pin 92 and the fitting 88 being engaged on pin 68.

The cradle 76 includes a latch part 94 which is normally in latched engagement with a latch 96 of the trip mechanism which normally serves to restrain the pivoted cradle 76 in latched position. The trip mechanism is operable in response to an overload on any of the circuits controlled by the breaker to effect release of the cradle and thus automatically open all of the movable contacts of the breaker.

An insulating actuating handle 100 is suitably secured to the actuating member 64, said handle projecting through the opening 102 of the cover for accessibility thereat. The actuating member 64 is provided with a depending portion 67 for engaging and resetting the cradle to the latched position by operating handle movement in the opening direction. The carrier 34 includes a dished out portion 35 which accommodates the pivoted end portion 37 of the cradle. The upper surface of carrier 34 engages tube 81, integral with the cradle, for limiting open movement of the contact carriers. On circuit closing movement of the handle 100 and member 64, the latter tensions springs 82 of the toggle 70, 72. On overcentering of the toggle the contact members are actuated to closed position as shown in FIG. 1, and overcentering of the toggle is limited by stop 98. Actually this stop could be eliminated, instead of relying on shoulder 74' to act as a stop for the lower toggle link 72 for limiting the overcentering of the toggle, and such is within present contemplation. On circuit opening movement of the handle, the toggle collapses at the knee 68 to move the contact carriers to circuit open position.

In the circuit closed condition, the release of the cradle for rotation by the tripping mechanism 98 results in the collapse of the toggle and movement of the contact members to open position to thereby open the contacts at all of the poles of the breaker, as shown in FIG. 2. More particularly, pursuant to the present invention, the slot 74 in the contact member carrier for the extension therethrough of toggle member 72 has a shoulder 74' defined by said slot which cooperates with the arcuate edge portion 72' of member 72 to determine the disposition of the toggle in the tripped position thereof. The slot 74 is of minimal dimension to provide for the extension therethrough of member 72 and to define the stop 74' therefor. Thus stop 74' limits the extent to which the toggle can straighten when the breaker is tripped, the linkage including the carrier 34, toggle 70, 72 and the cradle 76 being all restrained in a predetermined position when the carrier reaches the full "open" position shown in FIG. 2. In the tripped position of the linkage the springs 82 are under tension and retain the handle 100 in the prescribed tripped position. Heretofore when the breaker was tripped on overload or short circuit conditions and the handle 100 was forcibly held in the "on" position, it was possible for a wedging action to take place between the upper arcuate edge 76' of the upwardly pivoting cradle 76 and the underneath surface 84' of the part 84 of the actuating member, resulting in binding of the operating mechanism. Pursuant to the present invention, this possibility of binding of the operating mechanism is obviated as stop 74' positively limits the extent of toggle straightening and defines the tripped position of knee pin 68 as shown in FIG. 2.

The contact member carriers 34, 34' are completely free to move to their full open position on breaker tripping to thereby eliminate the possibility of failure to interrupt a short-circuit arc, there being no frictional engagement between the cradle and the toggle linkage as the mechanism shifts from the "on" position to the tripped position. Thus there is no possible restraint against the free opening of the contact member carriers when required and at the same time the carrier associated with the operating mechanism performs the aforedescribed positioning of the linkage thereof on tripping.

As aforenoted, the slot 74 is of minimal dimension and is of substantially lesser dimension than that heretofore used in structures of this same general type to thereby substantially increase the strength of the contact carrier 34. The outer pole contact carriers 34' correspond to the carrier 34 except that the former are not provided with a slot 74. The carriers 34' are thus free of slots and consequently can apply firm contact closing pressure to the springs 42 and any structural weakening of the carrier 34 is herein minimized with minimal effect on reducing the contact pressure at the center pole. The strengthening of the center pole carrier 34 is advantageous in rendering the same dimensionally and constructionally more symmetrical in relation to the outside pole carriers 34', this effect being especially noticeable at the instant of contact engagement during a closing operation and prior to actual build-up of contact pressures.

Various additional modifications of the above embodiment of the invention will readily occur to those skilled in the art, and therefore the invention should be broadly construed in accordance with its full spirit and scope.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a circuit breaker, contact means relatively movable between open and closed positions, a contact device movable to open and closed positions to open and close said contact means, operating mechanism for said device comprising an actuating member movable to said positions, a releasable cradle operable on release to effect movement of said contact device to open position, and a toggle operatively associated with said cradle and contact device, said toggle including a link connected by a pivot to said device, an overcenter spring operable by said actuating member to operate said toggle and thereby move said contact device to said positions, and means providing for the inter-engagement of said toggle and contact device on the release of said cradle to said open position to maintain said toggle in a predetermined position, said interengagement means being spaced from said pivot.

2. In a circuit breaker, a supporting frame, contact structure movable to open and closed positions, and operating mechanism therefor mounted in said frame, said mechanism comprising a toggle operable to actuate said contact structure to open and closed positions, said toggle including a link connected by a pivot to said structure, an actuating member movable to said positions, an overcenter spring operable by said actuating member to operate said toggle, and a releasable member operable on release to effect movement of said contact structure to open position independent of actuating member position, said toggle and contact structure having interengageable means spaced from said pivot to maintain said operating mechanism in a predetermined relation with said spring under tension.

3. In a circuit breaker, contact means relatively movable between open and closed positions, a contact device movable to open and closed positions to open and close said contact means, operating mechanism for said device comprising an actuating member movable to said positions, a releasable cradle operable on release to effect movement of said contact device to open position, and a toggle operatively associated with said cradle and contact device, an overcenter spring operable by said actuating member to operate said toggle and thereby move said contact device to said positions, said contact device being slotted for the extension therethrough of said toggle, said slot defining a shoulder at one end thereof, and said toggle and shoulder engaging on the release of said cradle to open position to maintain said toggle in a predetermined position.

4. In a circuit breaker, a supporting frame, contact structure movable to open and closed positions, and operating mechanism therefor mounted in said frame, said mechanism comprising a toggle operable to actuate said

contact structure to open and closed positions, an actuating member movable to said positions, an overcenter spring operable by said actuating member to operate said toggle, and a releasable member operable on release to effect movement of said contact structure to open position independent of actuating member position, said toggle and contact structure having interengageable means to maintain said operating mechanism in a predetermined relation with said spring under tension, said contact structure having a slot for the extension therethrough of said toggle, said interengageable means comprising a shoulder defined at one end of said slot and a companion confronting edge portion of said toggle.

5. In a circuit breaker, contact means relatively movable between open and closed positions, a contact device movable to open and closed positions to open and close said contact means, operating mechanism for said device comprising an actuating member movable to said positions, a releasable cradle operable on release to effect movement of said contact device to open position, and a toggle operatively associated with said cradle and contact device, an overcenter spring operable by said actuating member to operate said toggle, and thereby move said contact device to said positions, said contact device being slotted for the extension therethrough of said toggle, said slot defining a shoulder at one end thereof, and said toggle comprising upper and lower toggle members interconnected by a knee pin, said lower toggle member engaging said shoulder on the release of said cradle to open position to maintain said toggle in a predetermined position with said spring tensioned.

6. In a circuit breaker, a supporting frame, stationary contact means, movable contact means comprising a contact carrier mounting a contact member relatively movable with respect to said stationary contact means to open and closed positions, and operating mechanism for said movable contact means mounted in said frame, said operating mechanism comprising a toggle operable to actuate said movable contact means to open and closed positions, said toggle comprising upper and lowert toggle linkage interconnected by a knee pin, an actuating member movable to said positions, an overcenter spring extending between said knee pin and actuating member and operable by the latter to actuate said toggle, and a releasable cradle operable on release to effect movement of said movable contact means to open position, said contact carrier having a slot of predetermined dimension for the extension therethrough of said lower toggle linkage, said slot defining a shoulder at one end thereof for the engagement of said lower toggle linkage thereagainst on the release of said cradle to open position to maintain said linkage in a predetermined position.

7. In a circuit breaker, a supporting frame, stationary contact means, movable contact means comprising a contact carrier mounting a contact member relatively movable with respect to said stationary contact means to open and closed positions, and operating mechanism for said movable contact means mounted in said frame, said operating mechanism comprising a toggle operable to actuate said movable contact means to open and closed positions, said toggle comprising upper and lower toggle linkage interconnected by a knee pin, an actuating member movable to said positions, an overcenter spring extending between said knee pin and actuating member and operable by the latter to actuate said toggle, and a releasable cradle operable on release to effect movement of said movable contact means to open position, said contact carrier having a slot of predetermined dimension for the extension therethrough of said lower toggle linkage, said slot defining a shoulder at one end thereof for the engagement of said lower toggle linkage thereagainst on the release of said cradle to open position to maintain said linkage in a predetermined position and said spring under predetermined tension, said cradle and toggle linkage being free of engagement as the operating mechanism shifts from the "on" position to said "open" position on the release of said cradle.

8. In a circuit breaker, a supporting frame, contact structure movable to open and closed positions, and operating mechanism therefor mounted in said frame, said mechanism comprising a toggle operable to actuate said contact structure to open and closed positions, said toggle including a link connected by a pivot to said structure, an actuating member movable to said positions, an overcenter spring operable by said actuating member to operate said toggle, and a releasable member operable on release to effect movement of said contact structure to open position independent of actuating member position, said toggle and contact structure having interengageable means spaced from said pivot to maintain said operating mechanism in a predetermined relation on the release of said releasable member, the latter and said toggle being free of engagement as said operating mechanism shifts from the closed position to said open position on the release of said releasable member.

9. In a circuit breaker, a supporting frame, stationary contact means, movable contact means comprising a contact carrier mounting a contact member relatively movable with respect to said stationary contact means to open and closed positions, and operating mechanism for said movable contact means mounted in said frame, said operating mechanism comprising a toggle operable to actuate said movable contact means to open and closed positions, said toggle comprising upper and lower toggle linkage interconnected by a knee pin, an actuating member movable to said positions, an overcenter spring extending between said knee pin and actuating member and operable by the latter to actuate said toggle, and a releasable cradle mounted in said frame and pivotally connected to said upper toggle linkage, said cradle being operable on release to effect movement of said movable contact means to open position, said contact carrier having a slot of predetermined dimension for the extension therethrough of said lower toggle linkage, said slot defining a shoulder at one end thereof for the engagement of said lower toggle linkage thereagainst on the release of said cradle to open position to maintain said linkage in a predetermined position.

10. In a circuit breaker, a supporting frame, stationary contact means, movable contact means comprising a contact carrier mounting a contact member relatively movable with respect to said stationary contact means to open and closed positions, and operating mechanism for said movable contact means mounted in said frame, said operating mechanism comprising a toggle operable to actuate said movable contact means to open and closed positions, said toggle comprising upper and lower toggle linkage interconnected by a knee pin, an actuating member movable to said positions, an overcenter spring extending between said knee pin and actuating member and operable by the latter to actuate said toggle, and a releasable cradle operable on release to effect movement of said movable contact means to open position, said contact carrier having a slot of predetermined dimension for the extension therethrough of said lower toggle linkage, said slot defining a shoulder at one end thereof for the engagement of said lower toggle linkage thereagainst on the release of said cradle to open position to maintain said linkage in a predetermined position, and an actuating handle connected to said actuating member for moving the latter to said open and closed positions, said actuating handle and member being trip-free.

11. In a multi-pole circuit breaker having at each pole stationary and movable contact means, the latter comprising a contact carrier mounting a contact member relatively movable with respect to said stationary contact means to open and closed positions, said contact carriers being rigidly coupled for conjoint movement with respect to their companion stationary contact means, a supporting frame at one pole, and operating mechanism mounted

in said frame for actuating said coupled contact carriers to said positions, said operating mechanism comprising a toggle operable to actuate said coupled contact carriers to said positions, said toggle comprising upper and lower toggle linkage interconnected by a knee pin, an actuating member movable to said positions, an overcenter spring extending between said knee pin and actuating member and operable by the latter to actuate said toggle, and a releasable cradle operable on release to effect movement of said coupled contact carriers to open position, the contact carrier at said one pole having a slot of predetermined dimension for the extension therethrough of said lower toggle linkage, said slot defining a stop at one end thereof for the engagement of said lower toggle linkage thereagainst on the release of said cradle to open position to maintain said linkage in a predetermined position with said spring under predetermined tension.

12. In a multi-pole circuit breaker having at each pole stationary and movable contact means, the latter comprising a contact carrier mounting a contact member relatively movable with respect to said stationary contact means to open and closed positions, said contact carriers being rigidly coupled for conjoint movement with respect to their companion stationary contact means, a supporting frame at one pole, and operating mechanism mounted in said frame for actuating said coupled contact carriers to said positions, said operating mechanism comprising a

toggle operable to actuate said coupled contact carriers to said positions, said toggle comprising upper and lower toggle linkage interconnected by a knee pin, an actuating member movable to said positions, an overcenter spring extending between said knee pin and actuating member and operable by the latter to actuate said toggle, and a releasable cradle operable on release to effect movement of said coupled contact carriers to open position, the contact carrier at said one pole having a slot of predetermined dimension for the extension therethrough of said lower toggle linkage, said slot defining a stop at one end thereof for the engagement of said lower toggle linkage thereagainst on the release of said cradle to open position to maintain said linkage in a predetermined position with said spring under predetermined tension, the circuit breaker being a three-pole unit with said one pole being the center pole thereof, the contact carriers at the outer poles being free of said slot but otherwise being similar to the contact carrier at the center pole to provide a series of contact carriers that are essentially dimensionally and structurally symmetrical.

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