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Marot et al.

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[54] **CIRCUIT BREAKER TOGGLE MECHANISM WITH SPRING-BIASED LATCH PLATE**

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[52] **U.S. Cl.**..... **200/153 G**, 335/21, 335/165, 335/167

[51] **Int. Cl.**..... **H01h 3/46**, H01h 71/12

[58] **Field of Search**..... 200/153 G; 335/170, 335/174, 21, 165, 167, 191, 38, 171; 337/59, 70, 345

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[57] **ABSTRACT**

A circuit breaker operating mechanism which may be set to constrain movable contacts to close with stationary contacts, but which is adapted to collapse resulting in the contacts opening. The operating mechanism comprises a toggle-link and a latch-frame articulated with one another so as to permit collapsing of the operating mechanism and a latch which may be disengaged to permit the collapsing. The invention provides in addition a latch-plate in the operating mechanism which by virtue of a lever advantage reduces the energy requirements to disengage the latch and so permits a more sensitive operating mechanism. The components are shaped to minimize space taken by the mechanism in its collapsed state.

5 Claims, 9 Drawing Figures

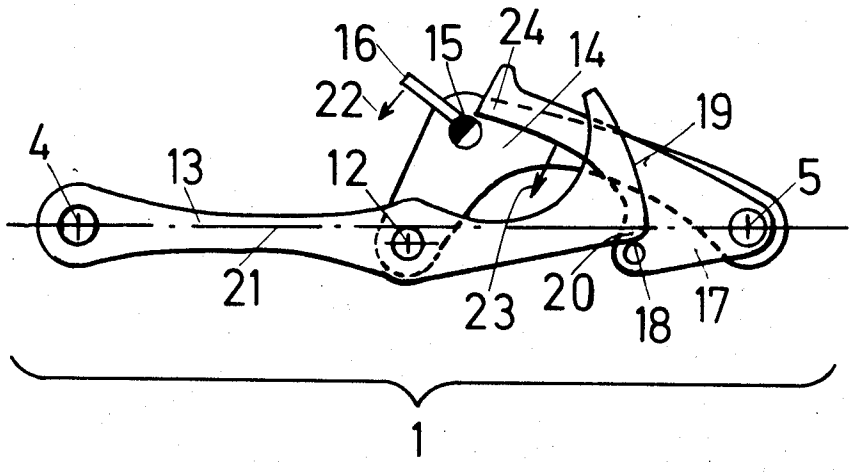


Fig.1.

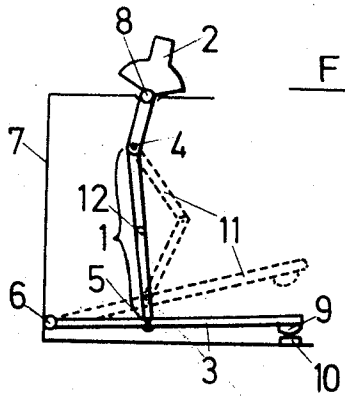


Fig.2.

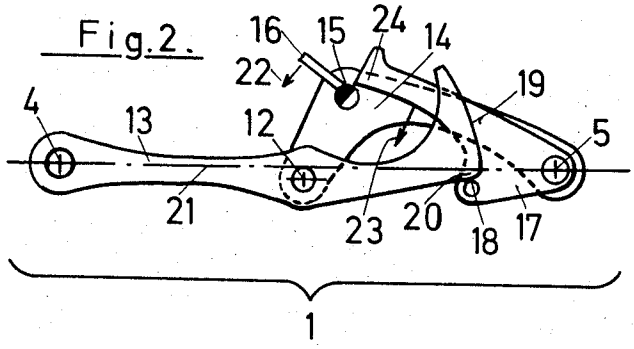


Fig.3.

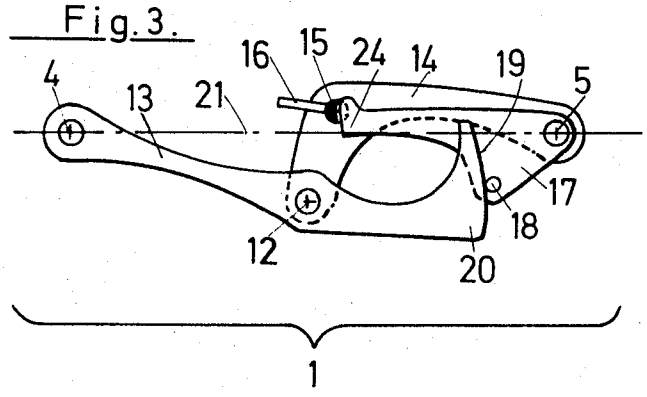


FIG. 4.

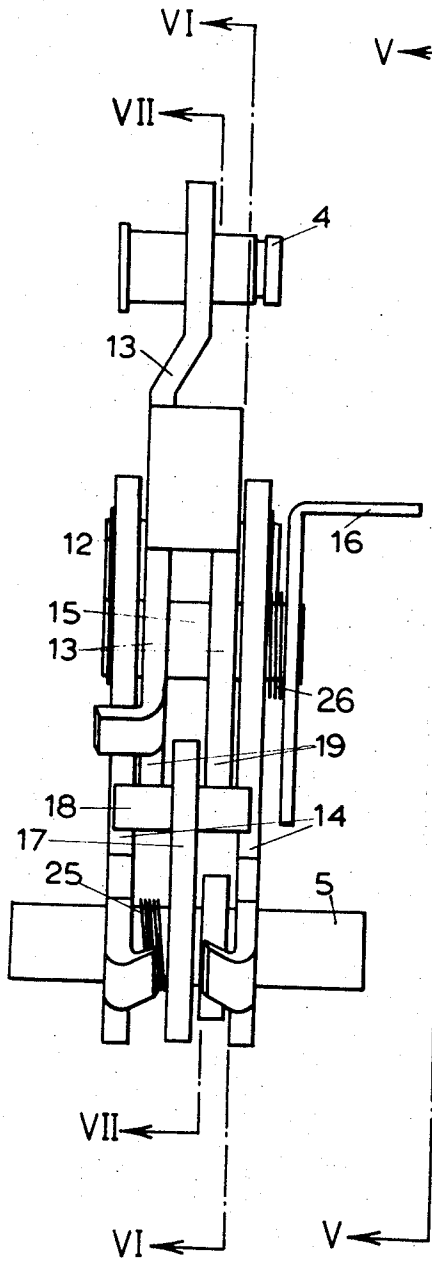

VI
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VII
VI
V

FIG. 5.

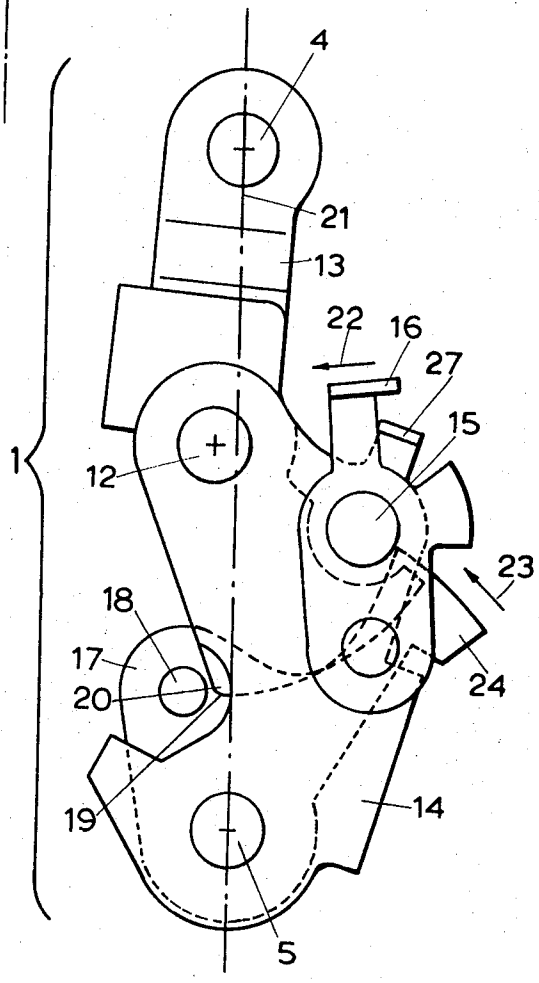

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FIG.6.

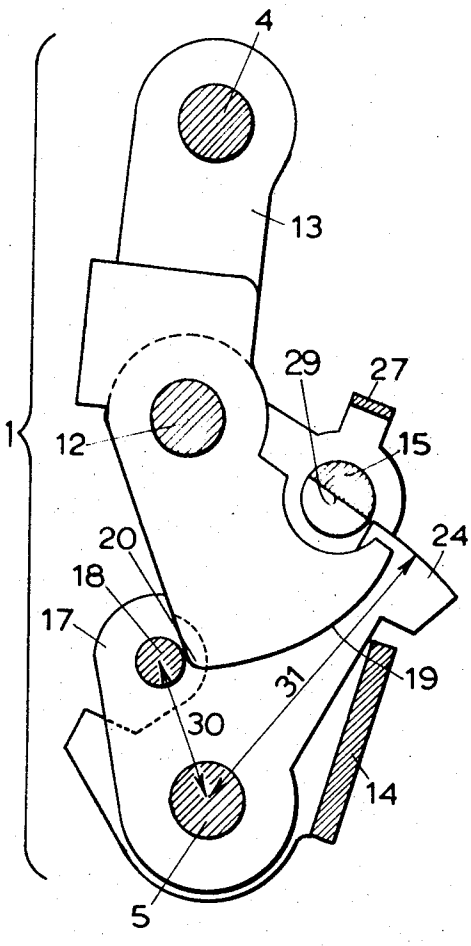

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FIG.7.

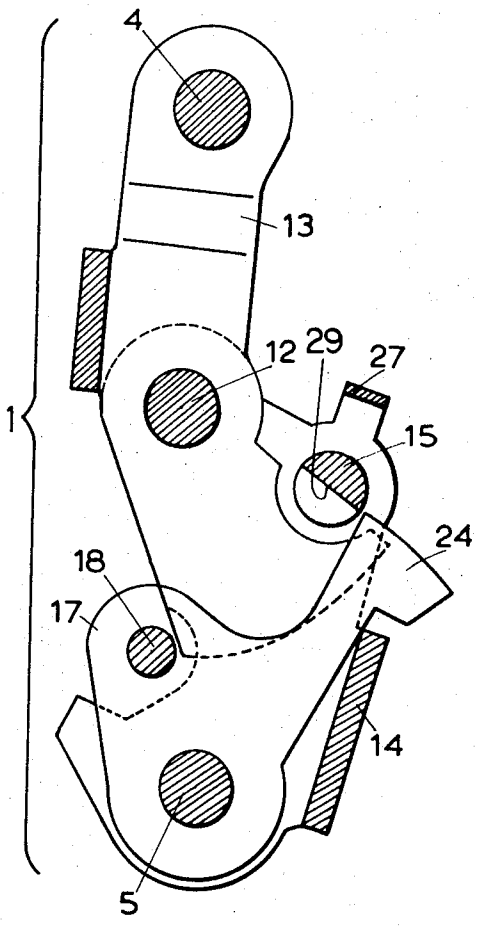

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FIG. 8.

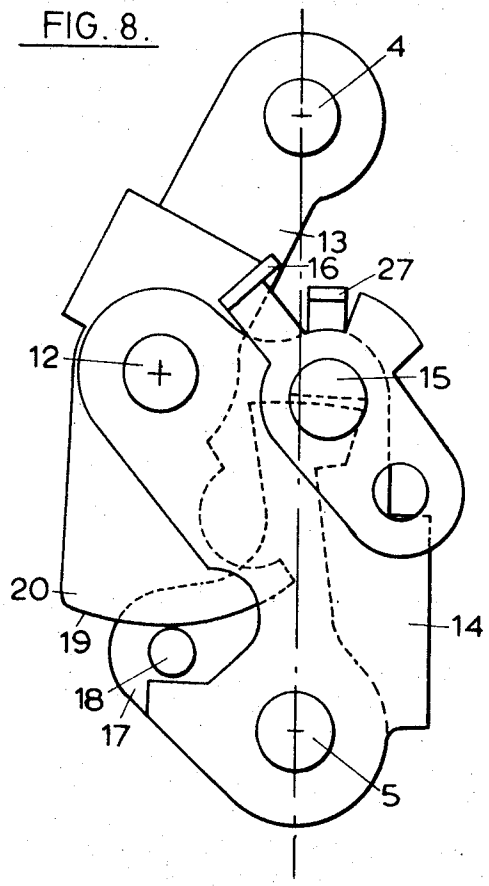
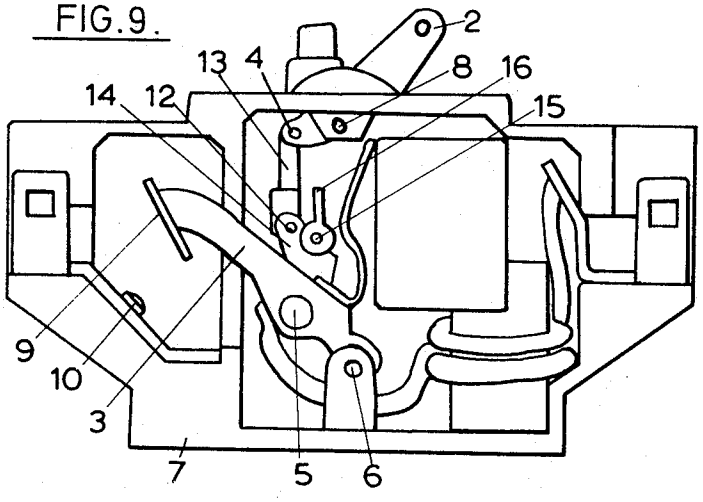


FIG. 9.



CIRCUIT BREAKER TOGGLE MECHANISM WITH SPRING-BIASED LATCH PLATE

BACKGROUND OF THE INVENTION

This invention concerns improvements relating to circuit breakers, for example moulded case circuit breakers. More particularly this invention concerns an operating mechanism in circuit breakers.

Circuit breakers, more particularly moulded case circuit breakers are known which comprise an "operating mechanism" settable to an "on" position in which it constrains contacts on a movable contact carrier to be closed with complementary fixed contacts. Conversely the contacts are opened on return of the operating mechanism away from the "on" position. Circuit breakers are furthermore known in which such an operating mechanism is collapsible in its length between pivotal connections by articulation of two main parts of the operating mechanism, a latch-frame and a toggle-link, on disengaging a latch of the operating mechanism. This collapsing of the operating mechanism opens the contacts even when the operating mechanism is in the "on" position. When the operating mechanism latch is engaged again the contacts are closed again, providing the operating mechanism remains in the "on" position.

Former circuit breakers which employed this type of operating mechanism used an electro-mechanical transducer, usually in the form of a small solenoid, to supply the necessary energy to disengage the latch. A reduction of the energy required to disengage the latch would permit reduction or elimination of the amplification of the electrical signal used to initiate disengaging of the latch. Thus the energy requirement for disengaging the latch is important.

One object of this invention is to provide a latch mechanism which may be used to reduce the quantity of energy needed to disengage the latch. A further or subsidiary object of this invention is to provide such a latch mechanism which at least in preferred embodiments may occupy a minimum space in the unlatched position as well as the latched position and with the operating mechanism in the collapsed position as well as the uncollapsed position.

BRIEF SUMMARY OF THE INVENTION

A circuit breaker in accordance with this invention comprises an operating mechanism settable to an "on" position in which it may constrain contacts on a movable contact carrier to be closed, the operating mechanism being collapsible by articulation of a toggle-link and a latch-frame after disengagement of a latch, in which the operating mechanism comprises a latch-plate adapted to restrain the latch-frame and toggle-link against articulation only while the latch-plate is itself restrained by engagement of the latch.

Conveniently a catch and a lever of the latch are mounted on the latch-frame, so that the catch may engage an edge of the latch-plate during engagement of the latch, and the catch disengage the edge during disengagement of the latch.

In accordance with a preferred embodiment of this invention the toggle-link comprises a curved sliding face terminating in a restraining region and the latch-plate comprises a coacting formation adapted to engage with the restraining region when the latch-plate is to restrain the toggle-link against articulation and to slide against the sliding face when the latch-plate is to release the toggle-link to articulate with the latch frame.

Preferably the sliding face is juxtaposed substantially overlapping the latch-frame when the toggle-link is in a position in which it is restrained by the latch-plate, and the toggle-link and latch-frame are in the uncollapsed position.

Preferably the curved sliding face of the toggle-link is shaped so as to extend from a position near the latch-frame in a direction opposite to the direction of movement of the latch-frame and toggle-link on articulating towards the collapsed position.

Preferably a toggle-link portion which carries the sliding face is shaped to minimize the distance of projection of that portion beyond the operating member when it is in the collapsed position.

Preferably the toggle-link extends from its main portion on beyond a pivot by means of which it is articulated to the latch-frame and terminates in a restraining region adapted to restrain the latch-plate on a coacting formation of the latch-plate, the said coacting formation located at a radial distance from an axis of pivotal connection of the latch-plate to the latch-frame which is less than the radial distance from an edge of the latch-plate engaged by a catch of the latch to the axis of pivotal connection of the latch-plate to the latch-frame.

In accordance with another aspect of this invention a collapsible operating mechanism, for a circuit breaker, having a toggle-link articulated to a latch-frame and a latch, comprises a latch-plate adapted to restrain the toggle-link and latch-frame against articulation only while the latch-plate is itself restrained by engagement of the latch.

This invention will be more fully described by way of example, with reference to the drawings.

BRIEF DESCRIPTION OF DRAWINGS

In the drawings:

FIG. 1 is a schematic illustration of a circuit breaker of which the operating mechanism is illustrated in subsequent figures in more detail,

FIG. 2 is a schematic illustration of the operating mechanism shown in FIG. 1,

FIG. 3 is a similar illustration of the operating mechanism shown in FIG. 2 but in the collapsed condition,

FIG. 4 is a front view of an operating mechanism in accordance with the preferred embodiment of this invention,

FIG. 5 is a side view of the operating mechanism shown in FIG. 4, on view V—V of FIG. IV,

FIGS. 6 and 7 are side sectional views of the operating mechanism shown in FIGS. 3 and 4 on sections VI—VI and VII—VII respectively,

FIG. 8 is a side view of the operating mechanism shown in FIGS. 4 to 7 but in the collapsed condition, and

FIG. 9 is a side view of a moulded case circuit breaker incorporating the operating mechanism shown in FIGS. 4 to 8, on a smaller scale.

DESCRIPTION OF THE PREFERRED EMBODIMENTS.

As indicated in FIG. 1 the main functional parts of a circuit breaker comprise the following: an operating mechanism 1, pivotally connected between a toggle 2

and a movable contact carrier 3, by pivots 4 and 5 respectively, contact carrier 3 being pivotally mounted by pivot 6 in the case 7, and toggle 2 being pivotally mounted by pivot 8 in the case 7. Contact carrier 3 carries contacts 9 here shown contacting contacts 10 fixed in the case 7, toggle 2 being in a position in which the operating mechanism 1 is in the "on" position. Broken lines 11 indicate the positions of the movable components if the operating mechanism 1 is collapsed. The operating mechanism 1 is articulated by pivot 12 for the purpose of collapsing as shown.

As shown in FIG. 2 the operating mechanism 1 comprises a toggle-link 13 articulated to a latch-frame 14 by pivot pin 12. The latch-frame 14 carries a latch comprising catch 15 in the form of a shaft having a flat ground on it and a lever 16, the catch 15 being operable by the lever 6. The operating mechanism further comprises a latch-plate 17 which has an edge 24 which is engaged by the catch 15 as shown. Latch-plate 17 carries a pin 18 which formation restrains the toggle-link 13 against articulation so that the operating mechanism 1 cannot collapse. The toggle-link has a curved sliding face 19 terminating in a restraining region 20 engaged by the pin 18 of the latch-plate 17 in the uncollapsed condition. It will be noted that the pivot pin 12 articulating the toggle-link 13 and latch frame 5 is eccentric of a straight line 21 joining the centres of the pivot pins 4 and 5 which are used to pivotally connect the operating mechanism 1 to toggle 2 and contact carrier 3, (see FIG. 1), respectively. This eccentricity biasses the operating mechanism to collapse when a compressive force is applied to the operating mechanism by carrier 3 and toggle 2. In these sketches biassing springs for additional biassing are not shown as it will be clear to those skilled in the art where these are necessary or desirable.

When the lever 16 is moved in the direction of arrow 22 the catch 15, in the form of a shaft with a flat ground on it rotates until the flat coincides with the edge 24 of the latch-plate 17 and this releases the latch-plate 17. Under action of the bias the latch-plate 17 pivots on pivot pin 5 in the direction of arrow 23 and this releases the toggle-link 13 to articulate with the latch-frame 14 and the operating-member 1 collapses, the various components attaining the positions shown in FIG. 3.

In FIGS. 4 to 9 the operating mechanism and circuit breaker comprise the functionally identical components, the shapes being only somewhat different, and so the same reference numerals are used throughout these figures as are used in FIGS. 1 to 3, for corresponding features. The mechanism operates in the same way as that shown in FIGS. 1 to 3 and the description with reference to those figures can be read with reference to FIGS. 4 to 8. Biassing springs 25 and 26 are additionally shown in these figures, however. Spring 25 biases the latch-plate 17 in the opposite direction to that indicated by arrow 23 and spring 26 biasses the catch 15 in the opposite direction to that indicated by arrow 22. These figures also show a tag 27 bent at right angles to the latch-frame 14 and acting as a stop to limit movement of the catch 15 as indicated by the extreme positions of catch 15 in FIGS. 5 and 8. Also tag 28 limits movement of the toggle-link 13 relative to the latch-frame 14 from which the tag is bent at right angles. In FIGS. 6 and 7 the flat 29 of the shaft formed catch 15 is visible. In FIG. 6 distances 30 and 31 from the axis of pin 5 to the axis of pin 18 and from the axis of pin 5 to the edge 24 of the latch-plate respectively, are indicated. The ratio of these distances can be used in a calculation which will be clear to those skilled in the art to determine the mechanical advantage or leverage advantage furnished by the latch-plate 17 to reduce the amount of energy required to achieve unlatching. In an industrially manufactured operating mechanism according to FIGS. 4 to 9 at one fourth the size of these figures, an energy consumption of 0.59 Newton millimeters was sufficient to disengage the catch 15 from the edge 24 of the latch-plate 17 while the operating mechanism 1 was loaded so that its collapsing expended an energy of 147 Newton millimeters, approximately. This order of sensitivity was achieved while nevertheless having reliable operation with freedom from accidental unlatching, e.g., from knocks or vibration of moderate intensity.

In FIG. 9 the movable contact carrier 3 is shown in the position in which contacts 9 and 10 are open, in contrast with FIG. 1 where they are closed. Again corresponding parts are numbered with corresponding numerals as in the previous figures.

What we claim is:

1. In a circuit breaker, an operating mechanism which comprises an operating mechanism settable to an "on" position in which it may constrain contacts on a movable contact carrier to be closed, the operating mechanism being collapsible by articulation of a toggle-link and a latch-frame after disengagement of a latch, in which the operating mechanism comprises a latch plate adapted to restrain the latch-frame and toggle-link against articulation only while the latch-plate is itself restrained by engagement of the latch, in which the toggle-link comprises a curved sliding face terminating in a restraining region and the latch-plate comprises a coacting formation which engages the restraining region when the latch-plate is to restrain the toggle-link against articulation and which engages the sliding face when the latch-plate is to release the toggle-link to articulate with the latch-frame, and which comprises a biassing spring which biasses the latch-plate relative to the latch-frame with a torque in opposite sense to the direction of rotation of the latch-plate, when it is engaged with the latch.

2. An operating mechanism according to claim 1, in which the sliding face is juxtaposed substantially overlapping the latch-frame when the toggle-link is in a position in which it is restrained by the latch-plate, and the toggle-link and latch-frame are in the uncollapsed position.

3. An operating mechanism according to claim 1, in which the curved sliding face of the toggle-link is shaped so as to extend from a position near the latch-frame in a direction opposite to the direction of movement of the latch-frame and toggle-link on articulating towards the collapsed position.

4. An operating mechanism according to claim 1, in which the toggle-link extends from its main portion on beyond a pivot by means of which it is articulated to the latch-frame and terminates in a restraining region adapted to restrain the latch-plate on a coacting formation of the latch-plate, the said coacting formation located at a radial distance from an axis of pivotal connection of the latch-plate to the latch frame which is less than the radial distance from an edge of the latch-plate engaged by a catch of the latch to the axis of pivotal connection of the latch-plate to the latch-frame.

5. A circuit breaker operating mechanism having a movable contact carrier for opening and closing the circuit breaker contacts and a linkage pivotally connected to the carrier and having a rigid condition for holding said contact carrier in a closed position and being biased to a collapsed condition wherein said carrier is permitted to move to an open position, said linkage comprising:

a first collapsible member pivotally connected to the contact carrier,

a second collapsible member pivotally connected to said first collapsible member for relative movement between rigid and collapsed positions,

said second member having a curved face formed thereon and a restraining region,

latch means pivotally mounted on said first member and including restraining means,

said restraining means being engageable by said restraining region to prevent movement of said second member out of its rigid position when said latch means is in a first position, said restraining means moving out of engagement with said restraining region when said latch means is moved from said first position to a second position to permit said second member to move to its collapsed position,

catch means movably mounted on said first member for engaging said latch means to maintain it in said first position when said catch means is in one position, said catch means being movable to a second position to disengage said latch means whereby said latch means may be moved to said second position,

the engagement between said second member and said latch means acting to urge said latch means into frictional engagement with said catch means,

spring means engaging said latch means for biasing the same away from said catch means to minimize said frictional engagement to reduce the tripping force necessary to move said catch means to its second position,

said restraining means engaging said curved surface when said latch member is released from said catch means to limit movement of said catch means under the influence of said spring means.

* * * * *