July 22, 1969 E. C. GOODWIN, JR 3,457,531

BALANCED LATCH MECHANISM

Filed June 5, 1967 3 Sheets-Sheet 1

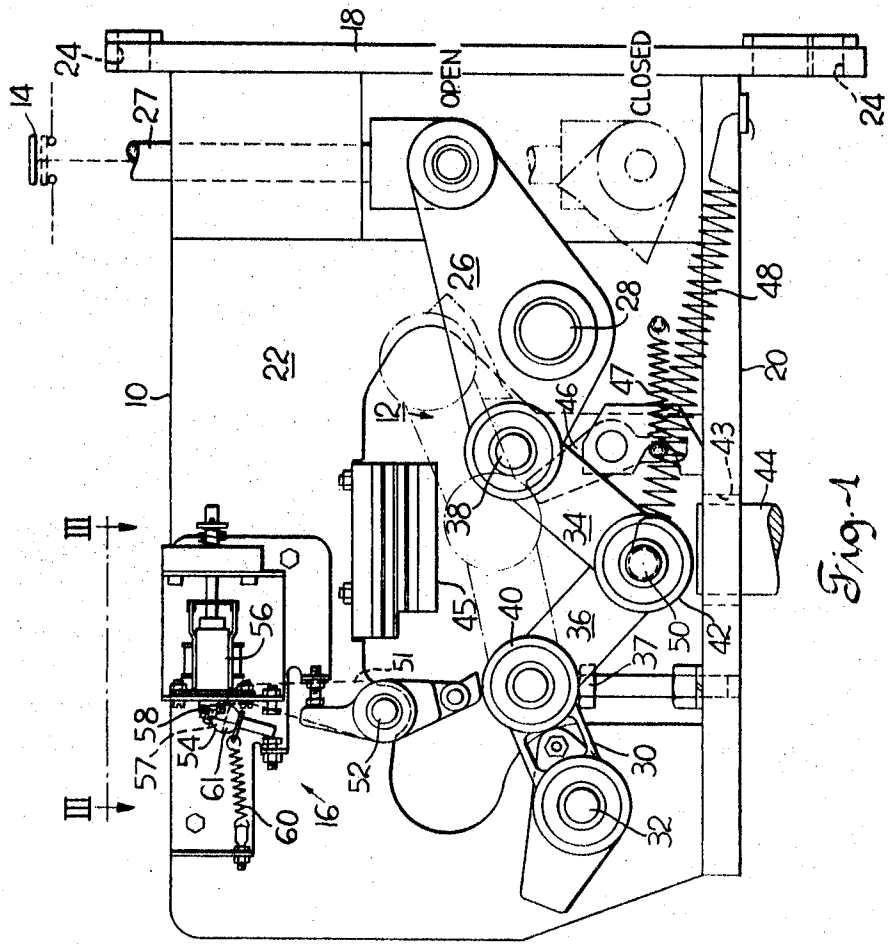


Fig. 1

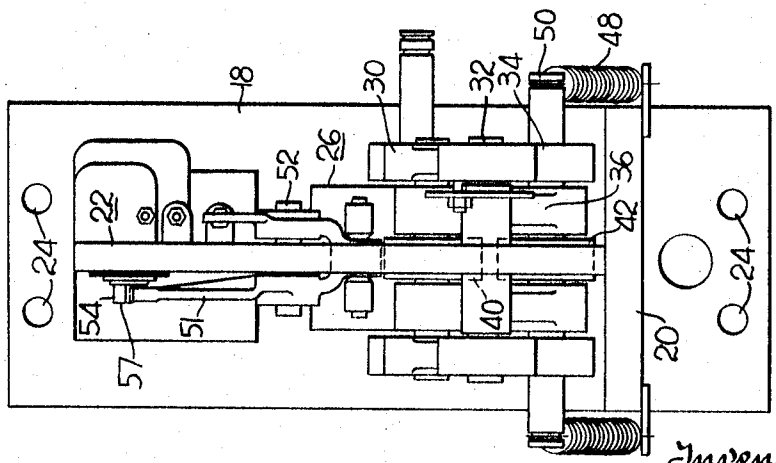


Fig. 2

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BALANCED LATCH MECHANISM

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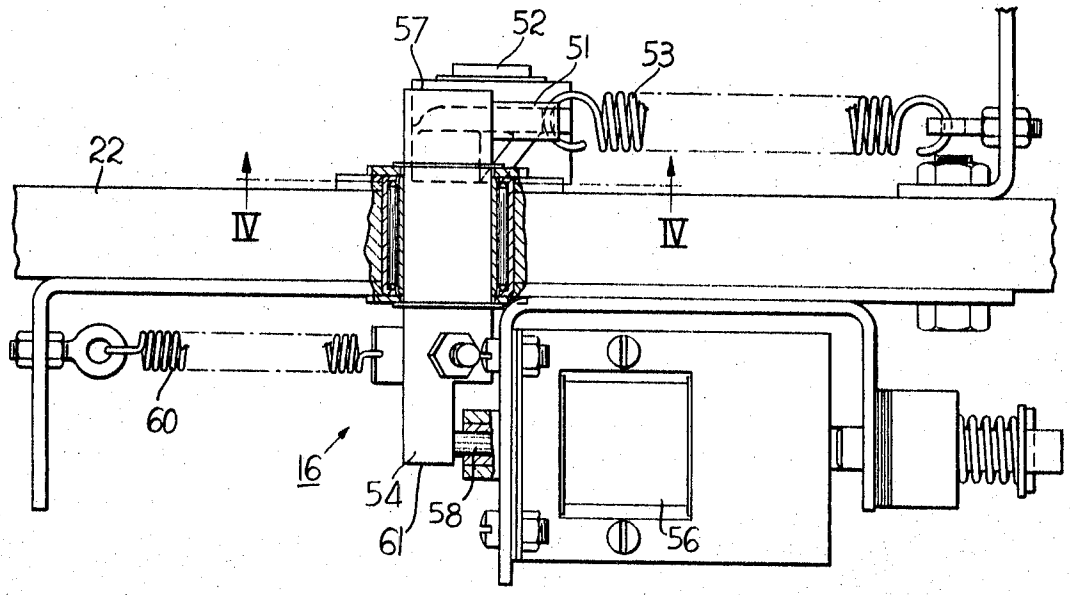


Fig. 3

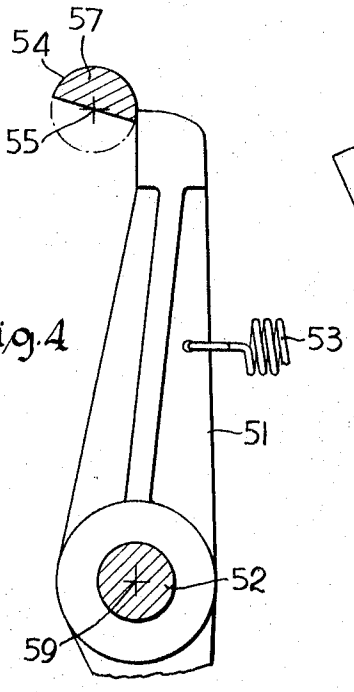


Fig. 4

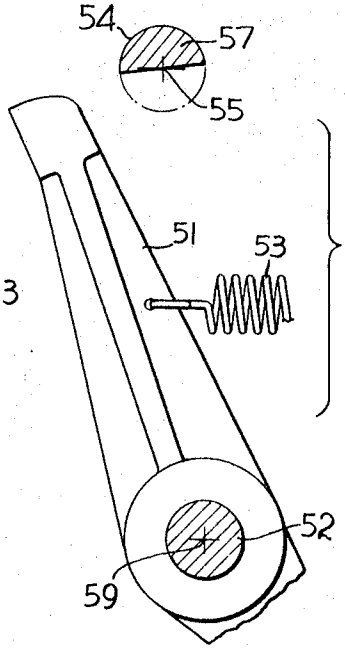


Fig. 5

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BALANCED LATCH MECHANISM

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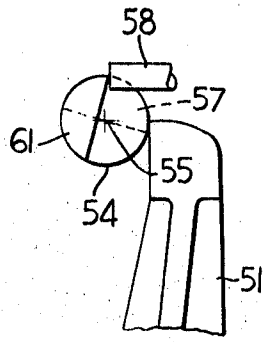


Fig. 6

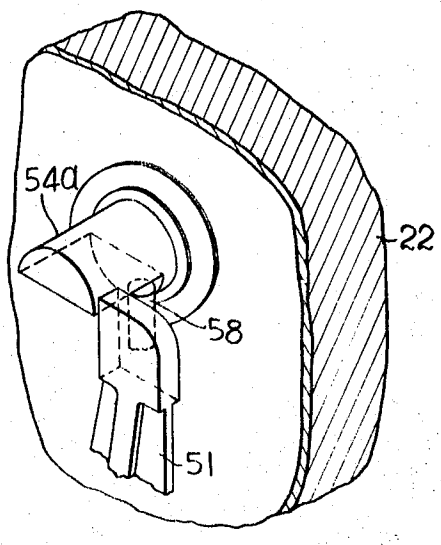


Fig. 7

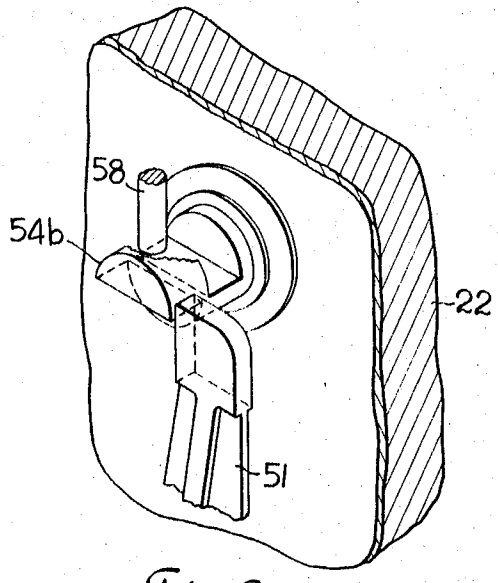


Fig. 8

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BALANCED LATCH MECHANISM

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Int. Cl. H01h 9/20, 9/00
U.S. Cl. 335—168 9 Claims

ABSTRACT OF THE DISCLOSURE

The movable linkage for operating the contacts of an electric circuit breaker is symmetrically arranged on both sides of a vertical center plate of a support frame and is movable from contact closed to contact opened position by springs and from contact opened to contact closed position by a hydraulic ram. The linkage is held in contact closed position by a spring biased elongated prop latch which is pivotably mounted on the center plate in the same plane in which the center plate lies. The prop latch is in turn held latched by a spring biased mass-balanced releasing latch in the shape of a cylinder which is journaled for rotation in the center plate. The cylinder has milled portions so as to leave D shaped sections which engage one end of the prop latch and the plunger of the operating solenoid. The cylindrical releasing latch can be rotated to releasing position by energizing the solenoid.

Summary

This invention relates generally to latch mechanisms and particularly to mass-balanced high speed latch mechanisms which are adapted for use with contact operating mechanisms of electric circuit breakers.

One of the problems existing in the prior art with respect to latches for circuit breaker operating mechanisms was the tendency for an unbalanced latch to release accidentally in response to closing shocks. This tendency could be overcome by using heavier spring forces and larger overlapping relationship between latching components but these solutions contributed substantially to slower tripping of the circuit breaker.

In accordance with the present invention, there is provided an improved mass-balanced high speed latch mechanism which comprises a spring biased elongated rotatable prop latch holding a symmetrical movable linkage in latched position and which further comprises a spring biased mass-balanced cylindrical rotatable releasing latch having milled portions for holding the prop latch in latched position and for engagement with the plunger of suitable tripping means such as a solenoid.

Objects

It is an object of the present invention to provide an improved latch mechanism wherein the components thereof are bass-balanced so as to reduce the effect of shock and vibratory forces and so as to increase the operating speed and responsiveness of the latch mechanism.

Another object is to provide a latch mechanism of the aforesaid character wherein latch stability is maintained with a minimum of spring bias and with a minimum of overlapping between components and wherein standard trip coil currents and magnetic fields can be used.

Another object is to provide a latch mechanism wherein all components are mounted on the outsides of a center plate to facilitate accessibility.

Other objects and advantages of the invention will hereinafter appear.

Drawings

The accompanying drawings illustrate several preferred embodiments of the invention but it is to be understood

that the embodiments illustrated are susceptible of modifications with respect to details thereof without departing from the scope of the appended claims.

In the drawings:

FIG. 1 is a side elevational view of a circuit breaker operating mechanism and latch mechanism according to the present invention shown in the contact open position;

FIG. 2 is an end elevational view of the mechanisms shown in FIG. 1;

FIG. 3 is an enlarged plan view of the latch mechanism taken along lines III—III of FIG. 1;

FIG. 4 is a side elevational view of the prop latch and releasing latch of the latch mechanism shown in FIG. 3 taken generally along lines IV—IV showing the two latches in latched position;

FIG. 5 is a view similar to FIG. 4 but showing the two latches in unlatched or tripping position;

FIG. 6 is a view similar to FIG. 4, but showing the relative position of the solenoid plunger with respect to the releasing latch;

FIG. 7 is an isometric view of one alternative embodiment of a latch mechanism according to the invention; and

FIG. 8 is an isometric view of another alternative embodiment of the invention.

Description of the invention

Referring to FIGS. 1 and 2 of the drawings, the numeral **10** designates a supporting frame upon which is mounted a movable trip free linkage **12** for operating circuit breaker contacts **14** and a latch mechanism **16** in accordance with the present invention.

Frame **10** comprises a back plate **18**, having mounting holes **24**, and a bottom plate **20** to which is joined a single center plate **22**.

Linkage **12** is mounted on supported frame **10** so that its components are symmetrically arranged on either side of center plate **22**. Only those components on one side of center plate **22** are hereinafter described but it is to be understood that the components on the other side are similar. On one side of plate **22** linkage **12** comprises a lever **26** pivoted at **28** and a lever **30** pivoted at **32**. Lever **26** is connected by an operating rod **27** to circuit breaker contact **14**. Levers **26** and **30** are interconnected by a toggle comprising two toggle links **34** and **36**. Toggle links **34** is pivotally connected to lever **26** by a pin **38** and toggle link **36** is connected to lever **30** by a pin carrying a roller **40**. Toggle links **34** and **36** are pivotally joined together by a pin **50** which carries a roller **42** which is acted upon by an operating ram **44** which extends through an opening **43** in bottom plate **20**.

FIG. 1 illustrates the contact open position of linkage **12**. When linkage **12** moves to contact closed position, the upward movement of roller **42** is stopped by a shock absorbing abutment **45**. In the closed position of the circuit breaker roller **42** at the connection between toggle elements **36** and **34** is supported by a prop **46** which is biased by a spring **47**. A spring **48** resets linkage **12** upon a trip or trip free operation. Spring **48** is secured at one end on the frame **10** of the trip free operating mechanism and at the other end to a pin **50** on toggle elements **34**.

As FIGS. 1 through 5 make clear, the circuit breaker is tripped open by the breaker action, generated principally by a heavy spring, not shown, upon actuation of a tripping of latch mechanism **16**. Latch mechanism **16** comprises a first lever **51** or elongated prop latch pivoted at **52**, a mass-balanced releasing latch **54** and a trip solenoid **56** comprising a plunger **58** adapted to act on releasing latch **54**. Plunger **58** can be operated either electromagnetically by energizing solenoid **56** or mechanically by manual means. Prop latch **51** is pivoted for

rotation in substantially the same plane in which center plate 22 of frame 10 lies. Releasing latch 54 is journaled for rotation on an axis which is transverse to center plate 22. Releasing latch 54 is in the form of a cylinder which is mass-balanced about its axis of rotation. As FIG. 6 shows, releasing latch 54 has a first cutaway portion which leaves a D shaped segment 57 having a rounded surface which engages the end of prop latch 51. This allows for a minimum of overlap (on the order of .032" in a practical device) and thus a very short movement for high speed release. A tension spring 60 for resetting releasing latch 54 is connected between that latch and frame 10. Another tension spring 53 for resetting prop latch 51 is connected between that latch and frame 10. FIG. 6 also shows that releasing latch 54 also has a second cutaway portion which leaves a second D shaped segment 61, the flat surface of which is adapted to be engaged by the plunger 58 hereinafter described in detail. The two D shaped segments of releasing latch 54 are disposed approximately at right angles to each other. Upon rotation of mass-balanced releasing latch 54 about point 55 in the counterclockwise direction, prop latch 51 is free to pivot about pin 52 in the counterclockwise direction under the action of a force component transmitted to it by roller 40. The rotation counterclockwise of releasing latch 54 permits counterclockwise movement of prop latch 51 followed by collapse of the toggle formed by toggle elements 34 and 36 and movement of lever 26 to the position shown in FIG. 1 to cause the separation of the circuit breaker contacts 14. One of the principal advantages of releasing latch 54 is its mass-balanced configuration. Specifically, since latch 54 is cylindrical its mass is evenly distributed about its axis of rotation. The portions which have been milled away are relatively small and do not contribute substantially to unblanace of latch 54.

To close the circuit breaker contacts 14 and to return the trip free linkage 12 from the open position shown in FIG. 1, the closing force of a motor (not shown) is applied to linkage 12 by engagement of ram 44 and roller 42. Toggle elements 34 and 36 in moving upward during a closing stroke of ram 44, rotate lever 26 about its pivot point 28 in the clockwise direction. That rotary motion of lever 26 causes operating rod 27 to move downward, thereby closing the breaker contacts 14.

When the toggle elements 34 and 36 reach the prop 46 in their upward movement under the action of ram 44, prop 46 is rotated clockwise and then slides under roller 42 when roller 42 reaches abutment 45. After roller 42 slides on prop 46, prop 46 rotates counterclockwise under the action of its biasing means 47 until it is in a position to support roller 42. Prop latch 51 and latch 54 retain roller 40 in position adjacent a stop 37. The toggle formed by elements 34 and 36 is retained in contact closed position by the combined action of prop latch 51 with latch 54 and prop 46. A closing operation is completed when the contacts are closed and the toggle ements are locked in contact closed position.

The circuit breaker system is shown in FIG. 1 with the contacts 14 in the open circuit position and the tripping mechanism in the reset position.

When the contacts are closed and upon the energization of trip solenoid 56, plunger 58 actuates releasing latch 54 counterclockwise. After a predetermined movement of latch 54, prop latch 51 is released to rotate counterclockwise about point 59 under the action of a force component transmitted to it from roller 40. The counterclockwise rotation of prop latch 51 releases or unlocks the operating linkage and roller 40 moves upward under the breaker action causing the collapse of the toggle formed by elements 34 and 36 and the opening of contacts 14. During the collapse of elements 34 and 36, roller 42 slides off prop 46.

Upon the complete collapse of the toggle formed by elements 34 and 36, roller 40 settles back on its support 37, and prop latch 51 rotates clockwise under its biasing means to its original position where it holds roller 40 adjacent stop 37. Latch 54 rotates back to its reset position by the action of a spring biasing means 60 to hold latch 54 in its reset position. The circuit breaker trip mechanism is then in the reset position.

The mechanism is trip free in that, if latch 51 is free to rotate while ram 44 is attempting to close contacts 14, lever 30 rotates counterclockwise and thereby prevents the transmission of closing efforts from ram 44 to lever 26. Lever 26 remains essentially in the open position shown in FIG. 1.

FIG. 7 shows a releasing latch 54*a* which is provided with only one milled away portion which accommodates plunger 58 and affords clearance for prop latch 51 which are booth located on the same side of the center plate.

FIG. 8 shows a releasing latch 54*b* which is provided with two separate milled away portions which are both located on the same side of the center plate but are spaced 180° apart to achieve perfect balance.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a mechanism,
a stationary frame comprising a plate,
a linkage arranged on said frame,
said linkage being movable from one position to another,
a prop latch pivotally mounted on said frame,
said prop latch having one position into which it is biased and wherein it maintains said linkage in its one position,
said prop latch having another position into which it is movable and wherein it releases said linkage to its other position,
said prop latch being pivotable in a plane adjacent said plate,
a releasing latch rotatably mounted on said frame about an axis which is transverse to said plate,
said releasing latch being substantially cylindrical in form and having a first portion cut away to afford clearance for said prop latch as the latter pivots,
said releasing latch having its mass substantially balanced and evenly distributed about said axis to prevent vibration induced rotational movement,
said releasing latch having one position into which it is biased and wherein it maintains said prop latch in its one position,
said releasing latch having another position into which it is movable and wherein it permits said prop latch to move to its other position,
and latch operating means for moving said releasing latch to its other position wherein it releases said prop latch.

2. A mechanism according to claim 1 wherein said releasing latch has a second portion cutaway to afford a surface for engagement with said latch operating means.

3. A mechanism according to claim 2 wherein said first and second cutaway portions are located on opposite sides of said plate.

4. A mechanism according to claim 3 wherein said cutaway portions are displaced at right angles with respect to each other.

5. A mechanism according to claim 1 wherein said releasing latch is substantially cylindrical in form and has a single cutaway portion which affords clearance for said prop latch and a surface for engagement with said latch operating means.

6. A mechanism according to claim 2 wherein said first and second cutaway portions are located on the same side of said plate.

7. A mechanism according to claim 6 wherein said cutaway portions are disposed 180° apart with respect to each other.

8. In a mechanism,
a stationary frame having a single center plate,
a linkage symmetrically arranged on opposite sides of said center plate,
said linkage being movable from one position to another,
a prop latch pivotally mounted on said center plate and rotatable in the plane in which said center plate lies,
said prop latch having one position wherein it maintains said linkage in its one position and being movable ot another position wherein it releases said linkage to its other position,
biasing means for biasing said prop latch toward its one position,
a releasing latch rotatably mounted on said center plate and having its axis transverse to said plate,
said releasing latch being cylindrical and extending on both sides of said center plate and having cutaway portions on opposite sides of said center plate,
said releasing latch having its mass substantially balanced and evenly distributed about said axis to prevent vibration induced rotational movement,
one of said cutaway portions affording clearance for said prop latch,
and the other of said cutaway portions providing an engageable surface for cooperation with the plunger of a solenoid operating means,
said releasing latch having one position wherein it maintains said prop latch in its one position and being movable to another position wherein it permits said prop latch to move to its other position,
biasing means for biasing said releasing latch toward its one position,
and solenoid operating means having a plunger for moving said releasing latch to its other position.

9. In a circuit breaker operating mechanism,
a stationary frame having a single center plate,
a circuit breaker contact operating linkage symmetrically arranged on opposite sides of said center plate,
said linkage being movable from one position wherein said circuit breaker contacts are closed to another position wherein said circuit breaker contacts are open,
a prop latch pivotally mounted on said center plate

and rotatable in the plane in which said center plate lies,
said prop latch having one position wherein it maintains said linkage in its contact closed position and having another position wherein it releases said linkage to its contact open position,
biasing means connected between said prop latch and said frame for returning said prop latch to its one position,
a cylindrical releasing latch rotatably mounted on said center plate and having its axis transverse to said plate,
said releasing latch extending on both sides of said center plate and having cutaway portions on opposite ends,
said releasing latch having its mass substantially balanced and evenly distributed about said axis to prevent vibration induced rotational movement,
said releasing latch having one position wherein one of its ends engages and holds said prop latch in its one position and having another position wherein the cutaway portion at said one end permits said prop latch to move to its other position,
biasing means connected between said releasing latch and said frame for returning said releasing latch to its one position,
and solenoid operating means engageable with the other end of said releasing latch for moving said releasing latch to its other position.

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