Oct. 26, 1965 J. J. ZIMSKY 3,214,556

CIRCUIT BREAKER OPERATING MECHANISM FOR RAPID CONTACT OPENING AND CLOSING

Filed July 28, 1961 4 Sheets-Sheet 1

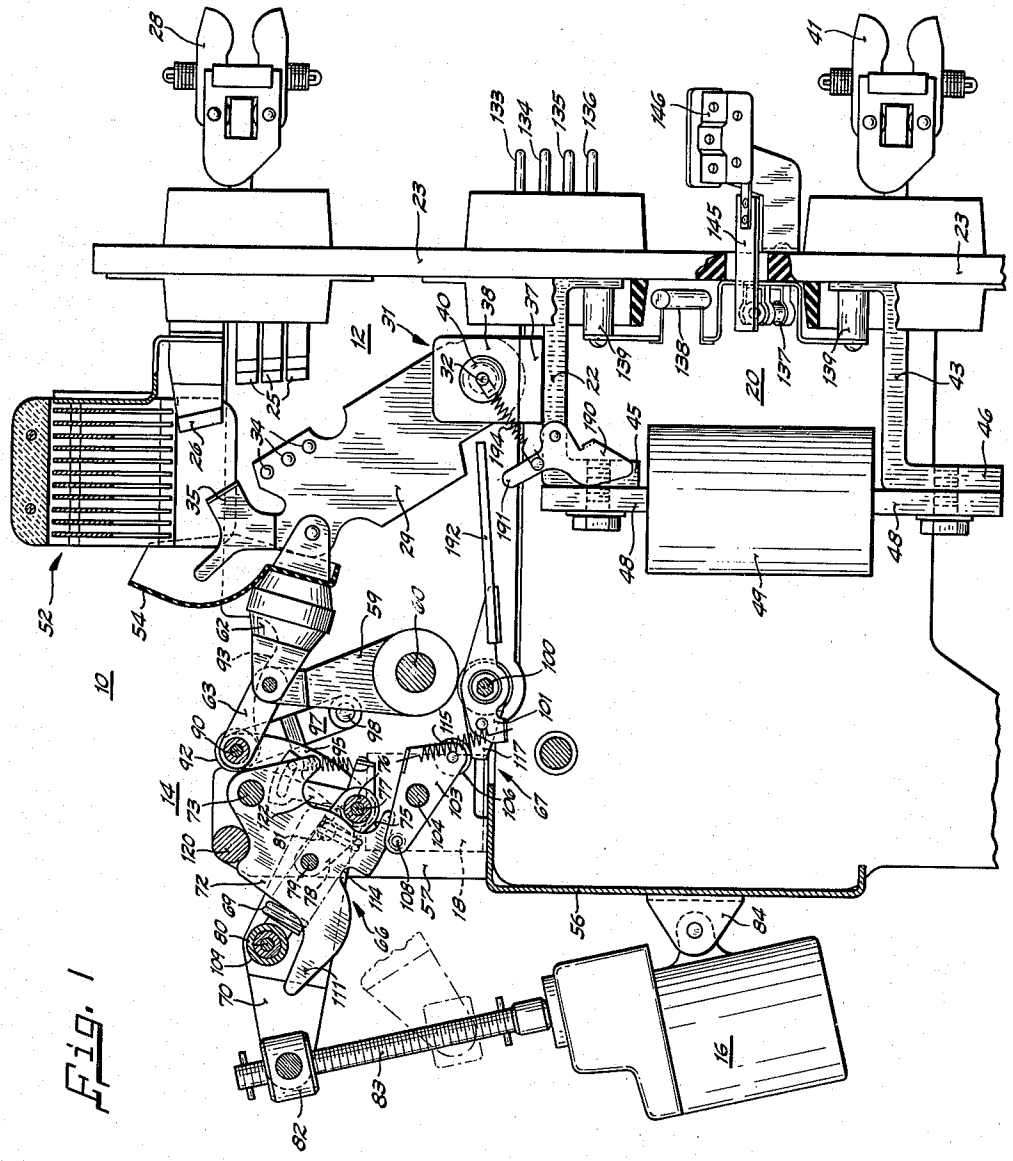


Fig. 1

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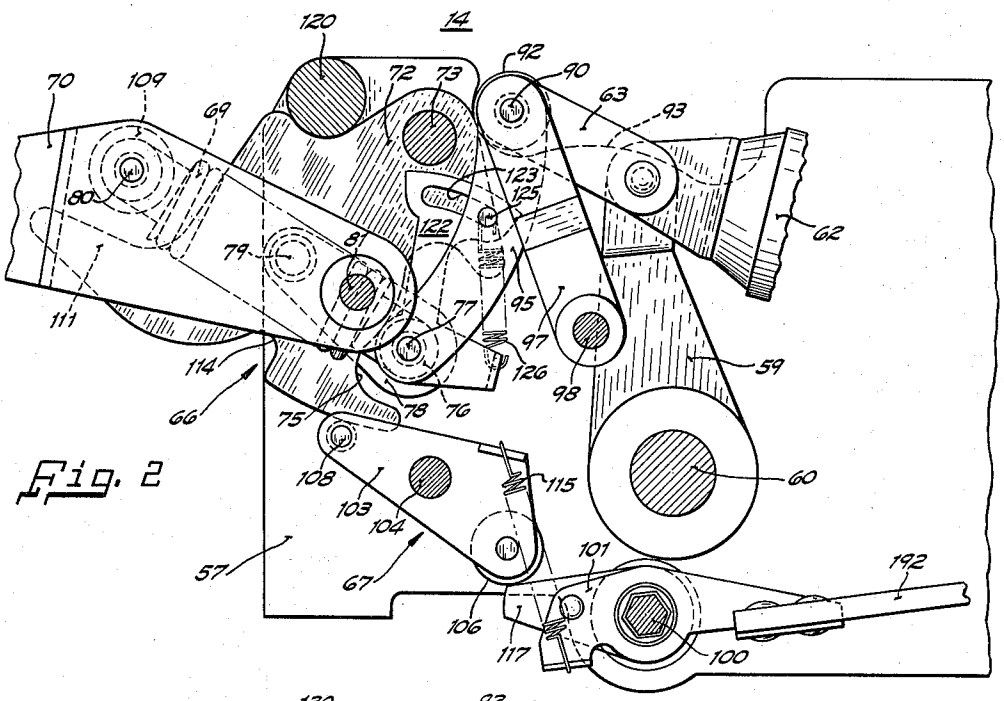


Fig. 2

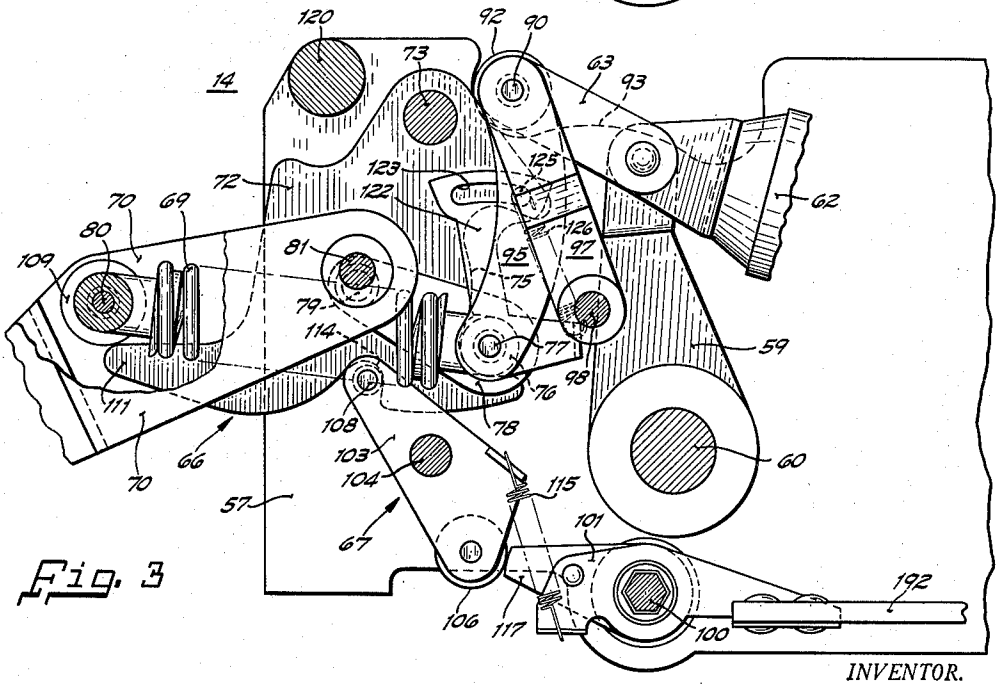


Fig. 3

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CIRCUIT BREAKER OPERATING MECHANISM FOR RAPID CONTACT OPENING AND CLOSING

Filed July 28, 1961 4 Sheets-Sheet 3

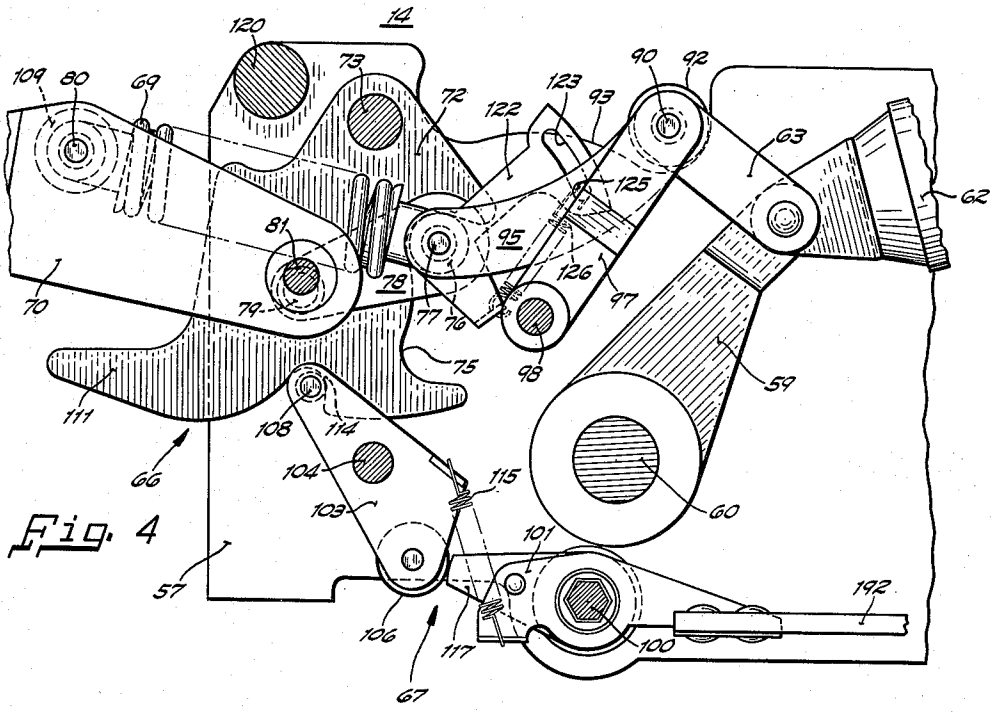


Fig. 4

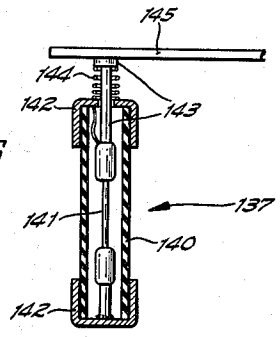


Fig. 6

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CIRCUIT BREAKER OPERATING MECHANISM FOR RAPID CONTACT OPENING AND CLOSING

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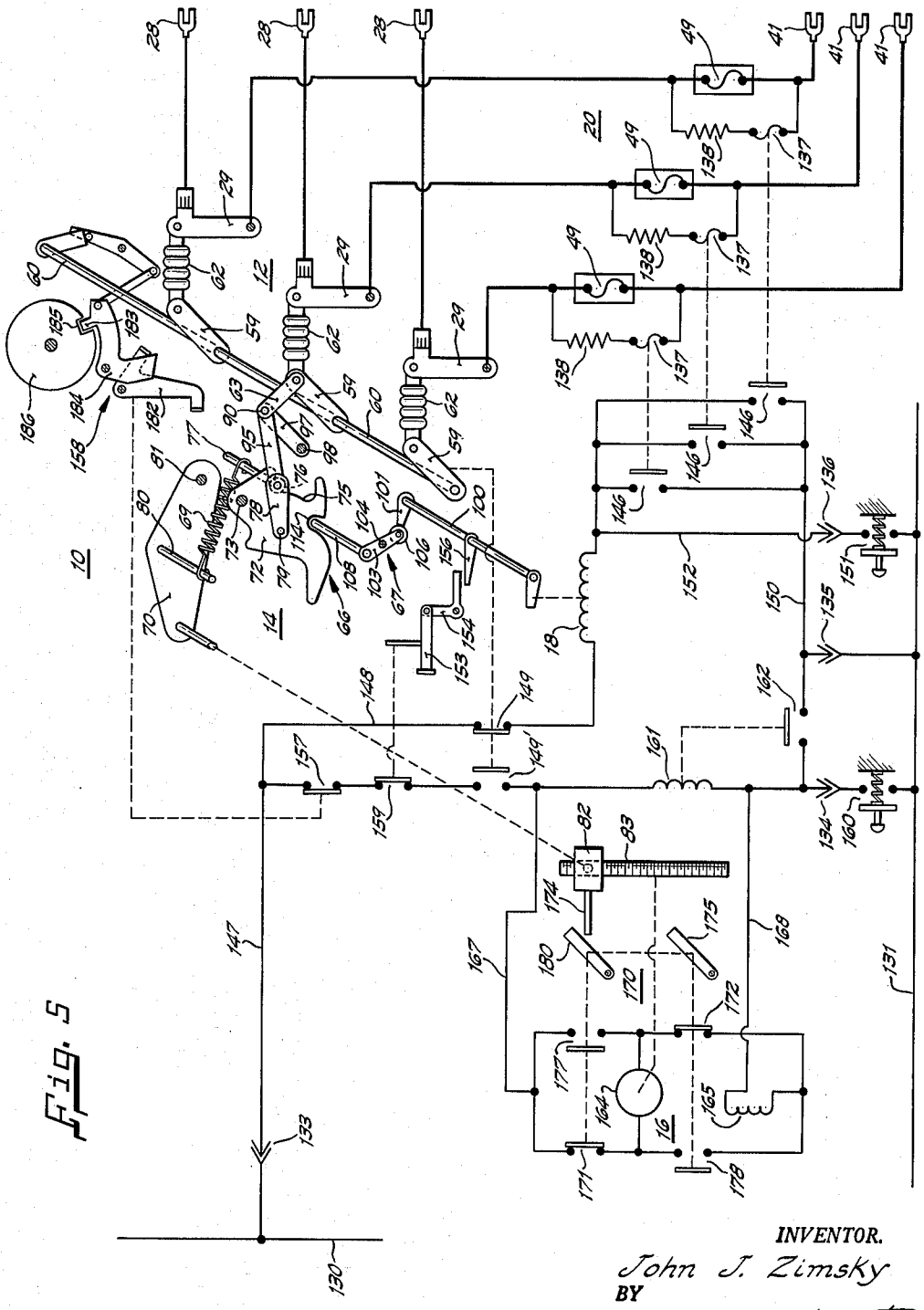


Fig. 5

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United States Patent Office 3,214,556 Patented Oct. 26, 1965

3,214,556

CIRCUIT BREAKER OPERATING MECHANISM FOR RAPID CONTACT OPENING AND CLOSING

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Filed July 28, 1961, Ser. No. 127,606
7 Claims. (Cl. 200—153)

This invention relates to circuit breakers and, more particularly, to a fused circuit breaker for the protection of polyphase circuits such as those supplying polyphase electrical equipment.

In the protection of three phase electrical equipment it is common to provide thermal overload protection in two phases. Equipment protected in this manner is, however, sometimes subject to a phenomenon known as "single phasing" in which serious damage to the equipment may occur. It is an object of the invention to provide a new improved switchgear component for providing three phase thermal overload protection for three phase electrical equipment. Another object is to provide a new and improved operating mechanism for such a switchgear component.

Another advantage of the instant invention is to provide a circuit breaker operating mechanism which provides rapid contact opening and closing.

These and other objects and advantages of the instant invention will become more apparent from the detailed description of the invention taken with the drawings in which:

FIG. 1 is a side elevational view of a preferred embodiment of the instant invention;

FIGS. 2, 3 and 4 illustrate the various positions of the circuit breaker operating mechanism;

FIG. 5 schematically illustrates the electrical and mechanical control elements of the circuit breaker shown in FIG. 1; and

FIG. 6 shows the auxiliary fuse for initiating a switch opening operation.

In general terms, one aspect of the invention comprises a polyphase circuit breaker having a main switch means in each phase, stored energy means urging the switch means toward an open position, and latch means for holding the main switch means closed in opposition to the stored energy means. In addition a primary fuse is connected in series with each of the main switch means and a series connected impedance and secondary fuse shunts each of the primary fuses. Each of the secondary fuses being effective when subjected to excessive currents to trip latch means so that all of the main switch means will be opened simultaneously.

According to another of its aspects, the invention comprises a circuit breaker having main switch means, stored energy spring means, a pivotally mounted operating element having guide means formed thereon, latch means for holding the operating element when the latter has been rotated to a first position, and follower means connected to the main switch means and movable on the guide means between first and second positions. Operating means are connected to the spring means for rotating the operating element to its first position and for extending the spring means. In addition toggle link means is pivotally mounted on the operating element and is connected to the follower means. The operating means is operative after the operating element has been latched to move the spring means overcenter relative to the toggle link so that said link is rotated to move the follower means from one end of the guide means to the other and to close the main switch means as said spring means partially discharges.

Referring now to the drawings in greater detail, FIG. 1 shows a circuit breaker mechanism **10** usable in a drawout switchgear assembly such as that shown in copending application Ser. No. 35,312, filed June 10, 1960, now abandoned, and which is assigned to the assignee of the instant invention. The circuit breaker **10** includes a plurality of main switch assemblies **12**, an operating mechanism **14** for moving the assemblies **12** between their open and closed positions, and a closing motor **16**. Overload protection is provided by fuse assemblies **20** which, upon the occurrence of a fault, actuate a shunt trip solenoid **18**, which in turn trips the operating mechanism **14** for release of the main switch assemblies **12** to their open position.

Each of the main switch assemblies **12** is identical and each includes a contact arm **29** mounted on a separate conductive bracket member **22** rigidly affixed to a front insulating panel **23**. The assemblies **12** also include a stationary main contact jaw **25** consisting of a plurality of resilient contact fingers and a stationary arcing contact **26** comprising a pair of resilient contact fingers. Each of the contact jaws **25** and **26** are rigidly mounted on the front insulating panel **23** and are electrically connected to the incoming disconnect contact **28** which is engageable with a cooperating stationary disconnect contact mounted in the rear of the drawout housing (not shown) in which the device **10** is mounted.

The contact arms **29** are each pivotally mounted on a conductive bracket **31** by means of a hinge pin **32** and each carries a movable current carrying contact **34** and an arcing contact **35** for cooperating with the stationary contact jaws **25** and **26** respectively. The hinge brackets **31** are rigidly affixed to the conductive brackets **22** and include a base portion **37** and a pair of vertical arms **38** for engagement with the opposite sides of the contact arm **29**. To enhance electrical contact between the arms **38** and the contact arm **29**, spring washers **40** may be employed.

Each pole of the circuit breaker also includes an outgoing disconnect contact **41** rigidly secured to the conductive bracket **43** affixed to the rear of said insulating panel **23** at a point vertically below the brackets **22**. Each of the conductive brackets **22** and **43** have a downwardly extending arm **45** and **46**, respectively, to provide conductive mounting surface for the terminals **48** of a main power fuse **49**. It can be seen, therefore, that current through each pole of the circuit breaker **10**, follows a path defined by the incoming disconnect contacts **28**, the contact jaws **25** and **26**, the contact arm **29**, the hinge bracket **31**, the support bracket **22**, the fuse **49**, the conductive bracket **43**, and the outgoing disconnect contact **41**. It can be seen in FIG. 1 that the fingers of the arcing contact jaw **26** are longer than the contact fingers of the current carrying jaw **25** so that during a switch opening operation the main current carrying contacts **25** and **34** will part while the arcing contacts **26** and **35** are still in engagement so that no arc will be struck between the current carrying contacts should the device **10** be opened under load. Also, arcing contacts **26** and **35** are disposed in interrupting structure **52** to help facilitate arc extinction. A shield **54** of molded insulating material is mounted on each of the contact arms **29** behind the arcing contacts **35** to prevent blow back of the arc.

The operating mechanism **10** is mounted on the main circuit breaker frame **56** by a pair of parallel mounting panels **57**, only one of which can be seen in FIG. 1. Three crank arms **59** are affixed to a shaft **60** journaled in the panels **57** and each of said arms is connected to one of the contact arms **29** by an insulator **62**. A pair of

parallel links 63 connect the operating mechanism 14 to the central crank arm 59 so that the operating mechanism can simultaneously rotate each of the contact arms 29 into and out of their closed positions.

The operating mechanism 14 includes a toggle assembly 66 for rapidly moving the contact arms 29 between their open and closed positions, a latch assembly 67 for holding toggle assembly 66 in a rigid condition, a pair of operating springs 69 for providing opening and closing energy and a pair of operating arms 70 for connecting the operating mechanism 14 to the motor 16.

The toggle assembly 66 includes an operating cam 72 pivotally mounted between the panels 57 on a shaft 73 and has a symmetrical cam or guide slot 75 formed on one side for engagement by a cam follower or roller 76 rotatably mounted on a shaft 77.

The toggle assembly 66 also includes a toggle link 78 pivotally connected at one end to the operating cam 72 at 79 and at its other end to the shaft 77. The operating springs 69 are connected at one end to the shaft 77 and at their other ends to the operating arms 70 at 80. The operating arms 70 are, in turn, pivotally connected at one end to the mounting panels 57 at 81 and at their other ends to an operating nut 82 which rides up and down operating screw 83 driven by the motor 16.

The control circuit for the motor 16 will be discussed in greater detail hereinafter, it being sufficient at this point to state that when the motor is energized the operating screw 83 will rotate in the first direction to move the operating nut 82 from its full position in FIG. 1 to its phantom position whereupon motor 16 will reverse and the operating nut 82 will be returned to its full position. Motor 16 is pivotally mounted on a bracket 84 affixed to the frame 56 since the nut 82 must travel in an arcuate path between its upper and lower positions.

The links 63 are pivotally connected at their opposite ends to the central crank arm 59 and to a shaft 90 upon which a pair of guide rollers 92 are also mounted. As the contact arm 29 moves between its open and closed positions the guide rollers 92 move between the opposite sides of a guide slot 93 formed on each of mounting plates 57. The cam roller 76 is connected to the guide roller 92 by a pair of parallel operating links 95. In addition, a pair of pivot links 97 are rotatably mounted on the mounting panels 57 at 98 and to the guide roller shaft 90.

The latch assembly 67 includes a trip shaft 100 rotatably mounted between the panels 57 and a latch prop 101 affixed thereto. In addition, a pair of parallel latch levers 103 are rotatably mounted on a shaft 104 extending between the panels 57 and carry a latch roller 106 and a latch pin 108 between their opposite ends.

When the contact arms 29 are in their open position the operating mechanism 14 is in its position shown in FIGS. 1 and 2. Energization of the motor 16 will rotate the operating arms 70 in a counterclockwise direction until an operating roller 109 on the shaft 78 engages the tail 111 of the operating cam 72 to rotate it counterclockwise about the shaft 73. Rotation of the arms 70 will also extend the springs 69 to provide closing and reopening energy. As the operating cam 72 rotates, the latch pin 108 rides along its lower edge until it reaches a latch recess 114 formed mid-way in said edge. Upon this event a setting spring 115 extending between the latch prop 101 and the latch levers 103 will rotate said levers through a slight clockwise angle to move the latch pin 108 into the recess 114. In addition, this movement causes a slight counterclockwise rotation of the latch prop 101 so that the latch roller 106 can move into engagement with its nose 117. This places the operating mechanism in its charged position shown in FIG. 3 wherein the springs 69 are fully extended.

The motor 16 thereupon reverses to rotate the operating arms 70 from their position shown in FIG. 3 to their position shown in FIG. 4. As the arms 70 rotate, the cam follower 76 will initially remain in its position shown in FIG. 3 and the operating springs 69 will rotate in a counterclockwise direction about this point. However, as the lines of action of the springs 69 pass the pivot point of the toggle link 86, the latter will be snapped counterclockwise to move the follower 76 from the lower to the upper end of the cam slot 75. This also rotates the links 95 and 97 clockwise to move the guide roller 92 from the left end to the right end of the guide slot 95 whereby the contact arms 29 are rotated to their closed position. The energy for this action is provided by a partial discharge of the springs 69.

An interlock crank 122 is provided to prevent pivotal movement of the connecting link 95 except when the cam roller 76 is moving in the cam slot 75. One arm of the interlock crank 122 has a slot 123 which engages a pin 125 extending laterally from the connecting link 95. A spring 126, extending between the pin 125 and the other arm of the crank 122, holds the left end of the slot 23 in engagement with the pin 125 when the mechanism is at rest.

When the main switch means 12 are closed, the mechanism 14 is in the position shown in FIG. 4. It will be appreciated that in this position clockwise rotation of the trip shaft 100 will move the latch prop 101 out of the rotational path of the latch lever 103. This frees the latch levers 103 for counterclockwise rotation which in turn allows the springs 69 to rotate the operating cam 72 clockwise. As a result, the roller 76 is forced by the upper end of the cam slot 75 to move downward and to the right as viewed in FIG. 4. Upon this event the follower 92 is snapped from the right to the left end of the guide slot 95 whereby the main switch means 12 is opened. The operating mechanism 14 is then in the position shown in FIG. 2. Rotational movement of the operating cam 72 during a tripping operation is arrested by a stop bar 120 extending between the mounting panels 57.

FIG. 5 shows the electric control circuit for the circuit breaker of FIG. 1 and like components are identified by the same reference numerals. Here the circuit breaker operating mechanism 14 is shown in its closed position. It will be recalled that when the mechanism 14 is in a rigid condition clockwise rotation of the operating cam 72 by the operating springs 69 is prevented by the latch pin 108 extending between the latch levers 103 which are in turn prevented from counterclockwise rotation by the latch prop 101. As will be explained more fully hereinafter, rotation of the trip shaft 100 to release the operating mechanism 14 for movement to its open position may be accomplished by the operator either electrically or mechanically or automatically upon the occurrence of an overload.

The operating energy for the electric control circuit is provided between the conductors 130 and 131 to which the control circuit is connected by disconnect contacts 133, 134, 135 and 136 which are mounted on the front insulating panel 23 and which are closed when the circuit breaker 10 is in its connected or test positions.

Referring again to FIG. 5, each of the main power fuses 49 is shown to be shunted by a contact making secondary fuse 137 and a current limiting resistor 138. When normal current flows in each pole, the resistors 138 are sufficiently large to substantially prevent any current flow through the secondary fuses 137. As seen in FIG. 1 the secondary fuses 137 and the resistors 138 are mounted adjacent the panel 23 behind the main power fuses 49 and are connected by conductive terminals 139 to the brackets 22 and 43 to place them in parallel with the fuses 49. FIG. 6 shows the secondary fuse 137 to include an insulating housing 140 in which a fusible element 141 is disposed. The element 142 is electrically connected to the end terminals 142 and mechanically to a plunger 143 which is urged by a spring 144 toward engagement with the operating arm 145 of a switch 146 (seen in FIG. 1).

Upon the occurrence of a fault current in one of the poles, its associated current limiting fuse **49** will open throwing a voltage across the fuse **137** which has a relatively short thermal time delay and blows almost instantly. Upon the latter event, the plunger **143** of the fuse **137** will be released to engage the arm **145** of its associated switch **146** whereby the latter is closed to energize the trip coil **18** through a circuit defined by contact **133**, conductors **147**, **148**, normally closed contact **149**, one of the switches **146**, conductor **150** and disconnect contact **135**. It will be appreciated that while the main fuse **49** will be selected with a relatively high current interrupting rating, the resistor **138** will hold the current through the secondary fuse **137** to a value within its relatively smaller rating.

The trip coil **18** may also be energized manually by closing a push button **151** which completes an energizing circuit around the contacts **141**, through disconnect contact **136** and conductor **152**. Complete manual tripping of the mechanism **14** may be accomplished by moving the manual trip button **153** longitudinally toward the right, as viewed in FIG. 5. This rotates the trip crank **154** clockwise whereupon it engages a trip arm **156** secured to the trip shaft **100**.

Contacts **149** are part of a safety switch mechanically coupled to the operating crank **59** and are arranged to be closed when the contact arm **29** is in its closed position and opened when the latter is opened. As a result, the trip coil **18** can be energized only when the circuit breaker operating mechanism **14** is in its closed position. In addition, this prevents continuous energization of trip coil **18** after one of the contacts **146** has been closed to initiate a switch opening operation. The other pole **146'** of the safety switch is connected in the motor **16** energizing circuit so that the motor cannot be energized when the operating mechanism **14** is in its closed position.

When the circuit breaker **10** is in its open position the nut **82** will be at the upper end of the screw **83** and the safety switch contacts **149'** will be closed. In addition, an interlock switch **157** mechanically connected to the racking mechanism **158** and the manual switch **159** mechanically connected to the manual push button **150** are both closed.

In order to initiate a switch closing operation, a close button **160** is pushed to complete the circuit through the motor **16** and a seal-in relay **161**, through disconnect contacts **134**, contacts **149'**, **159**, **157**, conductor **147** and disconnect contacts **133**. As a result, the seal-in relay **161** closes its contacts **162** to complete a by-pass circuit around the push button **160** through the disconnect contacts **135**. The motor **16** is of the reversing type and has a rotor winding **164** and a field winding **165** and is connected in parallel with the seal-in relay **161** through conductors **167** and **168**.

A reversing switch **170** is in the position shown in FIG. 5 when the nut **81** is at the upper end of the screw **82**. As a result, closing of the push button **160** and subsequently the seal-in relay contacts **162**, provides energy to the rotor **164** in a first direction through contacts **171** and **172** whereupon screw **83** will rotate in a first direction and the nut **82** moved downwardly. This will pivot the operating arm **70** counterclockwise to move the operating mechanism **14** from its open position shown in FIG. 2 to its charged position shown in FIG. 3. When the nut **82** reaches the lower end of screw **83**, a lateral projection **174** on the nut **82** will strike one of the arms **175** of the reversing switch **170** to open the contacts **171** and **172** and simultaneously close the contacts **177** and **178**. As a result, energy will be supplied to the rotor **164** in an opposite direction so that the screw **83** will begin moving the nut **82** toward its upper end. This pivots the operating lever **70** clockwise to move the operating mechanism **14** from its charged position in FIG. 3 to its closed position shown in FIG. 4. When the nut **82** again reaches the upper end of the screw **83**, the lateral projection **174** will strike the other arm **180** of the reversing switch **170** to close contacts **171** and **172** and open contacts **177** and **178** and thereby place the motor circuit in position for another operation. The motor **16** does not continue operating, however, because closing of the circuit breaker main contacts **12** opens safety switch contact **149** to de-energize the motor **16** and the seal-in relay **161** in preparation for a subsequent switch closing operation.

The interlock mechanism **158** is shown and described in greater detail in said aforementioned copending application Ser. No. 35,312 and forms no part of the instant invention. It is sufficient for the purposes of this disclosure, therefore, to state that before the interlock mechanism **156** can be operated the interlock crank **182** must first be rotated clockwise to rotate a locking member **183** mounted on the locking crank **184** out of engagement with a recess **185** formed in a racking plate **186**. Movement of the circuit breaker **10** into or out of its cubicle is accomplished by rotating the racking plate **186** so that engagement of the locking member **183** in the recess **185** prevents such movement of the circuit breaker **10**. The interlock switch **157**, in the motor **16** energizing circuit, is connected to the interlock crank **182** so that it is opened each time said crank is rotated. As a result, the motor **16** cannot be energized when the circuit breaker is being moved between its test, connected or disconnected positions.

In order to prevent the closing of the main switch assemblies **12** when one of the primary fuses **49** is not in position, a fuse interlock member **190**, seen in FIG. 1, is provided in each phase. One of the members **190** is pivotably mounted on each of the brackets **22** with an ear **191** in engagement with a trip arm **192** of insulating material which is secured to the trip shaft **100**. A spring **194** urges clockwise rotation of the member **190** to pivot the lock prop **101** in a latch releasing direction. When the primary fuse **49** is in position, however, such rotation is prevented by the upper fuse terminal **48**. On the other hand, if one of the fuses **49** is missing, the element **190** will be free to rotate and thereby prevent latching of the operating mechanism **14**.

It will be appreciated, too, that because the spring **144** of the auxiliary fuse **137**, seen in FIG. 6, biases the contact arm **145** toward its closed position whenever the element **141** has parted, its associated contacts **146** will be closed whenever one of the fuses **137** has blown. Consequently, the trip coil **18**, seen in FIG. 5, it will be energized simultaneously with the closing of the main switch assembly **12** so that the circuit breaker **10** will immediately trip open. Thus the circuit breaker **10** is prevented from being latched in its closed position without replacement of a blown auxiliary fuse.

While only a single embodiment of the instant invention is shown and described, it is intended that the invention be limited only by the scope of the appended claims.

I claim:

1. A circuit breaker having main switch means, stored energy spring means, a pivotally mounted operating element having guide means formed thereon, latch means for holding said operating element when the latter has been pivoted to a first position, follower means movable on said guide means between first and second positions, said spring means being connected at one end to said follower means, operating means connected to the other end of said spring means for pivoting said operating element to its first position and for extending said spring means, toggle link means pivotallly mounted on said operating element and connected to said follower means, said follower means also being connected to said switch means, said operating means being operative after said operating element has been latched to move said spring means overcenter relative to said toggle link means so that said toggle link means is rotated to move said fol-

lower means from one end of said guide means to the other and to close said main switch means as said spring means partially discharges, release of said latch means allowing said operating element to return to its first position to collapse said toggle link means and to open said main switch means as said spring means fully discharges.

2. A circuit breaker for protecting an electrical system and having main switch means, stored energy spring means, a pivotally mounted operating element having a first guide means formed thereon, latch means for holding said element when the latter has been pivoted to a first position, follower means movable on said first guide means between first and second positions, said spring means being connected at one end to said follower means, operating means connected to the other end of said spring means for pivoting said operating element to its first position and for extending said spring means, toggle link means pivotally mounted on said operating element and connected to said follower means, second guide means extending in a generally lateral direction and being stationary relative to said first guide means, link means having one end connected to said follower means and the other movable on said second guide means, the other end of said link means also being connected to said main switch means, said operating means being operative after said operating element has been latched to move said spring means overcenter relative to said toggle link means so that said toggle link means is pivoted to move said follower means from one end of said first guide means to the other and the other end of said link means to the other end of said second guide means to close said main switch means as said spring means partially discharges.

3. A circuit breaker having main switch means, stored energy spring means, a pivotally mounted operating element having a guide slot formed thereon, latch means for holding said element when the latter has been pivoted to a first position, follower means movable on said guide slot between first and second positions, operating means movable from an initial to a final position to pivot said operating element to its first position, said spring means being connected to said operating means and to said follower means, the rotation of said operating element extending said spring means, link means pivotally mounted on said operating element and connected to said follower means, said follower means also being connected to said switch means, return of said operating means to its initial position after said operating element has been latched being effective to move said spring means overcenter relative to said link means so that said link means is rotated to move said follower from one end of said guide slot to the other and to close said main switch means as said spring means partially discharges, release of said latch means allowing said operating element to return to its first position to collapse said link means and open said main switch means as said spring means discharges to its normal preload.

4. A circuit breaker having main switch means, stored energy spring means, a pivotally mounted operating cam having a cam slot, a latch element for holding said operating cam when the latter has been pivoted to a first position, a cam follower movable on said slot between first and second positions, an operating arm pivotally mounted for movement from an initial to a final position to pivot said operating cam to its first position, said spring means being connected to said operating arm and to said cam follower, the rotation of said operating cam and said operating arm extending said spring means, toggle link means pivotally mounted on said operating cam and being connected to said cam follower, said cam follower also being connected to said switch means, return of said operating arm to its initial position after said operating cam has been latched being effective to move said spring means overcenter relative to said toggle link means so that said toggle link means is rotated to move said cam follower from one end of said slot to the other and to close said main switch means as said spring means partially discharges, release of said latch element allowing said operating cam to return to its first position to collapse said toggle link means and to open said main switch means as said spring means discharges to its normal preload.

5. A circuit breaker for protecting an electrical system and having main switch means, stored energy spring means, a pivotally mounted operating cam having a cam slot formed thereon, a latch element for holding said operating cam when the latter has been pivoted to a first position, a cam follower movable on said slot between first and second positions, an operating arm pivotally mounted for movement from an initial to a final position to pivot said operating cam to its first position, said spring means being connected to said operating arm and to said cam follower, the pivoting of said operating cam and said operating arm extending said spring means, toggle link means pivotally mounted on said operating cam and connected to said cam follower, stationary guide means extending in a generally lateral direction relative to said cam slot, link means having one end connected to said cam follower and the other movable on said guide means, the other end of said link means also being connected to said main switch means, the return of said operating arm to its initial position after said operating cam has been latched being effective to move said spring means overcenter relative to said toggle link means so that said toggle link means is pivoted to move said cam follower from one end of said cam slot to the other and the other end of said link means to the other end of said guide means to close said main switch means as said spring means partially discharges, electroresponsive means operable upon the occurrence of an overload in said system to release said latch element allowing said operating cam to return to its first position to collapse said toggle link means and to open said main switch means as said spring means discharges to its normal preload.

6. A circuit breaker having main switch means, stored energy spring means, a pivotally mounted operating element having guide means formed thereon, latch means for holding said operating element when the latter has been pivoted to a first position, follower means movable on said guide means between first and second positions, said spring means being coupled to said follower means, pivotally mounted operating means connected to said spring means and operable upon pivotal movement in a first direction to engage said operating element for pivoting the latter to its first position and for extending said spring means, pivotally mounted link means connected to said follower means, said follower means also being connected to said switch means, said operating means being operative on movement in a second direction after said operating element has been latched to move said spring means over center relative to said link means and said operating means so that said link means is pivoted to move said follower means from one end of said guide means to the other and to close said main switch means as its spring means partially discharges, release of said latch means allowing said operating element to move to its first position to collapse said link means and to open said switch means as said spring means discharges to its normal preload.

7. A circuit breaker having main switch means, stored energy spring means, a pivotally mounted operating element having guide means formed thereon, a catch on said operating element, pivotally mounted latch lever means engageable at one end with said catch for holding said operating element when the latter is pivoted to a first position, pivotally mounted latch prop means normally preventing rotation of said latch lever means out of holding engagement with said catch, follower means movable on said guide means between first and second positions, said spring means being coupled to said follower means, pivotally mounted operating means connected to said spring means and operable upon a pivotal

movement in a first direction to engage said operating element for rotating the latter to its first position and for extending said spring means, pivotally mounted link means connected to said follower means, said follower means also being connected to said switch means, said operating means being operative upon pivotal movement in a second direction after said operating element has been latched to move said spring means over center relative to said link means and said operating means so that said link means is rotated to move said follower means from one end of said guide means to the other and to close said main switch means as said spring means partially discharges, release of said latch lever means allowing said operating element to return to its first position to collapse said link means and to open said main switch means as its spring means discharges to its normal preload.

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