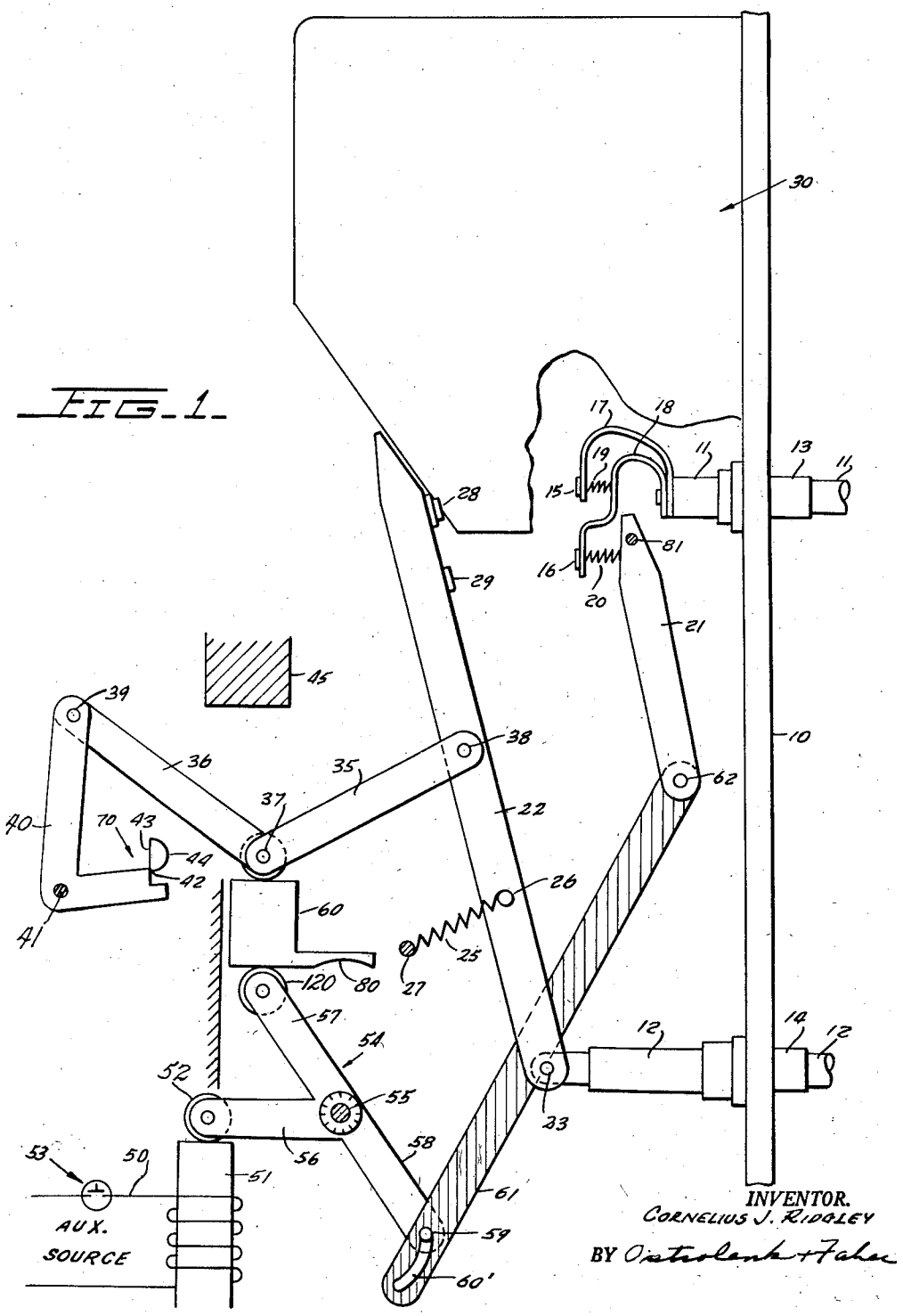
Jan. 28, 1958 C. J. RIDGLEY 2,821,600

CIRCUIT BREAKER OPERATING MECHANISM

Filed Aug. 14, 1953 3 Sheets-Sheet 1

FIG. 1



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CIRCUIT BREAKER OPERATING MECHANISM

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FIG. 2

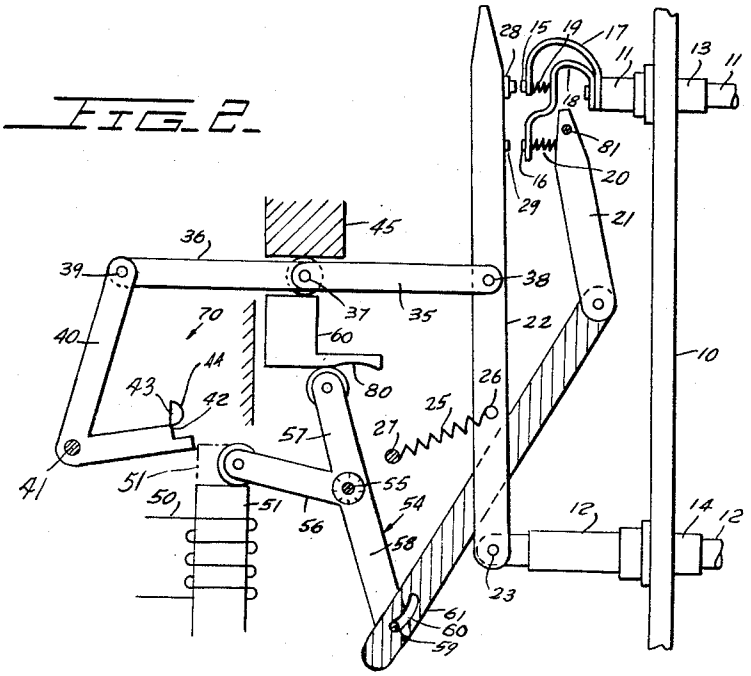
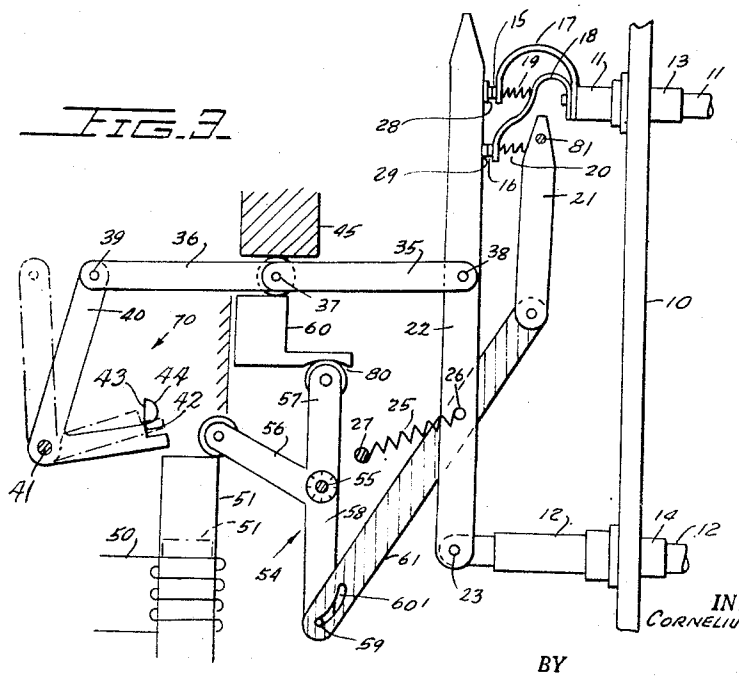


FIG. 3



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CIRCUIT BREAKER OPERATING MECHANISM

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FIG. 4

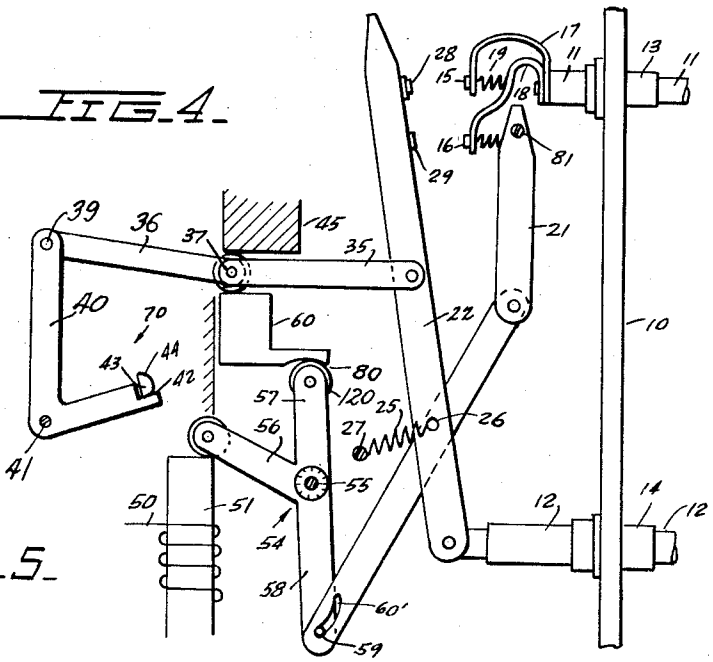


FIG. 5

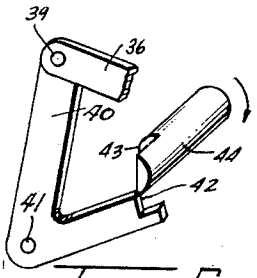


FIG. 6

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United States Patent Office

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CIRCUIT BREAKER OPERATING MECHANISM

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Application August 14, 1953, Serial No. 374,384

10 Claims. (Cl. 200—106)

This invention relates to circuit breaker operating mechanism and is particularly directed to novel closing means wherein the operating mechanism and trip latch are placed in a circuit breaker closed position prior to the engagement of the cooperating contacts.

Heretofore, considerable difficulty has been encountered in closing circuit breakers when there is a fault on the line.

When the closing solenoid is energized and the operating mechanism is moved towards circuit closed position, the blow-open effect at the cooperating contacts at the instant of current flow creates a force on the closing mechanism in a direction opposite to the force of the closing solenoid.

If the blow-open force forcing the contacts apart comes into play prior to the setting of the closing latch and when the strip free features of the circuit breaker are retarded, the closing solenoid will again exert a force on the closing mechanism in the closing direction and tend to re-establish contact engagement. This sequence of operation is usually referred to as pumping and is highly undesirable and may result in the ultimate destruction of the coacting contacts.

This undesirable pumping operation on the closing of a circuit breaker against a line fault is particularly prevalent in the circuit breakers used in sequential trip systems. That is, where a predetermined time delay is introduced for the tripping operation of the trip latch, the electromagnetic closing operation on a fault may result in pumping of the time delayed circuit breaker.

In the event an attempt is made to manually close a time delay circuit breaker on a fault, the blow-open forces will be transmitted back to the manual operating handle and thus create an extreme force which will be transmitted to the operator.

The above noted disadvantages of the prior art circuit breakers result when an attempt is made to close the mechanism on a faulty line and when the tripping device is delayed at these fault currents. The delay inserted in the tripping device prohibits trip-free opening of the latch mechanism until after a period of time during which the circuit breaker contacts may alternately make and break.

The circuit breaker of the invention incorporates two novel features which will completely eliminate all of the disadvantages heretofore encountered in the prior art on circuit breaker equipped with time-delay in the fault current range.

In the circuit breaker of the invention, a set of semi-stationary contacts are operated from one arm of the closing means. A second arm of the closing means is effective to position the operating mechanism and the movable contact arm in closed position.

After the trip latch is latched, the initial movement of the closing solenoid will be effective to position the toggle mechanism attached to the contact arm in a set or dead-center position. This pre-positioning of the operating mechanism in its closed circuit breaker mechanism

position will occur prior to the engagement of the cooperating contacts.

Continued movement of the operating solenoid will initiate movement of the semi-stationary contacts toward the movable contacts of the circuit breaker contact arm. Thus, it is possible to completely position the operating mechanism in its closed position prior to the engagement of the cooperating contacts. Furthermore, the semi-stationary contacts are mounted in a circuit so that the electromagnetic forces of fault current will create a blow-on and blow-closed force which will contribute to the contact pressure.

In the event an attempt is made to close the circuit breaker on a faulty line, it will still be possible to pre-position the operating mechanism in a closed position before there is any current flow through the circuit breaker due to the novel control over the semi-stationary contacts. By this method, it is possible to utilize the magnetic forces created by the fault current to effect contact engagement. However, since the operating mechanism is pre-positioned prior to the creation of the blow-open or blow-off forces, these blow-open or blow-closed forces cannot exert a resistance of opposition force to the closing forces exerted by the closing means except when the toggle will be in a position to handle these forces.

Thus, in the prior art arrangement, the circuit breaker closing means was defeated due to the inability of the closing solenoid to completely position the operating mechanism parts and mechanism latches due to the blow-open and blow-off forces thereby failing to latch the breaker closed and causing pumping operation of the circuit breaker instead.

The novel mechanism is pre-set before opening forces are created thereby allowing the circuit breaker contacts to be more easily placed in firm engagement in the event it has closed on the fault circuit.

The principles and construction of the circuit breaker of the invention can be used with either an instantaneous trip unit or a time delay trip unit.

Another feature of the invention which is inherent in the design is the ability to provide a trip free mechanism for a circuit breaker which is effective to close on a fault line without the necessity of having a closing latch.

Heretofore circuit interrupting means have been constructed with both strip latch and a closing latch.

As above noted, the undesirable pumping operation of the prior art devices is primarily due to the fact that the closing latch is not able to be engaged prior to the creation of blow-open forces. However, this disadvantage is completely overcome in the novel mechanism by (*a*) eliminating the necessity of a closing latch, and (*b*) pre-setting the operating mechanism prior to the creation of blow-off forces as above noted.

Accordingly, a primary object of the invention is to provide a novel operating mechanism for a circuit breaker which can be electrically or manually preset in its closed position prior to the engagement of the cooperating contacts and the creation of electromagnetic opening forces.

Another object of the invention is to provide a novel circuit breaker which can be closed on a fault circuit without the undesirable effects of pumping.

A still further object of the invention is to provide a novel circuit breaker mechanism in which the closing means thereof are effective regardless of the magnitude of current in the line upon which the circuit breaker is closed.

A still further object of the invention is to provide an operating mechanism for a circuit breaker in which the initial movement of the closing solenoid will pre-position the parts in a closed position and continued movement of the closing solenoid will force the semi-stationary con-

tacts into engagement with the movable contacts and in which the line current will contribute to the contact pressure.

A still further object of the invention is to eliminate the necessity of a closing latch in the circuit breaker operating mechanism.

Another object of the invention is to provide a novel operating mechanism for a circuit breaker which will retain its trip free features when incorporated with either an instantaneous trip unit or a time delay trip unit.

These and other objects of the invention will be apparent from the following description when taken in connection with the drawings in which:

Figure 1 is a view illustrating the position of the operating mechanism of the invention when the circuit breaker is in the fully open position.

Figure 2 illustrates the position of the operating mechanism of the invention due to initial movement of the closing solenoid or manual means. This figure illustrates the pre-positioning of the contact arm toggle in its closed position prior to the engagement of the cooperating contacts.

Figure 3 illustrates the operating mechanism of the invention when the circuit breaker is in the closed position. This figure shows the manner by which the closing solenoid or manual means urges the semi-stationary contacts into engagement with the moving contacts after the main operating mechanism has been preset in its closed position.

Figure 4 illustrates the position of the novel operating mechanism in the trip free position following an attempt to electrically close the circuit breaker on a fault line.

Figure 5 is a perspective view showing the half circular trip latch used in the invention.

Figure 6 is a modification of the invention illustrating an arrangement of parts wherein an insulating link which transmits motion to the semi-stationary contacts may be a compression member rather than a tension member as illustrated in the embodiment of Figures 1 through 5.

Referring now to Figures 1 through 5, the circuit breaker is mounted on a steel-backed plate or panel base mounting **10**. The upper connecting stud **11** and the lower connecting stud **12** extend through the steel-backed plate **10** and are insulated therefrom by means of insulating sleeves **13** and **14**. The semi-stationary arcing and main contacts **15** and **16** are resiliently mounted on the conductor **11**, respectively, by means of spring conductors **17** and **18**.

A compression spring **19** is secured at one end to the spring conducting means **17** and at its opposite end to a spring conducting means **18**. The compression spring **20** is connected at one end to the spring conducting means **18** and at its opposite end to the link **21**.

The moving contact arm **22** mounted on the permanent pivot **23** of the lower conducting stud **12** is biased in a counterclockwise or open direction by the opening spring **25** which is secured at its right end **26** to the contact arm **22** and its left end to a stationary portion **27** of the circuit breaker.

The upper end of the movable contact arm **22** carries the movable arcing contact **28** and the movable main contact **29** which, respectively, are engaged by the stationary contacts **15** and **16** when the circuit breaker is in the closed position, as seen in Figure 3.

The circuit breaker is provided with an arc chute **30**, attached to the back plate **10**, above the cooperating contacts **15—28** and **16—29**. The arc chute forms no part of the present invention and may be of any of the desirable constructions which are known in the art.

Toggle links **35** and **36** pivotally connected to each other at **37** are pivotally connected at **38** to the movable contact arm **22** and pivotally connected at **39** to the latch bell crank **40**. The latch bell crank **40** is rotatably mounted on the permanent pivot **41** and has a latch tip portion **42**.

The shaft **44** has a milled portion **43** the edge of which engages the latch tip **42** in the position illustrated in Figures 1, 2 and 3. The shaft **44** is biased in a clockwise direction to the position indicated at Figures 1, 2 and 3 and is operated by an over current coil of the circuit breaker. This type of latch **42** and **43** wherein a shaft has a milled portion which engages the latch tip of a second member forms no part of the present invention and is illustrated and described in the Patent 2,348,228 to W. M. Scott, Jr.

It will be noted that the over current coil which controls the position of the shaft **44** may be an instantaneous trip unit, as shown in the above mentioned patent, or may be a time delayed trip unit shown in copending applications Serial No. 152,674, filed March 29, 1950, and Serial No. 148,696, filed March 9, 1950.

The stationary block member **45** is provided to limit the upward movement of the toggle **35** and **36** to insure that it will be set in center position due to the initial operation of the closing solenoid. The closing solenoid **50** has a plunger **51** which will be moved upward when the coil **50** is energized from an auxiliary source by means of the closing of the manual closing button **53**.

Bell crank member **54** is rotatably mounted on the permanent pivot **55** and is provided with three arms **56**, **57** and **58**. The pivot **55** may be a bellville type washer so that the bell crank **54** will maintain the position to which it is moved due to the frictional engagement thereof.

The end of the arm **56** has a roller **52** rotatably mounted thereon which will be engaged by the plunger **51** of the closing solenoid **50** when the circuit breaker is electrically closed. The arm **54** has a roller **120** rotatably mounted on one end thereof for engagement with the guided member **60**. The guided member **60** is restricted to vertical movement and will be urged upwardly, when the plunger **51** of the closing solenoid **50** is energized, due to its engagement by the roller **120** of the arm **57**.

The arm **58** has a pin **59** extending from one end thereof which passes through the slotted opening **60** in one end of the insulating rod **61**. The opposite end of the insulating rod **61** is rotatably mounted to the link **21** at movable pivot **62**. The automatic tripping or opening operation of the circuit breaker is as follows: During normal load current flow, the position of the operating parts is as illustrated in Figure 3 with the contact arm toggle **35** in center position. The cooperating contacts **15—28** and **16—29** will remain in engagement due to the fact that the toggle is in center position and prevented from movement due to the latch **70** which is created by the engagement of the latch tip **42** with the semi-circular section of the shaft **44** at the milled section **43**. When the toggle **35**, **36** is in its center position, there are no downward force components exerted by the toggle on guided member **60**. Thus, even though the spring **25** is exerting an opening force on the movable contact arm **22**, the contacts will remain in engagement due to the latch **70**. It will be noted that the plunger **51** of the closing solenoid **50** will be in the dotted position, as seen in Figure 3, during the normal operation of the circuit breaker.

On the occurrence of a fault current, the trip coil (not shown) will be energized thereby rotating the milled shaft **44** in counterclockwise direction, as shown in the dotted view of Figure 3, and as fully described and set forth in connection with latch 450, 500, 501, 502 in the Patent 2,348,228 to W. M. Scott, Jr.

The force exerted on the contact arm **22** by the opening spring **25** will now be transmitted through the toggle **35**, **36** which will initially move to the left due to the disengagement of the latch **70** as noted. This force is transmitted by way of pin **34** to bell crank **40** causing it to rotate counterclockwise about pin **41**. As bell crank **40** rotates counterclockwise to the position of Figure 4, the pin **34** is raised above the knee **37** of the toggle **35**, **36** and the toggle **35**, **36** is urged to break downward and assume the position of Figure 1. When the plunger

51 is in its lowered position of Figure 1, the downward component exerted by the toggle 35, 36 will act on the guided member 60 which in turn will transmit a force through the roller 120, to the bell crank 54, overcoming the friction of the bellville washer 55 and thereby causing this unit to rotate in a counterclockwise direction around the permanent pivot 55. Thus, the cooperating contacts 15—28 and 16—29 will be open and the operating mechanism will assume the position illustrated in Figure 1 wherein the circuit breaker is in the fully open position.

It will be noted that although the toggle 35, 36 has an initial movement to the left, as above described, its breaking downward into a V, as seen in Figure 1, will again move the link 36 to the right thereby forcing bell crank 40 to its initial position.

Since the milled shaft 44 is biased in a clockwise direction, the latch will disengage and the components will be in a position as seen in Figure 1.

The electrical closing operation of the circuit breaker will now be described. As noted, Figure 1 represents the position of the operating mechanism when the circuit breaker is in a fully open position and ready for reclosing. When the closing solenoid 50 is energized from an auxiliary source by the closing of the switch 53, the plunger 51 will be moved forward. Initial movement of the plunger 51 will cause engagement with the roller 52 of the bell crank 54 thereby rotating this unit in a clockwise direction around the permanent pivot 55.

During the initial clockwise rotation of the bell crank 55, the pin 59 in the arm 58 thereof will slide in the slot 60' of the insulating link member 61. Hence this initial movement due to the sliding movement of the pin 59 and the slot 60 will not cause movement of the insulating link 61 or the stationary arcing or main contacts 15 and 16. However, the roller 58 of the arm 57 will engage the guided member 60 and thereby urge it in an upward direction, as best seen in Figure 2.

Due to engagement of the latch 70, the toggle 35, 36 will not be permitted to move to the left and hence, as the guided member 60 engages the central portion 37, the toggle 35, 37 will be forced to a set or central position thereby urging the movable contact arm 22 to the right in a clockwise direction against the bias of the opening spring 25.

Following the initial movement of the plunger 51, the toggle 36, 37 will be in its set or center position as indicated in Figure 2. It will be noted that all of the operating components 22, 35, 36, 40, 44 and 60 will be in a position they assume when the circuit breaker is in the full closed position. However, as clearly seen in Figure 2, although all of the operating components are in their closed position, the arcing contacts 15—28 and the main contacts 16—29 are still disengaged. That is, all of the operating parts do not precede another closed position prior to the creation of any opening force.

Continued upward movement of the plunger 51 will continue to rotate the bell crank 54 around its permanent pivot 55. However, this continued movement of the bell crank 54 will not reposition the toggle 35, which is stopped from continued upward movement due to the fact that the roller 120 of the bell crank 54 now rides in the extended bottom surface 80 of the guide member 60.

The bottom surface 80 may be swung from an arc having a center slightly to the left of the permanent pivot 55 so that continued clockwise rotation of the bell crank 54 will not urge the guided member 60 in the upward direction past its position of Figure 2.

This continued upward movement of the plunger 51 from the solid to the dotted position of Figure 2 or from the solid position of Figure 2 to the solid position of Figure 3 will urge the insulating links 61 toward the left. That is, since the initial clockwise rotation of the bell crank 54 permitted the protruding pin 59 of its arm 58 to slide in the slot 60 of the insulating link 61, the pin 59 will engage the lower end of the slot 60 following the initial movement when the toggle and operating mechanism is in the closed position. Thus, continued clockwise movement of the bell crank 54 will urge the insulating link 61 to the left and due to its pivot engagement 62 with the link 21 will urge the arcing and stationary contacts 15, 16 toward the movable contacts 28, 29, respectively, by force transmitted through the springs 19 and 20. That is, since the member 21 is rotated on the permanent pivot 80, leftward movement of the insulated link 61 by the bell crank 54 will cause clockwise rotation of the link 21 thereby urging the stationary contacts 28 and 29, respectively, to assume the position seen in Figure 3.

The bell crank 54 is provided with a bellville washer at the stationary pivot 55 which holds it in any position to which it is moved. Thus, following the automatic closing operation when the plunger 51 moves the components to the position of Figure 2, the washer 55 will maintain the bell crank 54 in the position indicated. After manual or automatic trip, the bell crank 54 will be moved to the position of Figure 1 and will be held in this position by the washer at 55.

It will be noted that the spring conducting members 17 and 18 form a loop connection from the stud 11 to the arcing and main contacts 15 and 16. Hence, current flow therethrough will create an electromagnetic force urging the stationary contacts toward the moving contacts 28 and 29 thereby creating a blow-closed and blow-on effect and also insuring continued high contact pressure. Thus, by means of the heretofore described sequence of operation, the circuit breaker will be moved from the completely open position of Figure 1 to the completely closed position of Figure 3.

If the circuit breaker is closed on a line on which normal load current is flowing, the circuit breaker will remain in the position indicated in Figure 3. Since the operator will effect deenergization of the closing solenoid 50, its plunger 51 will then resume the position indicated by the dotted line of Figure 3.

In the event a fault subsequently occurs on the line, the circuit breaker will open in a manner heretofore described. However, in the event the above closing operation occurs when a fault condition exists on the line, the closing solenoid 51 may be in the solid position indicated in Figure 3. That is, if the operator continues to energize the closing solenoid 50 by means of the closing button 53, its plunger 51 will remain in the up position.

However, if a fault current is on the line, the trip coil (not shown) will cause counterclockwise rotation of the milled shaft 44 and permit bell crank 40 to move to the dotted position of Figure 3 thereby permitting trip free operation of the circuit breaker. The position of the components to effect trip free operation is clearly seen by comparison of Figures 3 and 4. Thus, even though the plunger 51 is maintained in its extreme upward position by continued energization of the closing solenoid 50, the disengagement of the latch 70 will permit the opening spring 25 to exert sufficient force on the contact arm 22 through the toggle mechanism 35, 36 and force counterclockwise rotation of the bell crank 40 about the stationary pivot 41 due to the disengagement of the latch 70. Hence, Figure 4 illustrates the trip free operation and position of the novel circuit breaker.

It will be noted that the trip free position indicated in Figure 3 is achieved by a circuit breaker in which the closing coil for the operation of the milled shaft 44 of the latch 70 is about an instantaneous trip unit or a time delayed trip unit, as set forth in copending applications Serial No. 148,696, filed March 9, 1950, and Serial No. 152,674, filed March 29, 1950.

Although there is described the closing operation in connection with electromagnetic closing means such as

closing solenoid **50** and plunger **51**, it will be apparent to those skilled in the art that manual closing of the circuit breaker against fault will permit trip free operation due to the fact that the operating mechanism is permitted to assume its closed position prior to the creation of opening forces.

Figure 6 illustrates a modified form of the instant invention utilizing the principles and desirable features set forth in Figures 1 through 5 wherein the insulating link **61** may be a compression member rather than a tension member as is true in the arrangement shown in Figures 1 through 5.

In Figure 6, the various components which are similar to those of Figures 1 through 5 are identified by similar numerals.

In the modification of Figure 6, the bell crank **54** has protruding pin **59** extending from the arm **57** and engages in the slot **101** of the insulating link **100**. The insulating link **100** is a comparable unit to the insulating links **61** of Figures 1 through 5.

The opposite end of the insulating link **100** is rotatably mounted on the movable pivot **102** to the member **103**. The member **103** is rotatably mounted on the permanent pivot **104** and rotatably mounted on the movable pivot **106** to the link **107**. The link **107** is rotatably mounted on the permanent pivot **108**.

One end of the spring **20** is attached to the link **107** below the movable pivot **106** and the opposite end of the spring **20** is attached to the main stationary contact **16** in the same manner as described in connection with Figures 1 through 5.

Thus, it will be seen that in the modification of Figure 6 during the initial movement of the plunger **51** due to the energization of the solenoid coil **50** the continued clockwise rotation of the bell crank **57** will move the pin **59** from the left hand end of slot **51** to the right hand end thereof.

Thus, continued upward movement of the plunger **51** resulting in continued clockwise rotation of the bell crank **57** will now exert a compression force to the right on the insulating link **100** since the insulating link **100** is pivotally connected to the rocker arm **103** which is rotatably mounted on the permanent pivot **104**, the compression force on the insulating link **100** will result in counterclockwise rotation of the rocker arm **103**.

This movement will be transmitted to the link **107** through the pivot **106** thereby urging the stationary contacts **15** and **16** into cooperation with the movable and arcing contacts **28** and **29** in substantially the same manner as heretofore described in connection with the portion of the mechanism from the position of Figures 2 to 3.

In the foregoing, there is described the invention only in connection with preferred embodiments thereof. Many variations and modifications of the principles of the invention within the scope of the description herein are obvious. Accordingly, it is preferred to be bound not by the specific disclosure herein but only by the appending claims.

What is claimed is:

1. In a circuit breaker for protecting an electric circuit; said circuit breaker comprising a first movable contact mechanism having a contact open first position and a contact closed second position; a second movable contact mechanism having a contact open third position and a contact closed second position; a closing mechanism; a first connection from said closing mechanism to said first movable contact mechanism and a second connection from said closing mechanism to said second movable contact mechanism for respectively operating said first contact mechanism from its contact open first position to said contact closed second position in one direction and for operating said second movable contact mechanism in the opposite direction from its contact open third position to said contact closed second position after said first contact mechanism has reached the contact closed second position; biasing means individual to each of said contact mechanisms for biasing said contact mechanisms to their individual open first and third positions; a fault current responsive mechanism energized by fault current in the electric circuit protected by said circuit breaker and having a latch mechanism connected to said first movable contact mechanism for holding said first movable contact mechanism in its contact closed position against the action of its bias, said latch mechanism operating in response to the energization of said current responsive mechanism for releasing said first movable contact mechanism to permit its biasing means to operate said first movable contact to its contact open first position; a lock connected to said second contact mechanism when said first and second contact mechanism are in the contact closed second position for loking said second contact mechanism in said contact second position only while both said first and second contact mechanisms are in the contact closed second position and for releasing said second contact mechanism to be operated by its biasing means to said contact open third position when said first contact mechanism has left said contact closed second position, each of said contact mechanisms having circuit connections for providing connections to the electric circuit to be protected by said circuit breaker for closing at least its portion of the electric circuit when said first and seond contact mechanisms are in the circuit closed second position, the circuit connection for said second contact mechanism forming a loop with electric circuit for effecting a blow-on action of said second contact mechanism to said first contact mechanism resulting from the magnetic forces due to current flowing in the electric circuit, said blow-on action urging said second contact mechanism to its locked position.

2. In a circuit breaker for protecting an electric circuit; said circuit breaker comprising a first movable contact mechanism having a contact open first position and a contact closed second position; a second movable contact mechanism having a contact open third position and said contact closed second position; a closing mechanism; a first connection from said closing mechanism to said first movable contact mechanism and a second connection from said closing mechanism to said second movable contact mechanism for respectively operating said first contact mechanism from its contact open first position to said contact closed second position in one direction and for operating said second movable contact mechanism in the opposite direction from its contact open third position to said contact closed second position after said first contact mechanism has reached the contact closed second position; biasing means individual to each of said contact mechanisms for biasing said contact mechanisms to their individual open first and third position; a fault current responsive mechanism energized by fault current in the electric circuit protected by said circuit breaker and having a latch mechanism connected to said first movable contact mechanism for holding said first movable contact mechanism in its contact closed second position against the action of its bias, said latch mechanism operating in response to the energization of said current responsive mechanism for releasing said first movable contact mechanism to permit said biasing means to operate said first movable contact to its contact open first position; a lock connected to said second contact mechanism when said first and second contact mechanisms are in the contact closed second position for locking said second contact mechanism in said contact closed second position only while both said first and second contact mechanisms are in the contact closed second position and for releasing said second contact mechanism to be operated by its biasing means to said contact open third position when said first contact mechanism has left said contact closed second position, each of said contact mechanisms having circuit connections for providing connections to the electric circuit to be protected by said circuit

breaker for closing at least its portion of the electric circuit when said first and second contact mechanisms are in the circuit closed second position, the magnetic forces due to current flowing in said circuit connections for said second contact mechanism operating to drive said second contact mechanism into tighter engagement with said first contact mechanism when both said contact mechanisms are in their contact closed second position, said magnetic forces urging said second contact mechanism to its locked position.

3. In a circuit breaker for protecting an electric circuit; said circuit breaker comprising a first movable contact mechanism having a contact open first position and a contact closed second position; a second movable contact mechanism having a contact open third position and said contact closed second position; a closing mehanism; a first connection from said closing mechanism to said first movable contact mechanism and a second connection from said closing mechanism to said second movable contact mechanism for respectively operating said first contact mechanism from its contact open first position to said contact closed second position in one direction and for operating said second movable contact mechanism in the opposite direction from its contact open third position to said contact closed second position the first closing mechanism reaching the contacts closed second position before said second closing mechanism reaches the contact closed second position, biasing means individual to each of said contact mechanisms for biasing said contact mechanisms to their individual open first and third position; a fault current responsive relay energized by fault current in the electric circuit protected by said circuit breaker and positioned to operate a latch mechanism connected to said first movable contact mechanism for holding said first movable contact mechanism in its contact closed second position against the action of the bias, said latch latching said first closing mechanism in its second closed position before said second contact mechanism reaches the closed second position, said latch mechanism operating in response to the energization of said relay for releasing said first movable contact mechanism to permit said biasing means to operate said first movable contact to its contact open first position; a lock connected to said second contact mechanism where said first and second contact mechanisms are in the contact closed second position for locking said second contact mechanism in said contact closed second position only while both of said first and second contact mechanisms are in the contact closed second position and for releasing said second contact mechanism to be operated by its biasing means to said contact open third position when said first contact mechanism has left said contact closed second position; each of said contact mechanisms having circuit connections for providing connections to the electric circuit being protected by said circuit breaker for closing at least its portion of the electric circuit when said first and second contact mechanism are in the circuit closed second position, the magnetic forces due to current flowing in said circuit connections for said second contact mechanism operating to drive said second contact mechanism into tighter engagement with said first contact mechanism when both said contact mechanisms are in their contact closed second position, said magnetic forces urging said second contact mechanism to its locked position.

4. In a circuit breaker for protecting an electric circuit; said circuit breaker comprising a first movable contact mechanism having a contact open first position and a contact closed second position; a second movable contact mechanism having a contact open third position and said contact closed second position; a closing mechanism; a first connection from said closing mechanism to said first movable contact mechanism and a second connection from said closing mechanism to said second movable contact mechanism for respectively operating said first contact mechanism from its contact open first position to said contact closed second position and for operating said second movable contact mechanism from its contact open third position to said contact closed second position, biasing means individual to each of said contact mechanism for biasing said contact mechanism to their individual open first and third position; a fault current responsive relay energized by fault current in the electric current protected by said circuit breaker and positioned to operate a latch mechanism connected to said first movable contact mechanism for holding said first movable contact mechanism in its contact closed second position against the action of its bias; said latch latching said first closing mechanism in its closed second position before said second contact mechanism reaches the closed second position, said latch mechanim operating in response to the energization of said relay for releasing said first movable contact mechanism to permit said biasing means to operate said first movable contact to its contact open first position; a lock connected to said second contact mechanism where said first and second contact mechanism are in the contact closed second position for locking said second contact mechanisms in said contact closed second position only while both said first and second contact mechanisms are in the contact closed second position and for releasing said second contact mechanism to be operated by its biasing means to said contact open third position when said first contact mechanism has left said contact closed second position each of said contact mechanisms having circuit being protected by said circuit breaker for closing at least its portion of the electric circuit when said first and second contact mechanisms are in the circuit closed second position, the circuit connection for said second contact mechanism forming a loop within the loop of the loop formed by the circuit breaker and electric current for effecting a blow on action of said second contact mechanism to said first contact mechanism resulting from the magnetic forces due to current flowing in the electric circuit tending to flatten out the circuit connection forming the loop, said current flowing in said loop being effective to urge said second contact mechanism to its locked position.

5. In a circuit breaker having a movable and a semi-stationary contact, said movable contact comprising a movable contact arm; said semi-stationary contact and movable contact arm each having individual engaging and disengaging positions; biasing means for normally biasing said movable contact arm to its disengaging position; a closing mechanism for engaging and operating said movable contact arm from its disengaging to its engaging position; a trip latch operative to maintain said movable contact arm in its engaging position; current responsive means when energized for operating said trip latch to permit said movable arm to be operated by its biasing means to its disengaging position; said closing mechanism having a construction whereby initial movement in a first direction operates said movable arm to its latched engaging position and continued movement in said first direction operates said semi-stationary contact into engagement with the previously latched movable contact arm.

6. A circuit breaker having a movable contact arm; one end of a toggle mechanism pivotally mounted thereon; said contact arm carrying a set of movable contacts; said circuit breaker having a pair of stationary contacts; said stationary contacts cooperating with said movable contacts when said circuit breaker is in closed position; a closing solenoid and a plunger; energization of said closing solenoid effective to transmit a force through said toggle to move said movable contacts toward said stationary contacts; said toggle mechanism set in closed position prior to the engagement of said stationary and movable contacts; continued movement of said closing mechanism operatively connected to transmit force to move said stationary contacts into engagement with said cooperating

contacts; a trip latch to maintain said toggle mechanism in said set closed position.

7. A circuit breaker having a movable contact arm; one end of a toggle mechanism pivotally mounted thereon; said contact arm carrying a set of movable contacts; said circuit breaker having a pair of stationary contacts; said stationary contacts cooperating with said movable contacts when said circuit breaker is in closed position; a closing solenoid and a plunger; energization of said closing solenoid effective to transmit a force through said toggle to move said movable contacts toward said stationary contacts; said toggle mechanism set in closed position prior to the engagement of said stationary and movable contacts; continued movement of said closing mechanism operatively connected to transmit force to move said stationary contacts into engagement with said cooperating contacts; a trip latch to maintain said toggle mechanism in said set closed position; an opening spring for said movable contact arm; said opening spring ineffective to cause disengagement of said cooperating contacts when said toggle mechanism is in said set position; disengagement of said trip latch due to a fault current rendering said opening spring effective to disengage said opening contacts and to provide trip free operation of said circuit breaker.

8. A circuit breaker having a movable contact arm; one end of a toggle mechanism pivotally mounted thereon; said contact arm carrying a set of movable contacts; said circuit breaker having a pair of stationary contacts; said stationary contacts cooperating with said movable contacts when said circuit breaker is in closed position; a closing solenoid and a plunger; energization of said closing solenoid effective to transmit a force through said toggle to move said movable contacts toward said stationary contacts; said toggle mechanism set in closed position prior to the engagement of said stationary and movable contacts; continued movement of said closing mechanism operatively connected to transmit force to move said stationary contacts into engagement with said cooperating contacts; a trip latch to maintain said toggle mechanism in said set closed position; said stationary contacts connected to one terminal of said circuit breaker by means of conducting spring members; said conducting spring members being looped to create an electromagnetic blow on and blow closed effect after said circuit breaker is moved to closed position.

9. A closing mechanism for a circuit breaker comprising a toggle, a first bell crank, a second bell crank and an insulating link; said first and second bell cranks rotatably mounted on permanent pivots; said circuit breaker having a closing means and a first contact and a second contact; said toggle operatively connected to said second bell crank and said first contact; said insulating link operatively connected to said first bell crank and said second contact, said closing means effective to rotate said first bell crank and move said toggle mechanism toward circuit closed position; a trip latch means for said second bell crank; said second bell crank and said toggle moved to circuit closed position prior to the engagement of said first and second contacts; continued rotation of said first bell crank ineffective to move said toggle mechanism; said continued movement of said first bell crank effective to move said second contacts into engagement with said first contact through said insulating link.

10. In a circuit breaker having a set of movable and stationary contacts comprising a movable contact arm and a toggle mechanism; said toggle mechanism pivotally mounted to said movable contact arm; a trip latch for said toggle mechanism; a closing solenoid to move said toggle mechanism to center position upon energization of said closing solenoid; said closing solenoid operatively connectible to said toggle and said set of stationary contacts; initial movement of said closing solenoid in a first direction effective to position said toggle and said contact arm in closed position prior to the engagement of said sets of movable and stationary contacts; continued movement of said closing solenoid ineffective to alter the position of said toggle and said contact arm; said continued movement of said closing plunger effective to move said set of stationary contacts into cooperation with said set of movable contacts.

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