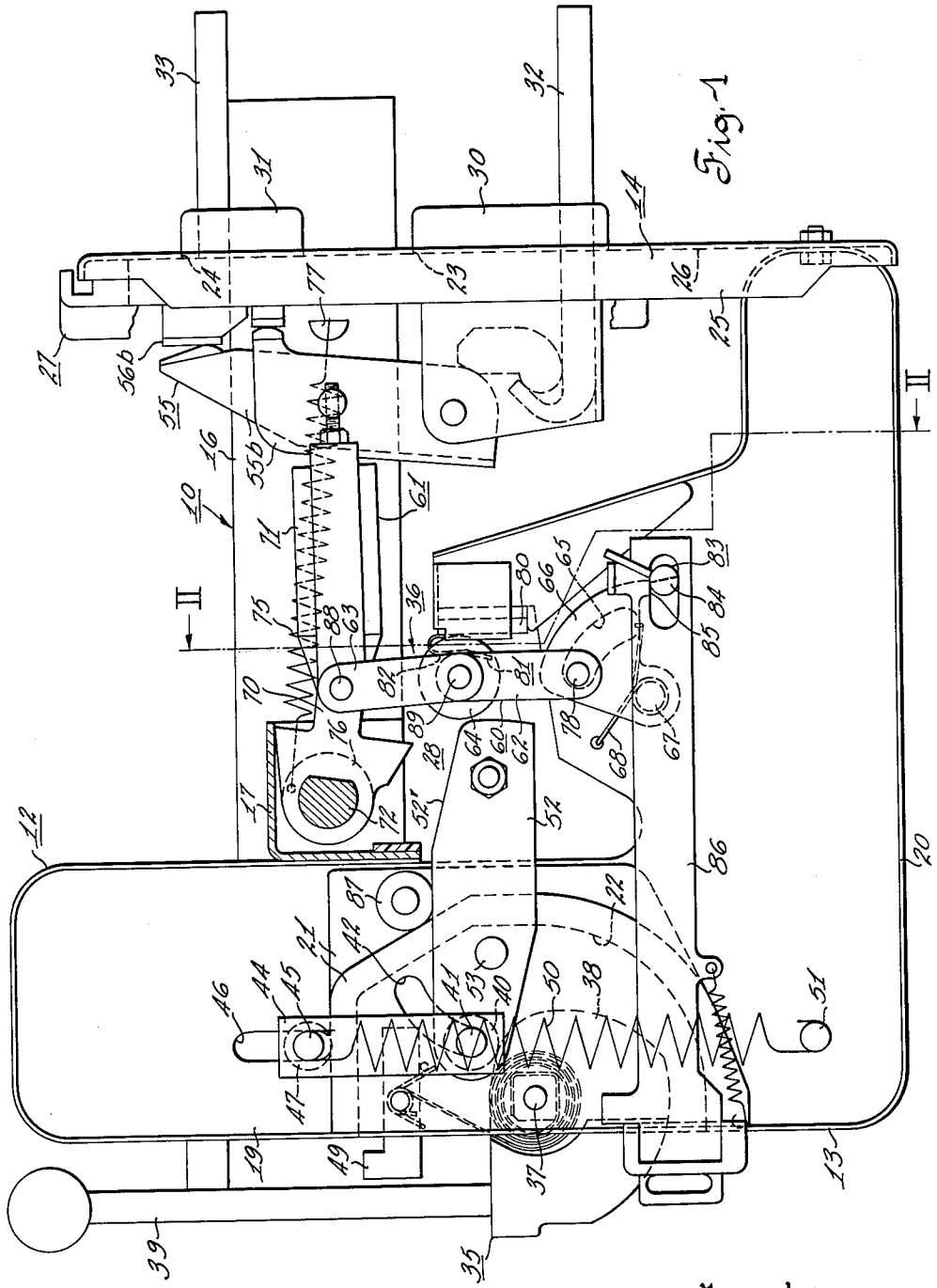
Sept. 21, 1965 E. C. GOODWIN, JR 3,207,879

OPERATING MECHANISM FOR CIRCUIT BREAKERS

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Fig. 1



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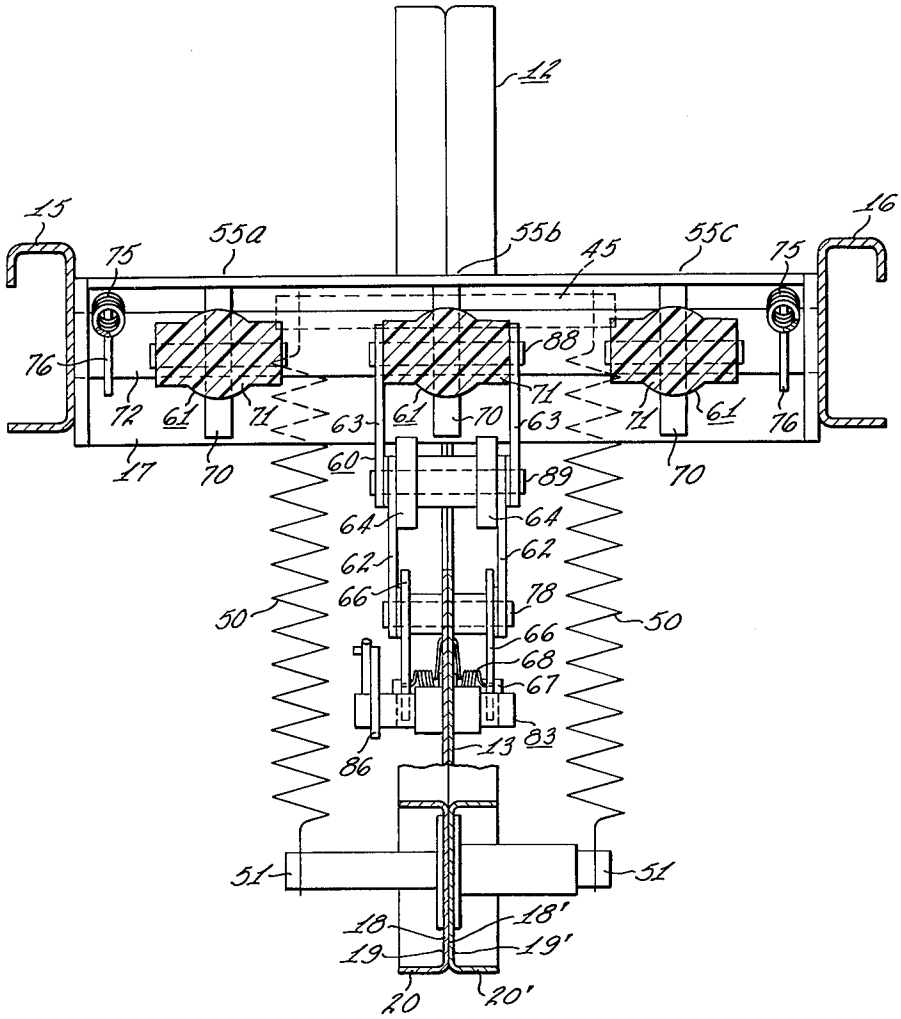


Fig. 2

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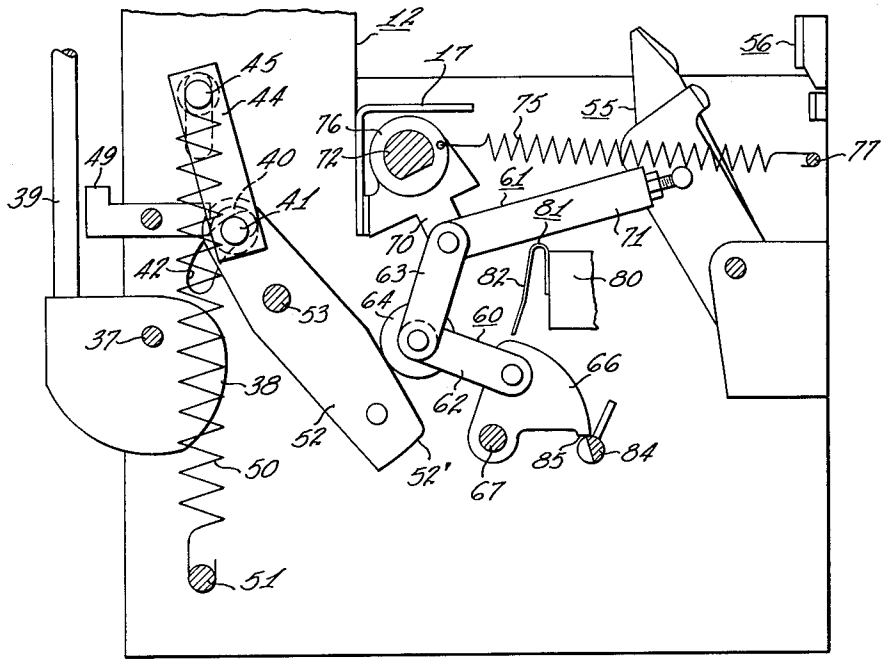


Fig. 3

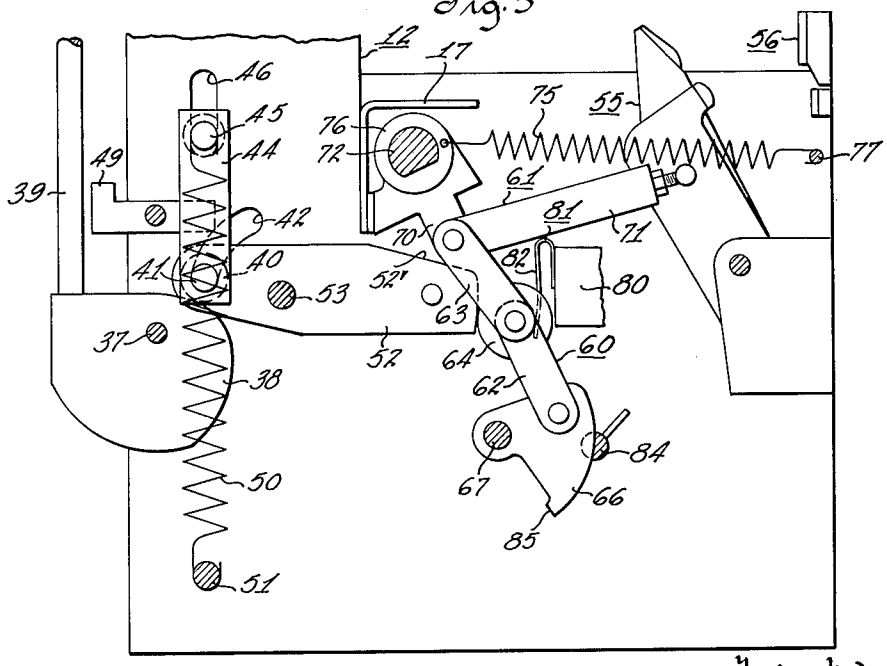


Fig. 4

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OPERATING MECHANISM FOR CIRCUIT BREAKERS

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8 Claims. (Cl. 200—153)

This invention relates to a circuit breaker structure and more particularly to a new and improved circuit breaker operating mechanism for opening and closing the circuit breaker contacts.

Low voltage circuit breaker structures of the conventional type employ links, cranks and other mechanisms which are placed within a relatively heavy box type frame and this frame is rigidly attached to cooperating structure which supports the primary electrical contacts. The heavy box type frame and the necessary welding joints, multiple bolting, etc., of the box to the cooperating switchgear structure rendered this mechanism highly inaccessible for servicing, repairing or maintenance of the component parts thereof. Further, the box type frame structure resulted in a frame geometrical configuration which incorporated unnecessary metal thickness and weight.

In accordance with the invention disclosed a new and improved circuit breaker structure and operating mechanism is provided for use with, but not limited to, low voltage air circuit breakers of the 600 volt class. This structure and operating mechanism is an improvement over the prior art in that it allows placement of the operating mechanism (the components) outside a single center plate type support frame where they are readily accessible for inspection, adjustment, cleaning and lubricating. This accessibility feature is of prime importance in the maintenance of protective equipment of this type. Further, it permits the use of a minimum number of parts of minimum size and complexity. This is accomplished by a structural design which effectively relates the stresses imposed by the operation of the circuit breaker mechanism to the placement of frame components. Component sections and fastening means are reduced to the ultimate minimum.

The new and improved placement of the circuit breaker operating mechanism components provides adequate protection for all of the parts involved as well as protecting personnel against accidental involvement therewith. Still further, the use of a minimal size structural component allows added space adjacent to the breaker structure for the placement of control components such as static overcurrent trip devices, relays, auxiliary switches and so forth which the present day breaker structures employ. The single center plate mechanism support of the disclosed structure increases the space adjacent the primary conducting means, thus facilitating inspection and maintenance as well as radiational cooling. The center plate mechanism support is not susceptible to transient strain during operation, which condition could cause displacement between cooperating parts of the circuit breaker operating mechanism.

In accordance with the invention, a circuit breaker structure is provided comprising in combination a frame or support having a leg member and a cross member extending laterally from the leg member. The leg member may be considered the single center plate mechanism support disclosed above. At least one relatively stationary contact is mounted on the cross member, although, in practice three stationary contacts are usually employed. A movable contact is pivotally mounted on the support and is movable to an open position and to a closed position wherein it engages its associated stationary contact. The leg member of the support is provided with a shaft which is rotatably mounted thereon and extends laterally therefrom. The shaft is connected to the movable contact by overcenter toggle means. The overcenter toggle means comprise a toggle arm which is rigidly connected to the shaft and another toggle arm which is pivotally connected to the first toggle arm to provide a knee and to the movable contact. The offcenter toggle means has an expanded position wherein it effects closure of the movable contact and it has a collapsed position wherein it effects opening of the movable contact. A contact opening spring is connected between the support and the first toggle arm of the offcenter toggle means. The contact opening spring is charged when the offcenter toggle means assumes its expanded position and is dischargeable to collapse the offcenter toggle means to effect opening of the contact.

Overcenter toggle means are provided to move the offcenter toggle means to its expanded position and also to permit the offcenter toggle means to assume the collapsed position. The overcenter toggle means comprise a first toggle arm and a second toggle arm which are pivotally connected to each other and have a cam roller at their point of pivotal connection or knee. The first toggle arm of the overcenter toggle means is pivotally connected to the knee of the offcenter toggle mechanism. The second toggle arm of the overcenter toggle means is pivotally connected to means such as a trip latch which is pivotally mounted on the support. The overcenter toggle means are movable to a collapsed position and are maintained in this position by a releasable rotary latch which is mounted on the support and acts upon the trip latch. The overcenter toggle mechanism is movable to an expanded position, as hereinafter explained, wherein it moves the offcenter toggle means and the movable contact to closed position.

A transmission mechanism is provided for acting upon the overcenter toggle mechanism. The transmission mechanism comprises a closing cam which is pivotally mounted on the support and is pivotally connected at one end to a link. The closing cam and the link are part of a collapsible linkage means. A contact closing spring is connected to the link and to the support. Means are provided to move the closing cam to one position wherein it effects movement of the link and consequently charging of the closing spring. Means such as a closing latch are provided to releasably latch the closing cam and the link in the position wherein they maintain the closing spring charged. As will be understood the closing cam is movable to the charging position, for example, either by a manually operated member such as a cam which acts upon the closing cam, or by electrically operated means such as a motor and gear train which effects movement of the closing cam.

Assuming that the contact is open and that both the closing spring and the opening spring are in discharged condition, the sequence of operation of the circuit breaker mechanism is as follows. The closing cam is moved to a position wherein it effects charging of the closing spring and is latched in that position by the closing latch. Upon release of the closing latch the closing cam is moved by the closing spring against the cam roller in the overcenter toggle mechanism and the latter is moved from its collapsed position to its expanded condition. In so moving, the overcenter toggle means effects movement of the offcenter toggle means from its collapsed position to its expanded position thereby effecting closing of the contact. This movement of the off-center toggle means effects charging of the opening spring. The overcenter toggle means is maintained in expanded position by the rotary latch which acts upon the trip latch.

To open the contact the rotary latch is released and thus, the overcenter toggle mechanism is free to move to a position which permits the offcenter toggle means to

collapse. Collapse of the offcenter toggle means and opening of the contact is effected by the action of the opening spring. It is to be noted that at this point in the operation the overcenter toggle means has not collapsed but has moved to an alternative position. Its collapse is prevented by the position assumed by the closing cam when the latter is in the position to which it was carried by the closing spring.

At this point, both the closing spring and the opening spring are discharged and the contact is open. As the closing cam is again moved to the position wherein it effects recharging of the closing spring, it permits the overcenter toggle mechanism to assume or to be biased into its collapsed position. In such position the trip latch is moved into a position wherein it is latched by the rotary latch.

It is, therefore, one object of this invention to provide a new and improved contact controlling mechanism for a circuit breaker structure.

A further object of this invention is to provide a new and improved frame and contact controlling mechanism wherein the forces resulting from opening and closing of the contacts are all coplanar.

A still further object of this invention is to provide a new and improved frame and contact controlling mechanism wherein the sum of the stresses from the opening and closing the contacts is zero.

A still further object of this invention is to provide a new and improved low voltage air circuit breaker structure wherein the forces resulting from the opening and closing of contacts employing rotary motion converted into linear motion are arranged coplanar with one portion of the frame structure.

A still further object of this invention is to provide a new and improved operating mechanism which effectively relates the stresses imposed by circuit breaker operation to the placement of frame components.

A still further object of this invention is to provide a new and improved circuit breaker frame structure employing a single plate for supporting all of the contact actuating mechanisms.

A still further object of this invention is to provide a new and improved circuit breaker operating mechanism employing a minimum number of parts of minimum size and complexity which are simple to construct and dependable and easily maintained.

Objects and advantages other than those set forth will be apparent from the following description when read in connection with the accompanying drawings in which:

FIG. 1 is a side elevation with parts broken away illustrating a circuit breaker structure utilizing a transmission mechanism employing the present invention and showing the contact closing and opening springs in their unbiased and biased positions, respectively;

FIG. 2 is a cross sectional view of the structure shown in FIG. 1 taken in the direction of the arrows II—II;

FIG. 3 is a side elevation with parts broken away similar to that illustrated in FIG. 1 wherein the closing springs are shown charged and the opening spring discharged; and

FIG. 4 is a view similar to FIG. 3 but showing both the closing springs and opening spring discharged.

Referring more particularly to the drawings by characters of reference, FIGS. 1 through 4 illustrate a circuit breaker **10** which employs supporting means comprising a single center plate mechanism support frame **12**, shown in FIGS. 1 and 2. Frame **12** comprises a T-shaped construction employing a single frame leg member **13** attached to a back plate or cross member **14** which extends laterally from the leg member **13**. Leg member **13** may be attached in any suitable way to cross member **14** such as by welding, bolting and so forth or it may be formed with cross member **14** out of one piece of material. Although the frame is formed of a metal, any suitable plastic material may be used.

The leg and cross member **13** and **14**, respectively, of the T-shaped frame are mutually braced by side rails **15** and **16** and an apron **17**. Because the T-shaped frame provides a means for symmetrical, balanced placement of the circuit breaker operating mechanism around leg member **13**, the rails **15**, **16** are subjected only to the tension stress of the toggle **61** (FIG. 1) thereby requiring only a minimum of material weight and strength.

Leg member **13** is formed of two flanged pieces **18** and **18'** arranged in juxtaposition with their flat surfaces **19**, **19'** adjacent each other and their flanged reinforcing edges **20**, **20'** extending laterally from the flat surfaces outwardly of each other. At the free end of leg member **13**, reinforcement blocks of metal **21** are attached to surfaces **19**, **19'** and are so formed to provide a cavity **22** extending through the flange surfaces at the free end of the leg member (as shown) for receiving parts of the circuit breaker operating mechanism **28**, hereinafter described.

As FIG. 1 shows, cross member **14** is provided with apertures **23**, **24** and a flange edge **25** which extends outwardly of the flat surfaces **26** of cross member **14** toward leg member **13**. A piece of insulating material **27** is mounted on cross member **14** between flange edge **25** with cleats **30** and **31** extending through apertures **23** and **24**, respectively, for supporting the current conducting elements on bus bars **32** and **33** of the energizing circuit.

Circuit breaker **10** utilizes a transmission mechanism or means **35** for actuating a contact controlling mechanism or means **36**. As will be understood, the transmission mechanism **35** shown includes means for manual operation thereof but means other than manually operated means may be employed. The transmission mechanism **35** comprises a pin **37** having rotatably mounted thereon a cam **38**. Cam **38** is rotated by a manually rotatable handle **39** which is rigidly attached thereto. Pin **37** extends through cavity **22** of leg member **13** and is rotatably mounted on metal blocks **21**. Cam surface **38** is arranged to extend within cavity **22** and upon rotation thereof drives a cam roller **40**. Cam roller **40** is mounted within cavity **22** on a pin **41**. Pin **41** extends through cavity **22** with the ends thereof loosely mounted in kidney-shaped slots **42**, one of which is formed in each of the surfaces of the metal blocks **21**. A pair of links **44** (one of which is shown in FIG. 1) are pivotally mounted on pin **41** one at each end of pin **41** between slots **42** and the ends of the pin on each side of leg member **13**. The other ends of links **44** are pivotally connected one to each end of a pin **45**. Pin **45** is arranged to extend within aligned slots **46** formed in the adjacent surfaces **19**, **19'** of leg member **13**. A pair of resilient rollers **47** are mounted on pin **45** one at each end thereof and come to rest at the bottom of slot **46** against the top of metal blocks **21** mounted on the outside of surfaces **19**, **19'**. To the ends of pin **45** is fixedly attached a pair of tension springs **50** one arranged on each side of leg member **13**. The other ends of springs **50** are fixedly attached to leg member **13** at point **51**. Thus, upon counterclockwise rotation of handle **39**, cam **38** forces roller **40** upwardly along the kindey-shaped slot **42** causing the upward movement of link **44** and pin **45** causing a tensioning or charging of spring **50**. Releasable closing latch means such as a spring biased prop latch **49** bears against roller **40** mounted on pin **41** and holds springs **50** in this charged position.

A pair of closing cams **52** having cam surfaces **52'** are pivotally mounted between the ends thereof one at each end of a pin **53**. Pin **53** is mounted to extend through and be supported by metal blocks **21** on surfaces **19**, **19'** of leg member **13**. One end of each of the closing cams **52** is pivotally mounted at different ends of pin **41** outside of the surfaces of block **21**. Thus, as pin **41** is pushed upwardly in kidney slots **42**, cams **52** are pivoted clockwise about pin **53**.

As shown in FIGS. 1 through 4, contact mechanism **55**

includes three pairs of cooperating contacts 55*a*, 55*b*, 55*c* and 56*a*, 56*b*, 56*c*. The relatively stationary contacts 56*a*, 56*b* and 56*c* are mounted on the cross member 14 with stationary contact member 56*b* mounted on cross member 14 substantially within the plane of leg member 13. Contact members 56*a* and 56*c* are mounted one on each side of contact 56*b*. The relatively movable contacts 55*a*, 55*b* and 55*c* are actuated by shaft 72 through toggles 61 to cooperate with the stationary contacts with contact 55*b* being mounted substantially within the plane of leg member 13 and contacts 55*a* and 55*c* being mounted one one each side symmetrically of leg member 13. In FIG. 1 the contacts are shown in contact closed position before the stored energy springs 50 are charged by counterclockwise rotation of handle 39. FIG. 3 shows the contacts in contact open position after the stored energy springs 50 have been charged. FIG. 4 shows the contacts in contact open position with the stored energy springs 50 uncharged. As is apparent, the links 44 and the closing cams 52 are part of a collapsible linkage means.

The contact controlling mechanism 36 comprises a cooperating overcenter toggle means 60 and an offcenter toggle means 61. Toggle 60 comprises a pair of toggle arms 62 and 63 interconnected at adjacent ends by a pin 89. Each toggle arm comprises a pair of spaced parallelly arranged arm members as shown in FIG. 2, however, for purposes of simplification each toggle arm is referred to as a single member. Toggle roll 64 is acted upon by closing cam 52. The free end of toggle arm 62 is pivotally mounted in a trip latch 66 by a pin 78 which is movable in a kindey-shaped slot 65 in leg member 13. Trip latch 66 is pivotally mounted at 67 on leg member 13 and is biased in a counterclockwise direction by a spring 68. The free end of toggle arm 63 is pivotally connected to the knee of toggle 61 by a pin 88. Toggle 61 comprises a pair of toggle arms 70 and 71. Toggle arm 70 is fixedly mounted on a shaft 72. Shaft 72 is rotatably attached to the ends of apron 17. Toggle arm 71 is pivotally attached to the movable contact 55. As shown in FIGS. 1 and 2, the center movable contact structure 55*b* of the three phase system is shown wherein the knee of toggle 61 is directly connected to the end of toggle arm 63. The movable contact structures 55*a* and 55*c* of the other two phases each employ a toggle 61 which is directly connected through toggle arm 70 to shaft 72 and are actuated thereby. Only the center phase of the three phase system has the knee of its toggle 61 connected to the end of toggle arm 63 of toggle 60.

A pair of contact opening tension springs 75 are connected one at each end to flanges 76 fixed to shaft 72. The other end of springs 75 are connected to the circuit breaker frame structure at 77.

With the circuit breaker in open position as shown in FIG. 3, the cooperating toggles 60 and 61 are in their collapsed positions. This collapsed condition is maintainable when the stored energy closing springs 50 are charged since in this condition the closing cam 52 is down and out of the way and cam roller 64 at the knee of toggle 60 can collapse to the left counterclockwise as the breaker contacts open. This function is dependent on releasably restrained connection of toggle arm 62 to the slot 65 and trip latch 66 through pin 78.

With the toggles 60 and 61 collapsed as shown in FIG. 3 and springs 50 charged, roller 64 on the knee of toggle 60 moves along the cam surface of closing cam 52. Spring biased prop latch 49 bears against roller 40 and holds springs 50 in their charged condition. With the release of latch 49 by downward pressure, as shown in FIG. 4, closing cam 52 is rotated counterclockwise driving the roller 64 and the knee of toggle 60 to its overcenter position against a resiliently cushioned stop 80. This motion effects movement of toggle 61 to close the contacts, as shown in FIG. 1.

Closure of the contacts results in charging of the contact opening springs 75. A component of the opening reaction of springs 75 results in a clockwise rotational bias of trip latch 66. This rotation is controlled by releasable trip latch means such as a rotary latch 83. Latch 83 comprises a notched pin 84. Clockwise rotation of trip latch 66 causes an edge 85 thereof to be biased against rotary latch 83. A small rotation of latch 83 by the inward movement of release rod 86 releases trip latch 66 and the force of springs 75 revolves trip latch 66 clockwise. The knee of toggle 60 rides vertically downward along the face of the stop 80. Pin 78 at the free end of toggle arm 62 rides downwardly in slot 65 in frame member 13. This downward vertical motion of toggle 60 causes collapse of toggle 61 and opening of the contacts. This action may occur even though closing cam 52 is in the up or spring discharged position shown in FIG. 4.

Rotation of cam 52 away from stop 87 to the charged position of springs 50 as previously described will permit toggle 60 to collapse to the left under the toggle collapsing influence of the toggle breaking spring 81 as shown in FIG. 3. Thus, the toggle linkage 60 is again in position for a reclosure of the contacts.

A description of the circuit breaker operation is as follows: with the circuit breaker in the open position as shown in FIG. 3 and with the contacts 55 and 56 open, the double toggles 60 and 61 formed by toggle arms 62, 63 and 70, 71, respectively, are collapsed. This collapsed condition can be maintained only when the stored energy closing springs 50 are charged by counterclockwise rotation of a handle 39. This rotation of handle 39 causes the clockwise movement of closing cam 52 to a position where the knee of toggle 60 can collapse to the position shown in FIG. 3.

To close the contacts of the circuit breaker, toggle 60 must be moved to its overcenter position. This is accomplished by moving downwardly trip latch 49 which releases pin 41 for movement downwardly in slot 42 and under the action of the bias of springs 50 causes closing cam 52 to rotate counterclockwise to move the toggles 60 and 61 thereby closing the contacts 55 and 56. This position is shown in FIG. 1.

A component of a previous opening reaction provided by accelerating contact opening springs 75 results in a clockwise rotation component of trip latch 66. This rotation is controlled by latch 83.

Opening of the contacts occurs upon a small rotation of shaft 84. This occurs upon the inward movement of rod 86 as shown in FIGS. 1 and 2. The previously referred to force component acting on rotary latch 83 by trip latch 66 revolves trip latch 66 and causes toggle 60 to ride vertically downward along cam face 82 of toggle breaking spring 81. This vertical motion of toggle 60 causes toggle 61 to collapse and the circuit breaker to open even though cam 52 is in the up or spring discharged position shown in FIG. 1. Rotation of cam 52 to the charged position by handle 39, previously described, allows toggle 60 to collapse to the left under the influence of toggle breaking spring 81 which bears against the toggle knee. The linkage comprising toggles 60 and 61 are again in a position for a reclosure operation.

Circuit breaker operating mechanism of the foregoing type has several advantages, as explained hereinafter. In the following discussion the abbreviation MMR stands for magneto-mechanical reaction and is defined as the algebraic total of the magnetic forces and the mechanical springs, accelerating springs, etc.

As hereinbefore explained, shaft 72 is supported by the side rails 15 and 16. With the circuit breaker in closed position, three concentrated loads are understood to occur. One load is on the center line through leg member 13 and two other loads are symmetrically located about the center line of leg member 13 along toggle 61.

Toggle arms **70** and **71** of toggle **61** are loaded in compression.

While the primary copper is designated as a single element in each phase, for purposes of this analysis the primary copper comprises the cooperating members of the contacts, namely the main and arcing contacts of the movable contacts **55**, the stationary contacts **56**, and the primary bus conductors **32** and **33**.

The cross member **14** which serves as the base of the T-shaped frame structure is supported upright at both ends by rails **15** and **16**. Three concentrated loads are applied to the primary copper as shown, one on the center base of leg member **13** and two symmetrically located about the center line. These loads are the MMR reactions per phase.

The stress in side rails **15** and **16** is essentially pure tension since it is located in the plane of toggle arms **70** and **71** of toggle **61**. The effective tension stresses in the side rails is not substantially different as the breaker closes. When the circuit breaker is in normal operation, the MMR loads imposed at each phase are accepted equally by the side rails **15** and **16**. The extreme condition of the side rail loading is encountered when the maximum current is reached in either one of the outer phases. Under this condition, the side rails **15** and **16** adjacent to the maximum current phase receive a higher tension stress.

Since substantially all of the stresses imposed by the MMR loads are completely contained within a parallelogram formed by shaft **72**, side rails **15** and **16** and cross member **14**, the mechanism frame is isolated from any external stresses and thus its reactions need not exceed those required by the stresses imposed by the operating mechanism.

With the vertical toggle arms **62** and **63** of toggle **60** loaded in compression, the trip latches **66** are loaded in compression and are releasably restrained by notched pin **84** of latch **83**. Notched pin **84** is supported in the middle by leg member **13** as shown in FIG. 2 and two concentrated loads are applied to it by symmetrically located trip latches **66** about its middle support or bearing in the following manner.

The toggle pin **88** interconnecting toggle arms **70** and **71** of toggle **61** and the end of toggle arm **63** of toggle **60** is supported and symmetrically loaded at each end by toggle arms **63**. The toggle pin **89** connecting together toggle arms **62** and **63** of toggle **60** and supporting toggle roll **64** is supported and symmetrically loaded at each end by toggle arms **62**. Toggle pin **78** connecting toggle arms **62** to trip latches **66** is also supported and symmetrically loaded at both ends. Thus the supporting members, trip latches **66**, apply symmetrically placed concentrated loads to latch **83**.

Since the member **13** comprising the mechanism frame is fastened to cross member **14** and through side rails **15**, **16'** and apron **17**, the horizontally arranged leg of member **13** becomes in essence a beam supported at both ends with a single concentrated load unsymmetrically placed in the vertical longitudinal plane. The value of this load is determined by the offcenter setting of toggle arms **70** and **71** and is applied in lateral symmetry through vertical toggle **60** as described above and is limited to a very nominal value with the circuit breaker closed in order to keep the required tripping force at a minimum. It is noted that during the closing cycle the resultant force of the aforesaid load reaches a somewhat higher transient value due to the changing toggle arm angles. Thus, the fastenings which support the mechanism frame are of minimum size and quantity as they are required to resist only the nominal shear stresses imposed by the load.

As described previously the external loading applied to the mechanism frame by the vertical toggle component load is transmitted to the frame through symmetrically disposed vertical toggle arms **62** and **63**, toggle pins **88**, **89** and **78**, latch pivot pin **67** and latch **83**. Also, forces exerted by the previously described closing means act symmetrically about the vertically arranged leg of member **13** of the T-shaped frame. Thus, the frame is not subjected to torque stresses in the lateral plane due to unsymmetrically applied loads and consequently the lateral stiffness of the frame can be held to the minimum required to support the operating mechanism.

Thus, the resultant forces for opening and closing of the contacts and the charging of springs **50** and **75** are substantially coplanar or parallel with the frame member **13** of the circuit breaker structure. Further, the sum of the stresses resulting from opening and closing of the contacts is substantially zero.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

Having now particularly described and ascertained the nature of my said invention and the manner in which it is to be performed, I declare that what I claim is:

1. In a circuit breaker operating mechanism having a contact movabe to a closed position and to an open position, in combination, a contact controlling mechanism connected to said contact and movable to a contact closed position wherein it is releasably latched and collapsible to a contact open position when unlatched, said contact controlling mechanism comprising an offcenter toggle means comprising at least two arms and having an expanded position and a collapsed position for moving said contact to its closed position and open position, respectively, a contact opening spring chargeable by movement of said offcenter toggle means to expanded position and dischargeable to effect collapse of said contact controlling mechanism, and overcenter toggle means comprising at least two arms and having an overcenter position wherein it moves said offcenter toggle means to expanded position and having a collapsed position wherein it permits collapse of said offcenter toggle means, and a transmission mechanism having a charged position wherein it is releasably latched and movable to another position wherein its acts upon said overcenter toggle means to move the latter to its overcenter position, said transmission mechanism comprising a contact closing spring chargeable by movement of said transmission mechanism to charged position and dischargeable to effect movement of said transmission mechanism to said other position.

2. In a circuit breaker operating mechanism having a contact movable to a closed position and to an open position, in combination, an offcenter toggle means comprising at least two arms and having an expanded position and a collapsed position for moving said contact to its closed position and open position, respectively, a contact opening spring chargeable by movement of said offcenter toggle means to expanded position and dischargeable to effect collapse of said offcenter toggle means, an overcenter toggle means comprising at least two arms and having an overcenter position wherein it moves said offcenter toggle means to expnded position, said overcenter toggle means further having a collapsed position wherein it permits said offcenter toggle means to collapse, trip latch means for releasably latching said overcenter toggle means in its expanded position, a linkage having a charged position and a contact closed position for moving said overcenter toggle means to overcenter position, a contact closing spring chargeable by movement of said linkage to charged position and dischargeable to effect movement of said linkage to contact closed position, closing latch means for releasably latching said linkage and closing spring in charged position, and means for moving said linkage to charged position.

3. In a circuit breaker operating mechanism, in combination, a support, a movable contact mounted on said support and movable to a closed position and to an open

position, offcenter toggle means connected to said support and to said movable contact and having an expanded position and a collapsed position for moving said contact to its closed position and open position, respectively, said offcenter toggle means comprising at least two arms, a contact opening spring connected to said support and to said offcenter toggle means, said contact opening spring being chargeable by movement of said offcenter toggle means to expanded position and dischargeable to effect collapse of said offcenter toggle means, overcenter toggle means connected to said support and to said offcenter toggle means, said overcenter toggle means comprising at least two arms and having an overcenter position wherein it moves said offcenter toggle means to expanded position and wherein it is releasably latched, said overcenter toggle means further having a collapsed position wherein it permits said offcenter toggle means to collapse, a linkage mounted on said support and having a charged position wherein it is releasably latched and a contact closed position for moving said overcenter toggle means to overcenter position, and a contact closing spring connected to said support and to said linkage, said contact closing spring being chargeable by movement of said linkage to charged position and dischargeable to effect movement of said linkage to contact closed position.

4. The combination according to claim 3 which comprises a trip latch mounted on said support for engagement with said overcenter toggle means and further comprises an opening latch mounted on said support for engagement with said linkage.

5. The combination according to claim 4 including a cam pivotally mounted on said support for engagement with said linkage and movable to effect movement of said linkage to charged position.

6. In an electric circuit breaker having a contact movable to alternate positions, in combination, a support, a linkage mounted on said support and movable to a first position and to another position wherein it effects movement of said contact to one of its alternative positions, spring means connected to said support and to said linkage, cam means movably mounted on said support and movable to effect movement of said linkage to its first position wherein said spring becomes charged, and latching means for latching said linkage in its first position, said latching means being releasable to permit said spring to discharge and thereby effect movement of said linkage to its other position.

7. In an electric circuit breaker having a contact movable to alternate positions, in combination, a support, a first cam mounted on said support and movable to a first position and to another position wherein it effects movement of said contact to one of its alternative positions, a link movably connected to said first cam and movably connected to said support, said link being movable with said first cam, a spring connected to said support and to said link, a second cam movably mounted on said support and movable to effect movement of said first cam to its first position thereby effecting charging of said spring, and latching means for latching said first cam in its first position thereby effecting maintenance of said spring in charged condition, said latching means releasable to permit said spring to discharge thereby effecting movement of said first cam to its other position.

8. In an electric circuit breaker having a contact movable to alternate positions and toggle means movable to a position wherein it moves said contact to one of said alternate positions, in combination, a support, a first cam pivotally mounted on said support and having a first position and another position wherein it moves said toggle means to its said position, a link having one end pivotally connected to said cam and its other end movably mounted on said support, said link being movable with said first cam, a spring connected to said support and to said link, another cam pivotally mounted on said support and movable to effect movement of said first cam to its first position thereby effecting charging of said spring, and latch means on said support and acting on said link for maintaining said first cam in its first position and releasable to permit said spring to move said first cam to its other position.

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