May 7, 1968 C. L. JENCKS ETAL 3,382,331

CIRCUIT BREAKER ROTARY HANDLE MECHANISM CAM LOCK

Filed Nov. 30, 1966 4 Sheets-Sheet 1

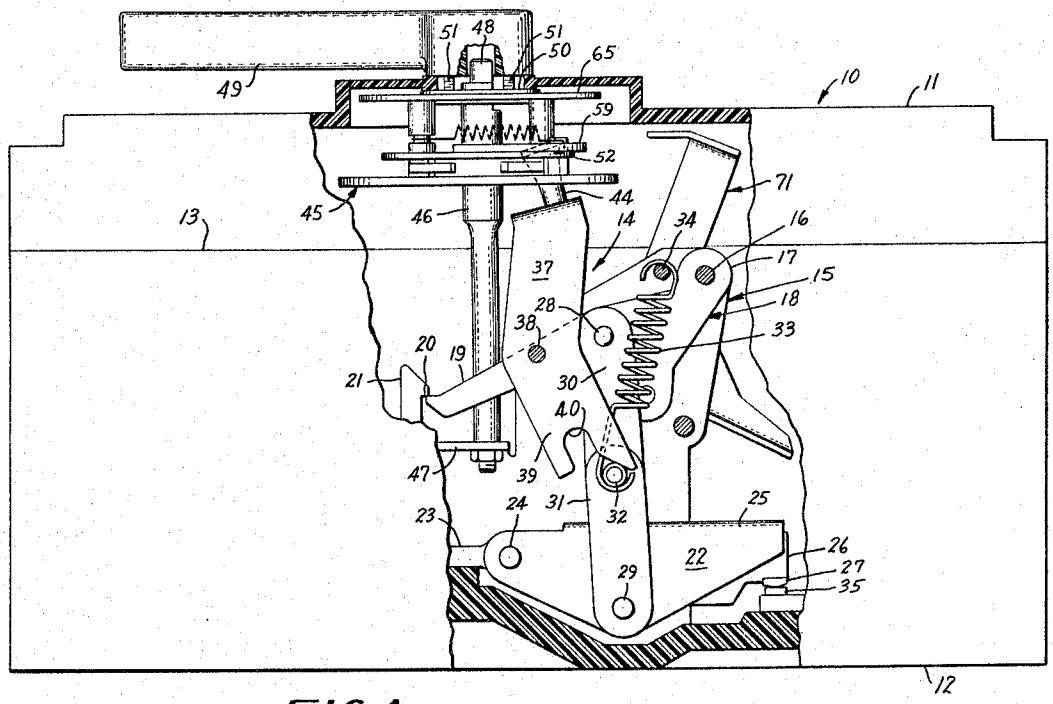

FIG. 1

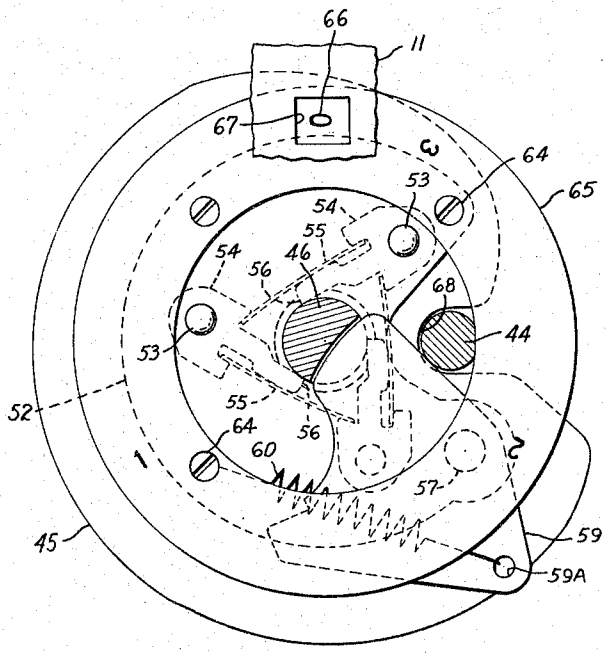

FIG. 2

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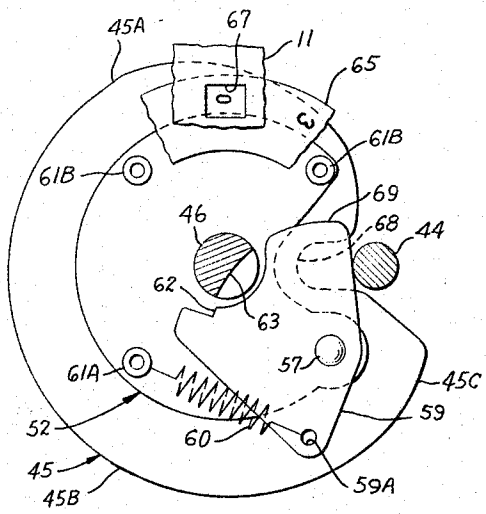

FIG. 3B

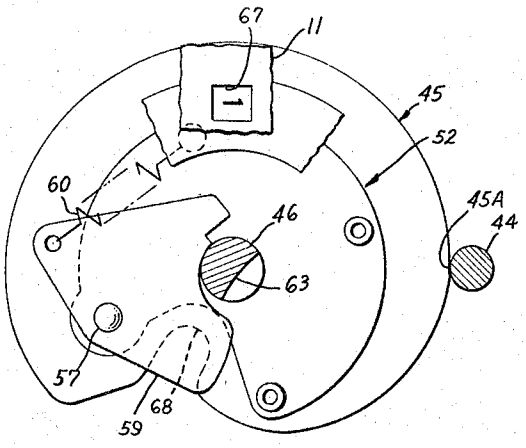

FIG. 4B

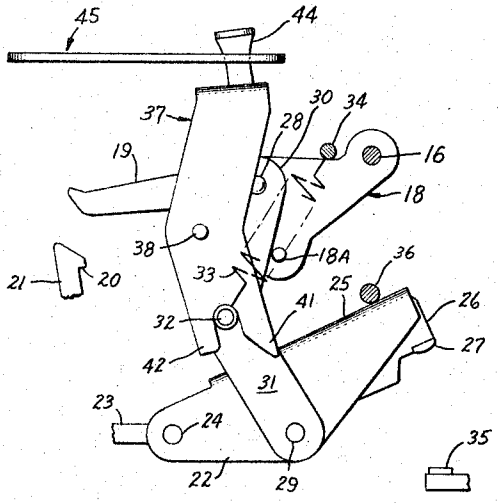

FIG. 3A

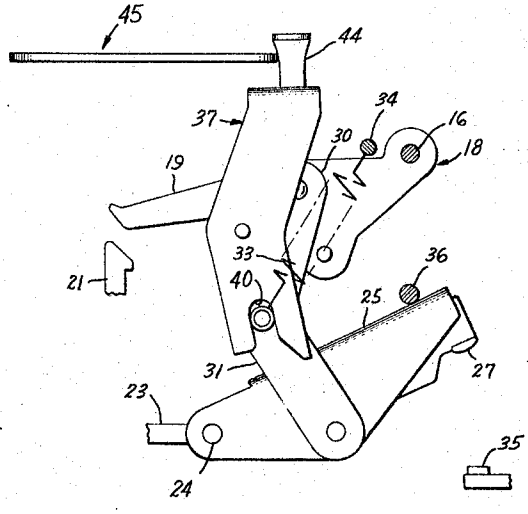

FIG. 4A

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CIRCUIT BREAKER ROTARY HANDLE MECHANISM CAM LOCK

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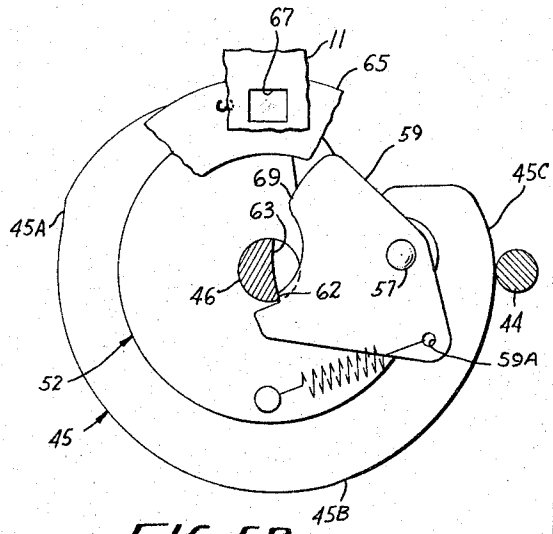

FIG. 5B

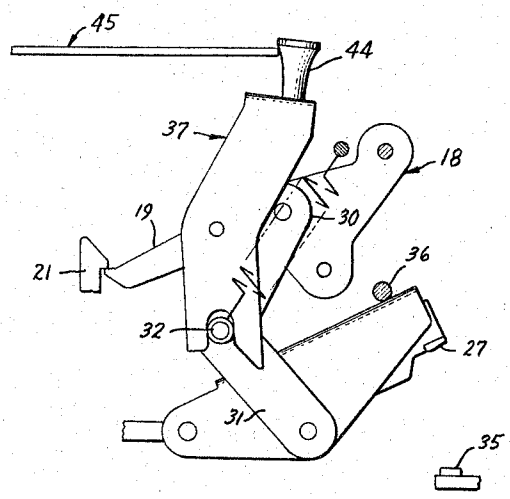

FIG. 5A

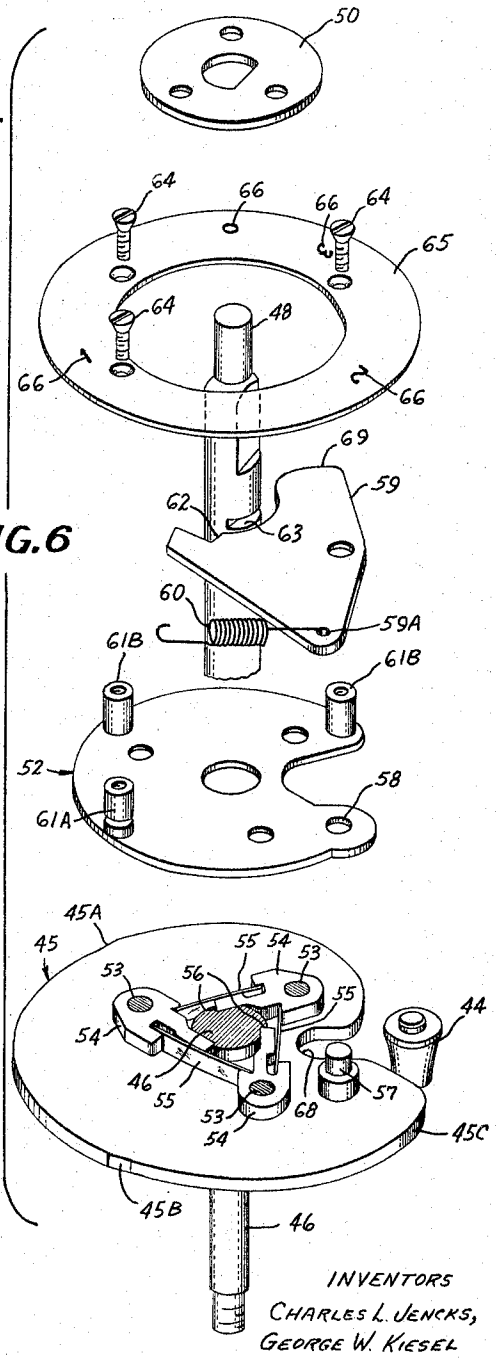

FIG. 6

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CIRCUIT BREAKER ROTARY HANDLE MECHANISM CAM LOCK

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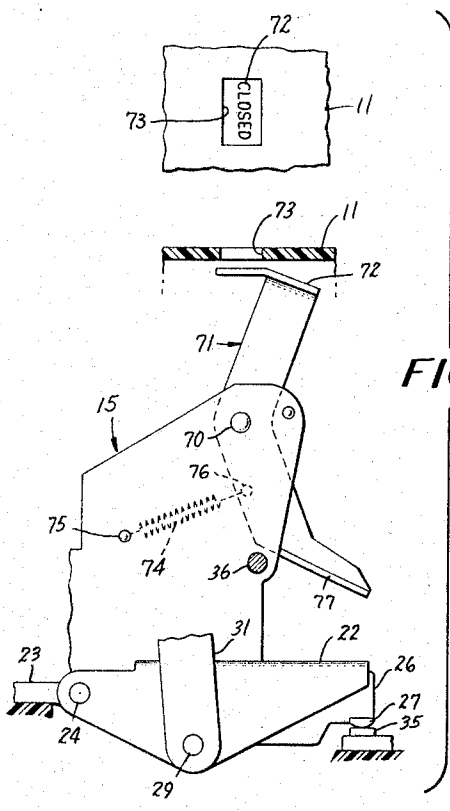

FIG. 7

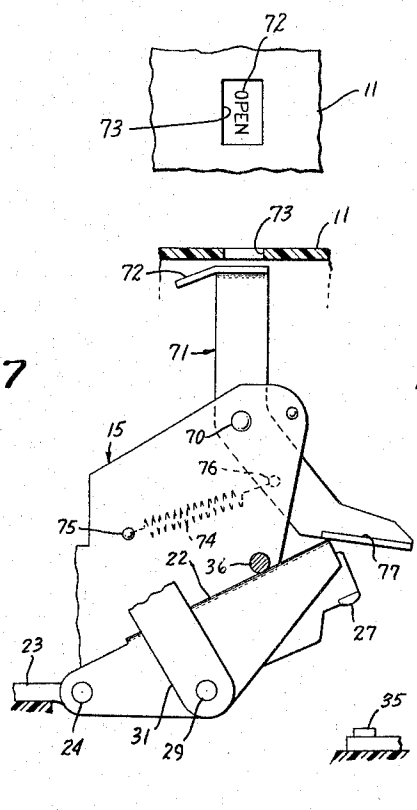

FIG. 8

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United States Patent Office 3,382,331
Patented May 7, 1968

3,382,331

CIRCUIT BREAKER ROTARY HANDLE MECHANISM CAM LOCK

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Filed Nov. 30, 1966, Ser. No. 597,946
9 Claims. (Cl. 200—50)

Our invention relates to circuit breakers of substantial current carrying capacity and more particularly to circuit breakers of the type including a rotary or twist type handle requiring repetitive arcuate motions and acting on an operated member through a ratchet type mechanism.

Circuit breakers that are designed to be of substantial current-carrying capacity require relatively large contacts which operate at high speed and exert high contact pressure. In order to facilitate manual operation of breakers of this type with their attendant high spring forces, various mechanical means have been developed. One such mechanical means is shown for example in our co-pending patent application Ser. No. 483,718, filed Aug. 30, 1965, now Patent No. 3,343,109, issued on Sept. 19, 1967 and assigned to the same assignee as the present application. This means involves a repetitively operable ratcheting type rotary handle mechanism to move the circuit breaker contacts to the closed position. A separate operating member is provided for causing movement of the contacts from closed to open position. In the mechanism as disclosed in the aforesaid application a means is provided to prevent further operation of the handle after the breaker is in "ON" position, thus requiring the breaker to be first tripped or moved to "OFF" position. With the ratcheting type of connection employed however, it is possible to move the handle away from "ON" position to the first ratchet-engaging position while the breaker remains closed. This permits the operator to exert a high force on the locked mechanism which could cause breakage. This is also undesirable because the handle becomes locked in an intermediate position, which is not desirable from an appearance standpoint, and which might be confusing to an operator.

In addition, and also posing a serious problem, it has been found that during the final closing of the circuit breaker, the shaft member to which motion is transmitted by the rotary handle is susceptible to being overridden by the operating mechanism of the breaker.

This overriding problem results from the fact that in the mechanism referred to, a cam member is used to move an operated member against the bias of a strong spring force and then suddenly release it. At the point where the cam suddenly releases the driven member, the cam surface changes its slope sharply. At this point the cam member, under the bias of the springs, tends to become the driving member and to "throw" the cam at accelerated speed in the same direction in which it is being manually turned. This is a particularly difficult problem in the case referred to since the cam member itself is being operated by a manually operable handle member which is connected to the cam member by a ratchet type connection as mentioned above, thereby permitting accelerated movement of the cam member with respect to the handle member. Such overriding causes impacting of the parts, with possibility of breakage after a large number of operations. Such overriding also creates the possibility that the mechanism cam may "jump over" the closed circuit position, in a manner to be described, and prevent the contacts from closing, and requiring repetition of the operating cycle.

It is an object of the present invention to provide a rotary handle mechanism for a circuit breaker of substantial current-carrying capacity which mechanism includes a locking means to lock the rotary handle against all movement when the circuit breaker is in the closed position.

It is another object of the present invention to provide in such a circuit breaker a rotary handle mechanism having means which will prevent the shaft member affixed to the rotary handle from being overridden during closing of the breaker.

It is still a further object of the present invention to provide in a circuit breaker of substantial current-carrying capacity a locking means for a rotary handle mechanism which will perform the dual function of locking the rotary handle against movement when the breaker is closed and will also prevent the shaft member of the rotary handle from being overridden during closing of the breaker.

Yet another object of the present invention is to provide such a locking means for rotary handle mechanisms which is relatively inexpensive to manufacture, easy to install, and reliable in operation.

In accordance with the invention in one form, there is provided a rotary handle type circuit breaker operating mechanism comprising a shaft member having one end thereof rotatably mounted within the the circuit breaker and an operating handle affixed to the other end of the shaft member whereby arcuate movement of the handle causes rotation of the shaft member. A cam means is supported on the shaft member intermediate the ends thereof and is movable relative thereto. Movement of the cam means causes closing of the circuit breaker from an "OFF" condition to an "ON" condition. A locking means is supported on the cam means for rotation therewith and also for movement relative thereto. A biasing means supported on the cam means biases the locking means in a given direction. The locking means is operatively engageable with the shaft member in such a manner that when the circuit breaker is in the "ON" position, the locking means locks the shaft member to the cam means thereby preventing operation of the operating handle and further movement of the cam means until the locking means is released.

The invention will be more fully understood from the following detailed description, and its scope will be pointed out in the appended claims.

In the drawings,

FIGURE 1 is a side elevation view of an electrical circuit breaker incorporating the invention, a portion of the side casing being broken away;

FIGURE 2 is a plan view of the rotary handle mechanism cam lock in accordance with the present invention illustrating the position of the moving elements thereof when the circuit breaker is in a closed condition;

FIGURE 3A is an enlarged side elevational view of the moving elements of the circuit breaker of FIGURE 1 in the tripped condition;

FIGURE 3B is a plan view of the rotary handle locking mechanism in accordance with the present invention shown in the condition which it assumes when the circuit breaker is in the tripped or "OFF" condition as shown in FIGURE 3A;

FIGURE 4A is a side elevational view similar to FIGURE 3A and shows the position of the moving elements after the cam has been rotated through a first "step" of 120°;

FIGURE 4B is a plan view of the rotary handle locking mechanism shown in the condition which it assumes when the circuit breaker is in the position shown in FIGURE 4A;

FIGURE 5A is a side elevational view similar to FIGURE 3A and shows the position of the moving elements just before the circuit breaker contacts close;

FIGURE 5B is a plan view of the rotary handle locking mechanism shown in the condition which it assumes when the circuit breaker is in the position shown in FIGURE 5A; and

FIGURE 6 is an exploded perspective view of the elements comprising the rotary handle locking mechanism in accordance with the present invention;

FIGURE 7 is a side elevational view of a portion of the circuit breaker of FIGURE 1 illustrating the position of the indicator arm when the contacts are in the "CLOSED" condition; and

FIGURE 8 is a side elevational view similar to FIGURE 7 and illustrates the position of the indicator arm when the contacts are in the "OPEN" condition.

Referring now to FIGURE 1, there is illustrated a circuit breaker shown generally at **10** embodying the present invention and having an insulating casing or housing comprising an upper portion **11** and a lower portion **12**. The upper portion **11** and the lower portion **12** of the circuit breaker are joined along planar surfaces designated generally at **13**.

Operating mechanism

The operating mechanism of the circuit breaker indicated generally at **14** is supported within the lower portion **12** of the housing, and includes a supporting frame **15** only a portion of which is shown in FIGURE 1. Pivotally mounted on the supporting frame **15** by means of the pivot pin **16** at end portion **17** is a releasable member or cradle generally designated by the numeral **18**. The opposite end or latch portion **19** of the releasable member **18** is engaged with the shoulder **20** on the latch member, generally designated by the numeral **21**, which is pivotally mounted within the lower portion **12** of the housing on a pivot pin (not shown) in a manner well-known in the art.

A generally channel-shaped contact arm **22** is pivotally mounted on a support member **23** which is attached to the bottom wall of the lower portion **12** of the circuit breaker housing by means of bolts (not shown). A contact member **26** is also pivotally mounted on the pivot pin **24** within the bracket **25**, and carries a contact **27** at its outer end. Suitable biasing means (not shown) is provided between the bracket **25** and the contact member **26** resiliently limiting movement of the contact member **26** toward the back of the contact arm **22**. The cradle **18** and the contact arm **22** are connected intermediate their ends by the pivot pins **28, 29** to a toggle linkage provided by the toggle links **30, 31** which are pivotally connected to each other by the knee pin **32**. The toggle linkage is biased toward straightened condition by a pair of tension springs **33** (only one shown) one on each side of the cradle **18** which are attached to the knee pin **32** of the toggle linkage at one end and to the pin **34** fixedly carried by the supporting frame **15**, at the other end.

The line of action of the tension springs **33** thus passes on the fixed contact side of the pivot pin **28**, when the parts are in the position shown in FIGURE 1. Thus, the springs bias the toggle knee pin to the right as viewed, retaining the toggle links in straightened condition. The toggle links when in straightened condition, retain the contact arm **22** in closed position, with the contact **27** in contact with the stationary contact **35**. At the same time, the line of action of the springs **33** passes to the left of the pivot **16** of the cradle **18** and bias the cradle **18** in a clockwise direction about the pivot pin **16**. Movement of the cradle **18** in clockwise direction is prevented however, by the engagement of the latch portion **19** with the latch member **21**.

When the cradle **18** is released by the latch member **21**, the cradle **18** rotates in a clockwise direction under the pressure of the tension springs **33** which apply an upward force on the knee pin **32** moving the contacts to open position as shown in FIGURE 3A. In this position, the pin **18A** engages the upper toggle **30** and causes the toggle links **30, 31** to buckle away from the fixed contact **35**, thereby increasing the amount of contact separation. In the open or tripped condition, the cradle **18** abuts against the pin **34**. Also, the bracket **25** of the contact arm **22** abuts against the stop **36** as shown in FIGURE 3A.

In order to re-close the circuit breaker from the open position shown in FIGURE 3A to the closed position shown in FIGURE 1 reclosing means is provided including a generally V-shaped lever, generally designated by the numeral **37**, which is pivotally mounted on the supporting frame **15** by the pivot pin **38**. The lever **37** has a bifurcated portion **39** providing a recess **40** and prongs **41, 42** which engage and operate the knee pin **32** of the toggle linkage in a manner to be described.

Pivotally mounted on the supporting frame **15** by means of pivot pin **70** as best seen in FIGURES 7 and 8 is an indicator arm **71** which by means of the indicia **72** carried at one end thereof indicates whether the contacts **27, 35** are in the "CLOSED" or "OPEN" condition. An opening **73** is provided in the upper portion **11** of the circuit breaker housing to permit viewing the indicia **72** on the indicator arm **71**. The arm **71** is spring biased in a clockwise direction by means of spring **74** which has one end fixed to pin **75** carried by the supporting frame **15** on the outer surface thereof, while the other end of the spring **74** is fixed in an opening **76** provided in the indicator arm **71**. The other end of the indicator arm **71** is provided with a reverse bend portion **77** which performs a dual function as set forth hereinbelow.

Thus, as seen in FIGURE 7, when the contacts are in the "CLOSED" condition, the indicator arm **71** under the influence of spring **74** has moved in a clockwise direction until the reverse bend portion **77** of the arm **71** engages the end wall of the supporting frame **15**. In this position, the word "CLOSED" carried by the arm **71** is positioned under the opening **73** in the upper portion **11** of the circuit breaker housing.

When the circuit breaker trips, the contact arm **22** moves in a direction away from the stationary contact **35**. This movement continues until a portion of the contact arm **22** abuts against the stop **36**. As best seen in FIGURE 8, when the contact arm **22** moves away from the stationary contact **35**, a portion of the contact arm **22** engages the reverse bend portion **77** of the indicator arm **71** thereby moving the arm **71** in a counterclockwise direction against the bias of spring **74**. This movement of the indicator arm **71** continues until the contact arm **22** abuts against the stop **36** wherein the word "OPEN" carried by the indicator arm **71** is positioned in the viewing opening **73** provided in the circuit breaker housing.

Handle mechanism

The uppermost end of the resetting lever **37** has a cam roller **44** rotatably mounted thereon which engages the periphery of a disc-type cam comprising a plate generally designated by the numeral **45**. The cam plate **45** is mounted on a shaft **46** (see FIGURE 1) which has one end rotatably supported in a bracket **47** on the supporting frame **15** and the other end portion **48** extending outwardly of the upper portion **11** of the circuit breaker housing. A handle **49** is mounted on the end shaft portion **48** and held in assembly by the plate **50** on the interior of the upper portion **11** of the housing and by fasteners **51** so that it will rotate the cam shaft **46**.

As best seen in FIGURES 2 and 6, a second generally circular plate **52** of lesser circumference than the cam plate **45** is supported on the cam plate **45** in spaced coaxial relation thereto, by means of rivets **53** or the like. Pivotally mounted on the rivets **53** between the cam plate **45** and the plate **52**, are pawls **54** which are biased by springs **55** into engagement with teeth or shoulders **56** on the shaft **46** so that the plates **45** and **52** will rotate with the shaft **46**. The cam plate **45** acts on the cam roller **44** to provide a step-type ratcheted operation of the

lever 37 against the pressure of springs 33 and then suddenly releases it to close the contacts 27, 35 rapidly, as will be explained more fully hereinbelow by reference to the partial views of the primary moving elements.

Pivotally supported on a pivot pin 57 which extends through an opening 58 in the plate 52 is a substantially triangular shaped cam lock member 59. A tension spring 60 has one end engaged in a hole 59A in the cam lock member 59 and the other end connected to a post 61A carried by the plate 52 and continually biases the cam lock member 59 in a clockwise direction (see FIGURE 3B). The cam lock member 59 has a notched portion or shoulder 62 which upon rotation of the shaft 46 enters the slot 63 in the shaft and locks the plates 45 and 52 to the shaft 46 for a purpose to be more fully described hereinbelow.

For the purpose of indicating to the operator the rotated condition of the cam plate 45, an indicator ring 65 is provided. The ring 65 is mounted in spaced relation to the plate 52 by post 61A, 61B and screws 64. the ring 65 has suitable indicia 66 marked on the upper surface thereof. A suitable opening 67 is provided in the upper portion 11 of the circuit breaker housing to permit viewing the indicia 66 on the indicator ring 65. Thus, the indicia 66 provides a means whereby an operator can readily determine the extent of rotation of the cam 45 at any particular time and concomitantly the relative position of the lever 37.

Handle operation

(1) *Opening or "tripping."*—FIGURES 1 and 2 illustrate the moving elements of the circuit breaker operating mechanism in the closed position of the contacts. In this position the cam roller 44 of the lever 37 is disposed within the notch 68 of the cam plate 45 and the contacts 27, 35 are closed. In this condition, the cam roller 44 has forced the cam lock member 59 counterclockwise against the bias of the spring 60 so that the portion 69 of the lock member 59 is positioned in the slot 63 of the shaft 46, thereby locking the shaft 46 against rotation with respect to the plates 52 and 45. The plates 52 and 45 are, in turn, prevented from rotating by the fact that, in this condition of the parts, the cam roller 44 is in the recess portion 68 of the cam plate 45. Thus, the roller 44 is restricted, by the pivoted mounting of the lever 37, to movement in a direction radially of the axis of rotation of the shaft 46. Rotation in either direction of the cam plate 45 in this condition of the parts, however, would tend to force the roller 44 at right angles to such radial direction and therefore such rotation is blocked. This in turn blocks movement of the shaft 46. Since the handle 49 is affixed to the shaft 46 the handle 49 cannot be moved away from the "ON" position until the breaker is first "tripped" or moved to "OFF" position. This is accomplished by manually depressing an "OFF" or "trip" button, not shown, which moves the latch 21 away from the cradle 18, releasing it.

Upon pivoting of the latch member 21, either manually or due to the action of a current-responsive means, not shown, the springs 33 rotate the released cradle 18 in a clockwise direction as viewed in FIGURE 1, and lift the contact arm 22 and contact 27 rapidly from the fixed contact 35 until the cradle 18 abuts against the stop pin 34 and the contact arm 22 abuts against the stop 36. The knee pin 32 of the toggle linkage is then fully within the recess 40 of the lever 37 and has moved the lever 37 clockwise as viewed, moving the roller 44 outwardly of the recess 68 in the cam plate 45. This is the tripped or "OFF" position shown in FIGURE 3A. As more clearly shown in FIGURE 3B, in the tripped condition the cam lock member 59 which is biased against the cam roller 44 by the spring 60 now is positioned in an intermediate position such that the portion 69 of the cam lock 59 is disengaged from the slot 63 in the shaft 46 and the shoulder 62 is also disengaged, thereby freeing the shaft 46 for rotation independently of the cam plate 45. In this condition, the handle 49 may be rotated counterclockwise as viewed in FIGURE 3B as permitted by the ratchet system 120° (as limited by stop means, not shown, carried by the cover) to the next ratchet position.

(2) *Closing.*—In closing the circuit breaker from this tripped condition, the operator first rotates the handle 49 *counterclockwise* 120° as described above, to the next ratchet position. The handle 49 is then rotated in a *clockwise* direction, imparting similar rotation to the shaft 46 and the cam plate 45 which is engaged therewith by the pawls 54 moving the parts to the position of FIGURES 4A and 4B. Following this, the handle 49 is again moved counterclockwise 120° to the next ratchet position, and clockwise again, moving the parts to a position 120° from that shown in FIGURES 4A and 4B. As the cam plate 45 is rotated in this manner, the upper end of the lever 37 is forced toward the fixed contact 35 by the increasing radius of the camming surface of the cam plate 45 and its bifurcated end portion 39 acts on the toggle linkage through the knee-pin 32. The contact arm 22 is prevented from pivoting counterclockwise by the stop 36, while the movement of the toggle links 30, 31 draws the latch portion 19 of the cradle 18 downwardly and tensions the springs 33. For the purpose of ensuring that the cam plate 45 retains its position at the end of the first 120° of rotation, and does not move backward while the shaft 46 is being rotated in counterclockwise direction to the next ratchet engaging position, the cam surface of plate 45 is provided with a slight recess or "dwell" 45A in which the cam roller 44 rests at the end of 120° of travel.

Likewise, a second recess or "dwell" 45B is provided, for a similar purpose in which the cam roller rests at the end of 240° of rotation.

(3) *Cam lock operation.*—During the first 120° rotation of the cam plate 45, the cam lock member 59 which is carried by the plate 52 has also been rotated and is now no longer biased against the cam roller 44, but rather against the shaft 46 by the spring 60 (which as noted earlier constantly biases the cam lock member 59 in a clockwise direction).

After a third counterclockwise movement of 120° and return of approximately 90°, the action of the handle 49 has advanced the cam plate 45 about 330° from the start, to the point where the cam roller 44 is about to drop into the notch 68 of the cam plate 45, as shown in FIGURE 5B. The cam plate 45 is preferably provided with a flattened or even slightly concave edge portion 45C at this point so that the cam roller 44 may be temporarily left in this "closing impending" position so as to facilitate the synchronizing of the final closing with some other selected event. The upper end of the lever 37 has been pivoted well towards the fixed contact 35 and the latch portion 19 of the cradle 18 has been moved downwardly to cam the latch member 21 out of the way, moving below the shoulder 20. This pivoting of the lever 37 substantially elongates the springs 33, and stores energy therein. In this "closing impending" position, the cam lock member 59 has been rotated such that the notched or recessed portion 62 of the cam lock member 59 engages a corner of the slot 63 in the shaft 46 thereby preventing any clockwise rotation of the cam plate 45 relative to the shaft 46. It will be recalled that relative movement of this sense is permitted at other times, being necessary in order to re-engage the handle at the next ratchet position. This locking action of the lock member 59 prevents the cam plate 45 from overriding the shaft 46 due to the forces exerted by the cam roller 44 of resetting lever 37 on the cam plate 45 as the cam roller 44 rides over the final point of the cam plate 45. Thus it will be observed that there is a high force exerted, because of the springs 33, by the roller 44 inwardly radially on the cam plate 45. When the roller 44 reaches the portion 45C of the cam plate 45, this inwardly-

directed force acts on the cam surface 45C and tends to "throw" the cam plate 45 in clockwise direction as viewed. If the cam plate 45 were free to rotate clockwise with respect to the shaft 46 as it is at other times, it would do so, since the shaft would not follow the rapid accelerating movement of the cam because of the inertia of the shaft 46 and of the handle 49 and the fact that at this time the handle is being held manually by the operator.

The engagement of the shoulder 62 of the lock member 59 with the shaft 46 takes place when the handle is rotated counterclockwise for the third time, to engage the ratchet for the third time.

As the cam plate 45 rotates the final 30°, the cam roller 44 drops into the recess 68 and allows the upper end of the lever 37 to move rapidly counterclockwise as viewed. At this same time, the toggle linkage is straightened rapidly by the stored energy of the springs 33 and drives the contact arm 22, and more specifically the movable contact 27 carried thereby against the fixed contact 35. The cam roller 44 is now within the recess 68 where it remains until such time as the circuit breaker is tripped.

When the cam roller 44 drops into the recess 68 of the cam plate 45, the cam roller 44 engages the cam lock member 59 and rotates it counterclockwise as viewed against the bias of spring 60. This releases the notched portion 62 of the cam lock 59 from its engagement with a corner of the slot 63 of the shaft 46. If desired, the parts could be allowed to remain in this condition, with no seriously objectionable results. As previously stated, since the sides of the recess 68 extend substantially radially of the cam plate 45, no rotation of the cam member is permitted in either direction until the roller is moved outwardly at least a small amount. It should be noted that if further manual operation of the cam member were permitted, it would cause separation of the contacts at a rate of speed directly proportional to the speed of movement of the operating handle. Such "slow-break" separation of the contacts is very undesirable and could cause complete failure of the device.

A minor objection to allowing the parts to remain in the condition described without further modification however is that it would be possible to turn the handle 120° counterclockwise to the first ratchet-engaging position. It would not, however, be possible to rotate the cam member in clockwise direction thereafter, since the roller 44 would engage the straight side of the recess 68 as previously described. This would leave the handle in an intermediate position, which is not considered desirable.

In order to prevent such ratchet engaging movement of the handle until the parts have first moved to the full open or tripped position, the cam lock member is provided with a second portion 69 which enters the slot 63 as the roller 44 moves the cam lock member 59 to its position shown in FIGURE 1. This locks the shaft 46 so that the handle 49 cannot be operated until the breaker has been tripped and again assumes the position shown in FIGURES 3A and 3B.

It will be observed that when the latch 21 is moved to released position, and the parts move to full open or "tripped" condition, the lever 37 assumes an intermediate position as shown in FIGURE 3A and as determined by the action of the roller or pin 32 in the slot 40. Referring to FIGURE 3B it will be seen that in this intermediate position, the cam lock member is permitted to assume a position in which a cut-away portion intermediate the shoulder 62 and portion 69 permits rotation of the shaft with respect to the cam plate 45. The handle may therefore be rotated 120° counterclockwise to the first ratchet-engaging position, to begin the closing cycle.

Thus, it can be seen that the present invention provides a cam lock for a rotary handle mechanism which performs the dual functions of preventing the cam plate 45 from overriding the shaft 46 of the handle 49 when the breaker is moving to the closed position and also locks the cam plate 45 to the shaft 46 after the breaker has closed thereby preventing rotation of the handle with respect to the cam to the first ratchet-engaging position.

While the invention has been shown in only one particular embodiment, it will be apparent that many modifications thereof may be made, and we therefore intend by the appended claims to cover all such modifications as fall within the true spirit and scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. An electric circuit breaker comprising:
   (a) a support;
   (b) at least one stationary contact supported on said support;
   (c) at least one movable contact;
   (d) means movably supporting said movable contact on said support for movement between a closed circuit position in which it is in engagement with said stationary contact and an open circuit position in which it is out of engagement with said stationary contact;
   (e) operating means for operating said movable contact between said open and closed circuit positions, said operating means comprising a contact operating member and means connecting said contact operating member to said movable contact;
   (f) biasing means biasing said contact operating member in contact closing direction;
   (g) a cam member having a cam surface;
   (h) means movably supporting said cam member for movement along a predetermined path;
   (i) a cam follower member supported on said support and connected to said contact operating member;
   (j) said cam surface engaging said cam follower member as said cam member is moved along said predetermined path and moving said cam follower member in a direction to move said contact operating member away from said closed circuit position against the bias of said biasing means and suddenly permitting movement of said cam follower member in a direction to permit movement of said contact operating member toward said closed circuit position;
   (k) cam operating means supported on said support for moving said cam member along said predetermined path;
   (l) one-way drive means connecting said cam operating means to said cam member to drive said cam member in contact-closing direction; and
   (m) locking means carried by one of said cam member and said cam operating means and preventing relative movement between said cam member and said cam operating means during the final portion only of said movement of said cam member immediately prior to and during said sudden release of said cam follower member and preventing acceleratiton of movement of said cam member in said contact closing direction by action of said cam follower member thereon.

2. An electric circuit breaker as set forth in claim 1, said circuit breaker also comprising means for moving said locking means to inactive position upon movement of said cam follower member to a position corresponding to said open circuit position of said contact operating member.

3. An electric circuit breaker as set forth in claim 1 wherein:
   (a) said cam member is of the circular type;
   (b) said cam operating means is a shaft;
   (c) said one-way drive means is a ratchet drive; and
   (d) said locking means is a locking member pivoted on said circular type cam member, said locking mem-

ber having a shoulder formed thereon engaging said shaft at the commencement of said final portion of said movement of said cam member along said predetermined path.

4. An electric circuit breaker as set forth in claim 3 wherein said cam follower member engages said locking member at the termination of said final portion of said movement of said cam member along said predetermined path to move said shoulder of said locking member out of engagement with said shaft.

5. An electric circuit breaker as set forth in claim 4 wherein:

(a) said locking member has a second portion formed thereon which is moved into engagement with said shaft as said shoulder is moved out of engagement with said shaft by said cam follower member;

(b) said biasing means moving said locking member to an intermediate position when said contacts are in said open circuit position in which both said shoulder and said second portion of said locking member are disengaged from said shaft.

6. A rotary handle mechanism comprising:

(a) a support;

(b) operating means movably supported on said support;

(c) biasing means biasing said operating means in a first direction;

(d) a cam member having a cam surface;

(e) means movably supporting said cam member for rotary movement about an axis fixed with relation to said support and along a predetermined arcuate path;

(f) a cam follower member supported on said support and connected to said operating means;

(g) said cam surface engaging said cam follower member as said cam member is moved along said predetermined path and moving said cam follower member in a direction to move said operating means away from said first direction against the bias of said biasing means and suddenly permitting movement of said cam follower member in a direction to permit movement of said operating means in said first direction;

(h) cam operating means supported on said support for moving said cam member along said predetermined path;

(i) one-way drive means connecting said cam operating means to said cam member to drive said cam member in said first direction; and

(j) locking means carried by one of said cam member and said cam operating means and preventing relative movement between said cam member and said cam operating means during the final portion only of said movement of said cam member immediately prior to and during said sudden release of said cam follower member and preventing acceleration of movement of said cam member in said first direction by action of said cam follower member thereon.

7. A rotary handle mechanism as set forth in claim 6 wherein:

(a) said cam member is of the circular type;

(b) said cam operating means is a shaft supported on said support for rotation about its longitudinal axis;

(c) said one-way drive means is a ratchet drive; and

(d) said locking means is a locking member pivoted on said circular type cam member, said locking member having a shoulder formed thereon engaging said shaft at the commencement of said final portion of the movement of said cam member along said predetermined path.

8. A rotary handle mechanism as set forth in claim 7 wherein said cam follower member engages said locking member at the termination of said final portion of the movement of said circular type cam member along said predeterined path to move said shoulder of said locking member out of engagement with said shaft.

9. A rotary handle mechanism as set forth in claim 8 wherein:

(a) said locking member has a second portion formed thereon which is moved into engagement with said shaft as said shoulder is moved out of engagement with said shaft by said cam follower member;

(b) said biasing means moving said locking member to an intermediate position when said contacts are in said open circuit position in which both said shoulder and said second portion of said locking member are disengaged from said shaft.

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