July 18, 1967 W. W. CAMP 3,332,043

REMOTE OPERATOR FOR A CIRCUIT BREAKER HANDLE

Filed Aug. 5, 1965 2 Sheets-Sheet 1

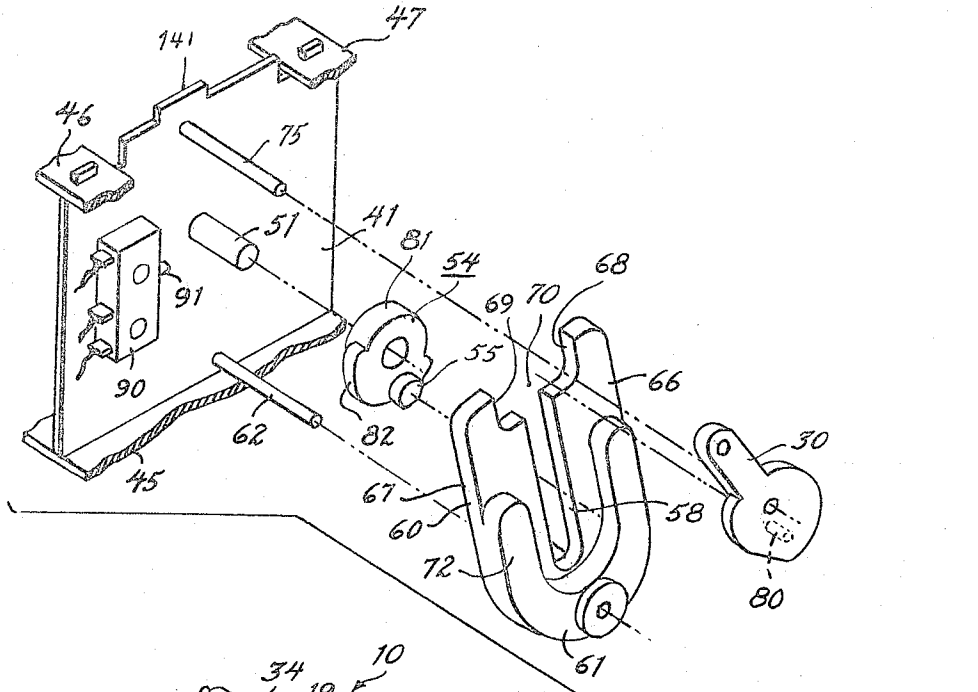


Fig. 6.

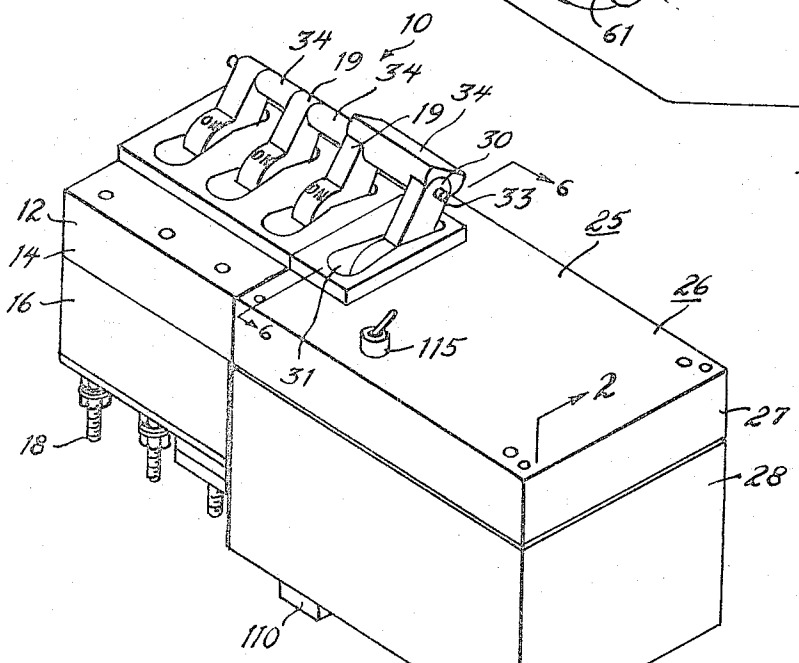
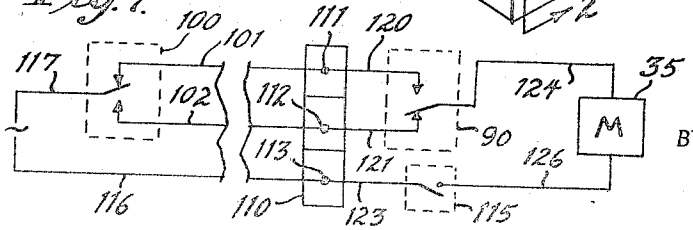


Fig. 1.

Fig. 7.



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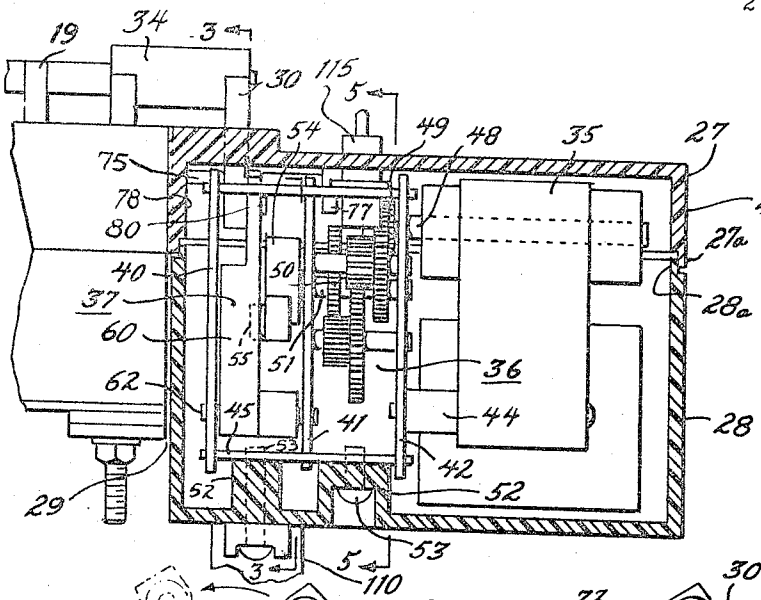


Fig. 2.

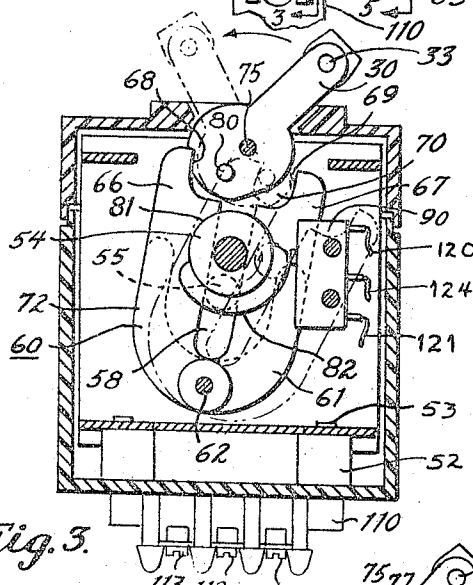


Fig. 3.

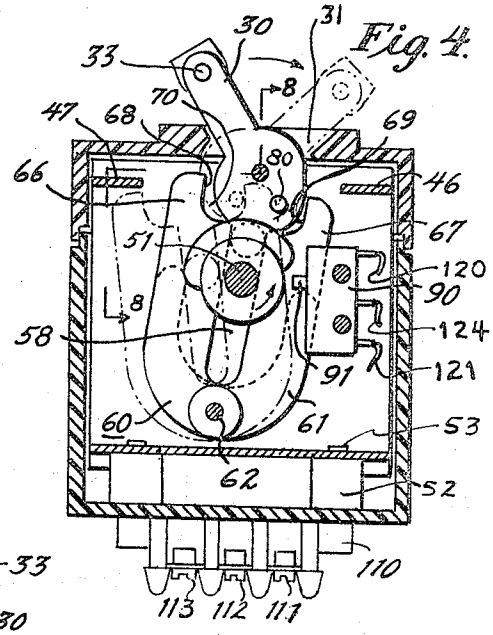


Fig. 4.

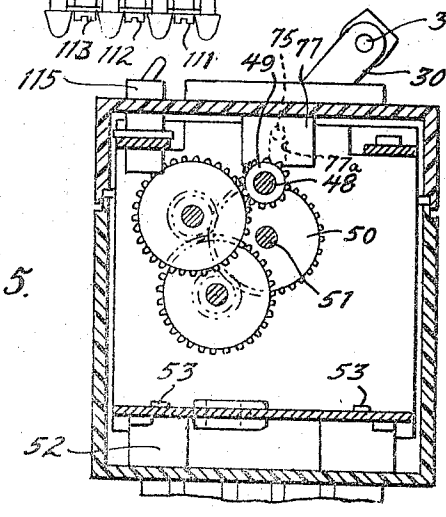


Fig. 5.

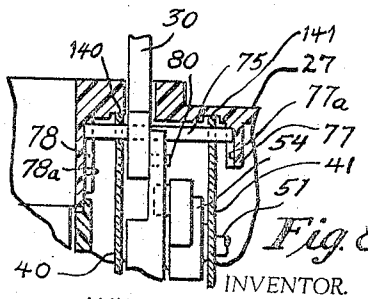


Fig. 8.

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United States Patent Office 3,332,043 Patented July 18, 1967

3,332,043

REMOTE OPERATOR FOR A CIRCUIT BREAKER HANDLE

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Filed Aug. 5, 1965, Ser. No. 477,496
18 Claims. (Cl. 335—71)

This invention relates to a motor driven operator for actuating the handle of a circuit breaker from a remote location and, more particularly, to a remote operator constructed so that manual operation of the circuit breaker handle is also permitted, if desired, and it is an object of this invention to provide an improved remote operator of this type.

This invention is a modification of an invention disclosed in U.S. patent application Ser. No. 477,559, filed Aug. 5, 1965, in the names of William W. Camp and William L. Pitts. In the aforementioned patent application, a remote operator is disclosed which includes an electrical motor connected to a cam-linkage means, the cam-linkage means being constructed so that even though the motor rotates always in the same direction, the connector between the remote operator and the circuit breaker handle is pivoted first in one direction, and then back to its neutral position, and then in an opposite direction, and back to its neutral position, to thereby pivot the circuit breaker handle back and forth between its on and off positions, upon energization of the motor, as desired.

In this invention, the movement of the operator, that is, the connector or arm of the remote operator, is similar to that of the circuit breaker handle but both the operator and the handle pivot about a common axis. This makes possible an extremely compact mechanical connection between the remote operator and the circuit breaker. Further, in this invention, the feature which enables the circuit breaker handle to be manually turned on or off is incorporated in the cam-linkage means housed within the case of the circuit breaker rather than being external thereof.

The remote operator, in this invention, is associated with a circuit breaker having contacts which are opened and closed by a mechanism which is actuatable manually by a pivotal handle, the handle being mechanically connected to the operator of the remote operator for joint pivotal motion about a common axis. The remote operator includes an electrical motor which rotates a shaft in one direction only and which drives a cam and a yoke, the yoke being connected to the operator. As the cam is rotated, it oscillates the yoke back and forth, from and to a neutral or initial position. While so moving, the yoke engages a part of the operator and turns it and the circuit breaker handle to the contacts on or off positions.

The yoke is oscillated back and forth initially in a first direction and then in a second (opposite) direction to first bring the yoke into driving engagement with said operator for pivoting the operator, in one direction, from a first position to a second position, and then to return the yoke to its neutral position in which another part of the yoke is then in driving relation with the operator, at which time movement of the yoke ends. Upon a subsequent initiation of oscillation of the yoke, the yoke is oscillated initially in the second direction, and then in the first (opposite) direction, to initially move the yoke into driving engagement with the operator for pivoting the operator in a second direction (opposite to the first direction) from its second position to its first position, and then to return the yoke to its neutral position, at which time motion of the yoke again ends.

As in the aforementioned application, a switch is provided to initiate energization of the motor and another switch is provided, controlled by the cam, to deenergize the motor when the operator has been pivoted to the contacts on or off positions.

In this invention, the driving connection between the yoke and the operator is formed by two spaced walls on the yoke which receive between them a driven part of the operator. In the initial or neutral position of the operator both walls are spaced from the operator's driven part and the walls are spaced from each other sufficiently that the operator may be pivoted, when the yoke is in the neutral position, between the two positions corresponding to the contacts on and off positions, without the operator's driven part engaging either wall.

The foregoing and other objects of the invention, the principles of the invention, and the best modes in which I have contemplated applying such principles will more fully appear from the following description and accompanying drawings in illustration thereof.

In the drawings,

FIG. 1 is a perspective view of a multipole circuit breaker unit, shown in the on contacts position, and of a remote operator incorporating this invention;

FIG. 2 is a longitudinal, sectional view showing the internal parts of the remote operator in elevation, the view being taken along the line 2—2 in FIG. 1, and showing only a part of the multipole circuit breaker unit in front elevation;

FIG. 3 is a sectional view taken along the line 3—3 in FIG. 2 showing some of the internal parts of the remote operator in elevation and illustrating the on position (circuit breaker contacts closed) of the operator;

FIG. 4 is a view similar to FIG. 3 but showing the off position (circuit breaker contacts open) of the operator;

FIG. 5 is a sectional view taken along the line 5—5 in FIG. 2 and illustrating the gear train for speed reduction;

FIG. 6 is an exploded perspective view illustrating the eccentric cam, yoke and operator or arm and certain associated parts, rotated 180° from the position shown in FIG. 1 generally viewed along the line 6—6 in FIG. 1;

FIG. 7 is a wiring diagram for the remote operator showing the position of the various switches after movement to the on position and deenergization of the motor; and

FIG. 8 is a partial sectional view taken along the line 8—8 in FIG. 4.

Referring to the drawings, a multipole circuit breaker unit **10** is illustrated comprising three circuit breaker poles housed within a common case **12** of molded insulation material, the case **12** being divided lengthwise and horizontally into an upper case **14** and a lower case **16**. The circuit breaker poles are provided with suitable terminals **18** (to be connected to the desired circuit) and with handles **19** for manually moving the circuit breaker contacts (not illustrated) between the on and off contacts positions. The multipole circuit breaker unit **10** is not described in detail herein, as it may be of usual construction, and one known construction is shown by Sprague Patent No. 3,098,912. While this invention is described in connection with a multipole circuit breaker it will be seen that it is equally applicable to a single pole circuit breaker.

Associated with the multipole circuit breaker unit **10** is a remote operator **25** comprising a case **26** of suitable molded insulation material and divided lengthwise and horizontally into an upper case **27** and a lower case **28**, the abutting portions being provided with mating tongues **27***a* and **28***a*. The left hand surface, as viewed in FIG. 2, of the upper case **27** is secured to the right hand surface of the upper case **14**, preferably by an epoxy cement, since

the cases are preferably of phenolic plastic material. Further, to facilitate the assembly, the left hand wall of the lower case **28** is made thinner than the corresponding wall of the upper case **27** so that a recess **29** (FIG. 2) is formed between the lower cases **16** and **28** when the circuit breaker **10** and remote operator **25** are assembled. Preferably, however, the top surfaces of the upper cases **14** and **27** are coplanar, as illustrated in the drawings, and the width and depth of the upper cases **14** and **27** is approximately the same. Suitable screws are provided to secure together the upper and lower cases of the circuit breaker and the remote operator.

The remote operator **25** comprises an operator, connector or arm **30** extending from within the case **26** through an opening **31**, the operator **30** being movable between two positions corresponding to the on (or contacts closed) and off (or contacts open) positions of the handles **19** of the circuit breaker poles. All the handles **19** and the operator **30** are mechanically connected by a tie pin **33** and spacers **34** for joint movement between the on and off positions about a common axis.

The operator **30** is actuated by an electrical motor **35**, FIG. 2, housed within the case **26**, through a gear train **36** and a linkage and cam means **37**, hereinafter referred to as a cam-linkage means **37**.

The motor **35**, the gear train **36** and the cam-linkage means **37** are supported by three vertical plates **40**, **41** and **42** connected together by bottom plate **45** and top plates **46** and **47**, the plate **45** being seated on four bosses **52** (as shown in FIGS. 2 to 5) and secured to the lower case **28** by screws **53**, FIGS. 2 and 5, while the motor **35** is connected to the plate **42** by suitable screws extending through bushings **44**. Preferably, the motor **35** is an alternating current motor. The gear train **36** comprises a suitable number of speed reducing gears mounted on rotating shafts having their ends rotatably supported by the plates **41** and **42** and the cam-linkage means **37** is mounted between the plates **40** and **41**.

The motor **35** has a shaft **48** on which is mounted a driving gear **49** which through the speed reducing gears rotates an output gear **50**. The output gear **50** of the gear train **36** is mounted on a shaft **51** which extends through the plates **41** and **42** and on the part of the shaft **51** which extends to the left (FIG. 2) of the plate **41** is mounted an eccentric cam **54**, the cam **54** being pinned to the shaft **51**, although the eccentric cam should also be pressed on to the shaft **51**, if desired. The eccentric cam **54** includes a pin or projection **55**, the pin **55** extending from the cam **54** (as shown) and being received in an elongated, and substantially straight, slot **58** centrally formed in a yoke or link **60**, FIGS. 3 and 4.

The yoke **60** is pivotally mounted at its lower end portion **61** on a pintle **62**, the ends of the pintle **62** extending through the plates **40** and **41** and receiving spring washers to thereby prevent axial movement of the pintle **62**, but the yoke **60** is freely pivotal about the pintle **62** and movable back and forth in an arcuate path by the pin **55**.

The yoke **60** comprises two legs **66** and **67**, the upper end portions of the legs **66** and **67** being notched to define a space **70** between opposed walls **68** and **69**, a pin **80** carried by the operator **30** being received in the space **70** between walls **68** and **69**. As illustrated, the upper portion of the slot **58** communicates with the space **70** and the yoke **60** is provided with a strengthening U-shaped rib **72** which, as illustrated, extends part way up the legs **66** and **67**.

The operator or arm **30** is pivotally mounted on a pintle **75** which is coaxial with the pintle (not shown) about which the handles pivot and the pintle **75** extends through suitable openings in the plates **40** and **41**, axial movement of the pintle **75** being prevented by a depending portion **77** and an end wall **78** of the upper case **27** which receive, in suitable grooves **77***a* and **78***a* (FIG. 8) whose lower ends are open, the end portions of the pintle **75**, i.e., the end portions which extend beyond the left hand side of the plate **40** and the right hand side of the plate **41**.

Since the handles **19** pivot between two limiting positions, as determined by the circuit breaker's construction, and the operator **30** has no limiting positions of its own, being limited in its end movement only by virtue of its mechanical connection to the handles **19**, the operator **30** is spaced from the end walls defining the space **31**, as viewed in FIGS. 3 and 4, and is also spaced from the driving walls **68** and **69** of the yoke **60**. Thus, the handles **19** and the operator **30** pivot in parallel planes, through the same angular motion, and about the same axis. Also, when the operator **30** is actuated by the cam-linkage means **37**, once the operator **30** carries the handles **19** past a certain position, the circuit breaker mechanism aids in completing the movement of the handles **19** and operator **30** due to the fact that the pin **80** can always be freely moved away from the wall **68** or **69** which happens to be driving it at a particular time.

The operator **30** is positioned along the pintle **75** by being between the yoke **60** and the end plate **40** (FIG. 2) and by being received in the opening **31** which is disposed generally perpendicularly to the pintle **75**.

The eccentric cam **54** comprises a low surface **81** and high surface **82**, the two surfaces each covering approximately 180° of the periphery of the cam **54**. Associated with the cam **54** is a switch **90**, preferably secured to the plate **41**, the switch **90** having a reciprocable plunger **91** spring biased to an initial position, the plunger **91** being in the path of movement of the cam **54** and the plunger **91** being depressed by the high surface **82** of the cam **54** and permitted to return to its initial position when the cam rotates sufficiently to disengage the high surface **82** from the plunger **91**, i.e., when the low surface **81** is opposite the plunger **91**.

Referring to the wiring diagram of FIG. 7, the motor **35** is usually controlled by a single pole double throw maintained contact switch **100** which is usually located at a distance from the remote operator **25** and the multipole circuit breaker unit **10** and is connected to a terminal block **110** carried by the under surface of the lower case part **28**, the block **110** having three connector posts **111**, **112** and **113** and being secured to the under side of the case by suitable screws. If desired, a safety switch **115** may also be provided mounted on the plate **47**, extending through the upper case **27**. A wire **117** connects one side of a suitable power source to the center contact of switch **100**, wires **101** and **102** extend from the switch **100** to the first and second posts, **111** and **112**, and a wire **116** connects the third post **113** back to the power source.

From the first terminal post **111** a wire **120** extends to an end contact of the switch **90**, a wire **121** extends from the second post **112** to the opposite end contact of switch **90**, and a third wire **123** extends from the third post **113** to the safety switch **115**. From the central contact of switch **90** a wire **124** extends to the motor **35** and a wire **126** extends from the motor **35** to the switch **115**.

The switches **90** and **100** are arranged so that when the circuit breaker handles **19** and the operator **30** are in the on position of the circuit breaker contacts, the contacts between the wires **101** and **117** are in engagement and the contacts between the wires **121** and **124** of the switch **90** are closed, the other contacts being open, whereupon the motor circuit is open, as shown in FIG. 7. Assuming the position to be as shown in FIG. 7 and the circuit breaker handles **19** to be in the on position, if it is desired to remotely move the handles **19** to the off position, assuming the safety switch **115** to be closed, the remote switch **100** is turned, closing the circuit between wires **102** and **117** (which simultaneously opens the circuit between wires **101** and **117**) energizing the motor **35** to rotate the cam **54** assuming the safety switch to be closed. The cam **54** rotates through about 180° moving the pin **55** from its lowest position within the slot **58** to the top thereof, and

simultaneously pivots the yoke **60**, as viewed in FIG. 3, first to the right and then to the left, the motion of the yoke stopping when the full line position of FIG. 4 is achieved.

When the handles **19** are in the on position and the yoke **60** is in the neutral position, solid lines FIG. 3, the surface **68** is in driving relation with, but slightly spaced from the pin **80**, and upon energization of the motor **35**, the cam **54** first pivots the yoke **60** to the right bringing the surfaces **68** into driving engagement with the pin **80** to rotate the operator **30** about its pintle **25** to the dot-dash (or off) position of FIG. 3, whereupon continued rotation of the cam **54** oscillates the yoke **60** back to the left, returning the yoke **60** to its initial or neutral position, illustrated in solid lines in FIG. 3. Just prior to the return of the yoke **60** to its initial position, the cam **54**, whose high surface **82** has till this time held the plunger **91** of the switch **90** depressed, rotates sufficiently to bring the low surface **81** opposite the plunger, whereupon the plunger is released, opening the circuit to the motor **35** by opening the circuit between wires **121** and **124**.

It will be noted that at the end of the aforedescribed movement from the on to the off position of the operator **30**, the yoke wall **69** now assumes a driving position with the pin **80**, but on the opposite side of and slightly spaced therefrom, and this position between the wall **69** and the pin **80** is illustrated in solid lines in FIG. 4. At this time, the circuit between wires **117** and **100** is open but closed between wires **117** and **102**, and the circuit between wires **121** and **124** is open but closed between wires **120** and **124**, this circuit arrangement not being shown in the drawings. However, when the handles **19** are in the off position (solid lines of FIG. 4) and the circuit is as just described, if the switch **100** is now actuated, closing the circuit between wires **17** and **101**, the motor will be energized to rotate the cam **54** about 180° further, in the same direction as before, and indicated by the arrow in FIG. 4, but the yoke **60** is then pivoted initially in the opposite direction, from the solid line position of FIG. 4 to the dot-dash position of FIG. 4, and then back to its neutral position. That is, the wall **69** moves to the left and engages the pin **80**, pivots the operator **30** to the on position and then oscillates back to the right to its neutral position and the position illustrated in solid lines in FIG. 4, but shortly before the solid line position is attained, the plunger is depressed by the high surface **82** to open the circuit to the motor, the cam-linkage means and the operator **30** now all having returned to the full line position of FIG. 3.

As seen in FIGS. 3 and 4, the engagement of the walls **68** and **69** with the pin **80** takes place between the pin **75** and the pin **62**. This arrangement results in the operator **30** pivoting from one side to the other and thus being placed in a position to be driven by either the wall **68** or **69** as the yoke **60** oscillates about the pin **62** through the same angle each time the cam rotates substantially one-half a turn.

Further, the various parts are constructed so that the legs **66** and **67** of the yoke **60** are deflectable when the operator **30** is near the end of its angular movement. That is, the cam **54** continues to pivot the yoke **60** slightly beyond the angular movement of the yoke **60** corresponding to the end or limit position of the operator **30**, as determined by the handles **19**. Such continued motion of the yoke **60** when the movement of the operator **30** has theoretically stopped places a force or overstress on the pin **80**, and bends the leg **66** or **67**, depending on which one happens to be driving the pin **80**, insuring that the handles **19** have in fact been moved to their end positions and tending to insure that the mechanism of the circuit breaker has relatched while moving to the off position. The material and size of the legs **66** and **67** is chosen so that the legs deflect or spring sufficiently but to not yield permanently. A glass filled nylon material has been found preferable for the yoke **60** and the same material has been used for the cam **54** and the operator **30**.

As seen in FIGS. 3 and 4, it has been found preferable to align the pin **75**, the shaft **51**, and the pin **62**, and to align with them the slot **58** when the latter is in the neutral position.

Further, due to the spacing between the walls **68** and **69**, if one attempts to actuate the remote operator to close the circuit breaker contacts while an overload persists, the operator **30** will be turned to the off position by the handles **19**, even if one attempts to close the contacts by energizing the remote operator, since the circuit breaker is of the kind which will trip open and whose contacts cannot be held in the contacts closed position even if one normally holds the handle in the on position at such time.

It is desirable to provide one of the circuit breaker poles with an auxiliary switch (not illustrated) which is sensitive to the physical relation of the circuit breaker contacts (also not illustrated) to each other and which controls a signal light near the remote control switch **100**. The auxiliary switch can be arranged, for instance, to close the circuit of the signal light when the circuit breaker contacts are closed and to open the circuit thereof when the contacts are open. Thus, the person operating the control switch **100** will know the condition of the circuit breaker contacts from whether the signal light is energized or not in addition to the position of the switch **100**. This is desirable because it is possible for the handles **19** to be moved to the off position while the switch **100** is in the on position or vice versa. Such manual movement of the handles **19** will not change the position of the switch **100** so that a person at the switch **100**, and not being able to see the handles **19**, could possibly be mistaken as to the actual position of the circuit breaker contacts, if no such signal light is provided, and if unknown to the person at the switch **100**, the handles **19** had been turned manually from that indicated by the position of the switch **100**.

The mentioned grooves **77***a* and **78***a* (which receive the ends of the pin **75**) together with, if desired, upper projections **140** and **141** of plates **40** and **41**, received in grooves in the upper case **27**, (FIG. 8), help seat the lower case **28** to which have been assembled the motor **35**, gear train **36** and the cam-linkage means **37**, and the space between the tongues may vary depending on the extent of the seating which takes place.

Of course, while a particular gear arrangement has been illustrated, other arrangements could be provided for the motor **35**.

Similarly while an alternating current induction motor is preferred, other types of motors, both for alternating and direct current, could be provided.

While not illustrated, spring clips or other arrangements can be provided on the ends of the handle tie pin **33** to prevent its axial movement.

Further, while particular materials have been mentioned, it is understood that other materials could be substituted for the various parts without departing from the scope of this invention.

In FIGS. 3 and 4 the wires **120**, **121** and **124** are shown broken off and no attempt has been made in FIGS. 1 to 6 and 8 to show the wiring arrangement for which the diagram of FIG. 7 should be consulted.

Thus, it is seen that the yoke walls **68** and **69** are spaced sufficiently apart so that if the operator **30** is in the on position it can be manually turned to the off position, or vice versa, when the yoke **60** is in the neutral position. Even while the yoke **60** is moving, the operator **30** can be manually moved toward the position toward which the moving yoke would otherwise move it.

If the handle **19** and the operator **30** are manually restrained or otherwise prevented from movement, and the motor **35** is energized to actuate the yolk **60**, the yoke **60** will move into engagement with the pin **80** and stop,

the motor shaft also stopping at this time, until the restraint is removed, at which time the motor shaft starts to rotate and the yoke completes its oscillation. Thus, with a sufficiently small motor, the handle 19 may be held manually in the off position, if need be, for safety or any other reason, even though the energized motor attempts to close the contacts. Of course, the various parts must be made strong enough to resist the loads imposed thereon at such time.

Having described the invention, what I claim is:

1. In combination, a circuit breaker having contacts which are opened or closed by a mechanism, a circuit breaker handle pivotal between first and second positions corresponding to the open and closed contacts positions, a remote operator having an arm pivotal between first and second positions corresponding to the first and second positions of said circuit breaker handle, said handle and said arm being mechanically connected and jointly movable about a common axis, said remote operator including an electrical motor having an output shaft rotatable only in one direction when successively energized, a linkage and cam means connected to said arm and driven by said motor, said linkage including opposed faces in driving position with said arm, said faces being spaced apart to permit manual operation of said handle and arm independently of said linkage, a first switch connected to said motor to energize the latter, and a second switch adjacent to and actuated by said linkage and cam means to deenergize said electrical motor upon movement of said arm from one of its positions to the other.

2. In combination, a circuit breaker having a handle pivotal between first and second positions, said circuit breaker having separable contacts controllable by said handle, a remote operator disposed side by side with said circuit breaker, said remote operator having an arm pivotal between first and second positions corresponding to the first and second positions of said circuit breaker handle, said circuit breaker handle and said arm being mechanically connected and jointly movable about a common axis, said remote operator including an electrical motor having an output shaft rotatable only in one direction when energized, a linkage and cam means connected to said arm and driven by said motor, a first switch connected to said motor to energize the latter, a second switch adjacent to and actuated by said linkage and cam means to deenergize said electrical motor upon movement of said arm from one of its positions to the other, said linkage and cam means comprising a rotatable cam, a yoke pivotal back and forth by said cam between two positions to drive said arm between its first and second positions, said yoke having two opposed walls defining a space into which is received a part of said arm, one or the other of said walls being engageable with said arm part to drive said arm, said space being wide enough to permit said arm part to be manually moved from one position to the other position without moving said yoke when said yoke is in one or the other of its two positions.

3. In combination, a circuit breaker and a remote operator, said circuit breaker and said remote operator having a case, said case being divided lengthwise into upper and lower parts, said remote operator including a mechanism secured to the lower case part, said circuit breaker having a pivotal handle, said mechanism including a pivotal arm, said handle and arm pivoting in parallel planes, said arm and handle extending through the upper case part and being mechanically connected for joint movement, whereby said remote operator mechanism may be first assembled to the lower case part and then the upper case part may be added thereto.

4. In combination, a circuit breaker having a handle movable back and forth, a remote operator including a pivotal arm movable back and forth and connected to said handle, a link connected to said arm, a unidirectional motor means connected to said link to drive said link back and forth, one of said arm and link having opposed walls positioned to engage a portion of the other to drive the latter, but said opposed walls being spaced apart sufficiently to permit the arm to be pivoted back and forth manually without actuating said link, and switch means electrically connected to said motor means to energize and deenergize said motor means.

5. A remote operator for a circuit breaker handle comprising a case, an electrical motor within said case and rotatable only in one direction when energized, a rotatable eccentric cam driven by said motor, said eccentric cam including an eccentric pin, an elongated yoke pivotally mounted within said case and having a slot receiving said pin, said yoke defining at one of its end portions spaced and opposed walls, said yoke being pivotally mounted at its other end portion, an operator pivotally mounted within said case and movable between two positions, said operator having a portion received between said opposed walls, said slot being disposed between the pivotal mounting of said yoke and its opposed walls, said eccentric pin driving said yoke about said pivotal mounting in a back and forth arcuate movement, said back and forth arcuate movement alternately moving one or the other of said opposed walls into engagement with said operator to pivot the latter from one to the other of its two positions, said yoke being pivoted back and forth from and to a neutral position in which both of said opposed walls are spaced from said operator, whereby upon energization of said motor, said eccentric cam is rotated, thereby pivoting said yoke to bring one of said walls into engagement with said operator to pivot the latter from and to its positions and thereupon said pivotal motion of said yoke is terminated.

6. A remote operator for a circuit breaker handle comprising a case, an electrical motor within said case and rotatable only in one direction when energized, a gear train connected to the shaft of said motor, said gear train having an output shaft, an eccentric cam connected to the gear train output shaft and rotatable thereby, said eccentric cam including an eccentric pin, an elongated yoke pivotally mounted within said case and having a slot receiving said pin, said yoke defining at one of its end portions spaced and opposed walls, said yoke being pivotally mounted at its other end portion, an operator pivotally mounted upon a pintle within said case and movable between two positions, said operator having a portion received between said opposed walls, said slot being disposed between the pivotal mounting of said yoke and its opposed walls, said eccentric pin driving said yoke about said pivotal mounting in a back and forth arcuate movement, said back and forth arcuate movement alternately moving one or the other of said opposed walls into engagement with said operator to pivot the latter from one to the other of its two positions, said yoke being pivoted back and forth from and to a neutral position in which both of said opposed walls are spaced from said operator, whereby upon energization of said motor, said gear train and said eccentric cam are rotated, thereby pivoting said yoke to bring one of said walls into engagement with said operator to pivot the latter from and to its positions and thereupon said pivotal motion of said yoke is terminated.

7. The structure recited in claim 6 wherein said remote operator case is divided into lower and upper parts and said upper part has a pair of depending walls which jointly define a space receiving the pintle about which said operator moves, said depending walls having open ended grooves receiving the end parts of said operator pintle.

8. A remote operator for a circuit breaker comprising a case of insulation material, a motor, an eccentric cam driven by said motor, a pivotal yoke connected to said eccentric cam, said motor, eccentric cam and pivotal yoke being all mounted within said case, an operator pivotally mounted within said case for movement between two positions, said operator being pivotally connected to said

yoke at one end and extending through said case at the other end, said yoke having two spaced walls movable into and out of driving engagement with said operator during movement of said operator to each of its positions, said walls being spaced sufficiently from each other and said operator to permit said operator, when in either of its two positions, to be moved, independently of said yoke, to the other position.

9. The structure recited in claim **8** wherein said yoke comprises two legs, the two spaced walls being formed one each on said two legs, said legs being deflectable, whereby upon continued rotation of said cam after said operator is moved to one or the other of its positions, the legs are deflected to place an additional force on the said operator to insure its full movement.

10. A remote operator for a circuit breaker comprising a case of insulation material, first, second and third vertical plates within said case and mounted to the lower part thereof, a motor within said case and mounted to said first plate, said motor having a shaft extending through said first plate, a gear train connected to the motor shaft, said gear train being disposed between said first and second plates and mounted thereon, said gear train having an output shaft extending through said second plate, a cam mounted on said output shaft between said second and third plates, a pivotal yoke disposed between said second and third plates and connected to said cam to pivot the yoke back and forth, a first pintle supported by said second and third plates on which said yoke is mounted, a second pintle supported by said second and third plates, and an operator pivotally mounted on said second pintle and connected to said yoke to pivot said operator as said yoke is pivoted by said cam.

11. The structure recited in claim **10** wherein said remote operator upper and lower case parts include abutting peripheral portions having mating tongues.

12. The structure recited in claim **10** wherein the yoke includes two legs, the two opposed walls being formed one each on said two legs, said legs being sufficiently flexible to bend, without permanent deformation, upon the continued rotation of said cam in the direction to pivot said yoke further after the pivotal motion stops due to the ending of the pivoting of the operator by virtue of the restraint against movement imposed on the operator by the circuit breaker handle to which it is connected, so that said operator and handle are overstressed at the end of the pivotal motion of the operator, the cam further rotating thereafter to cause the driving wall to become spaced from said operator and thereby relieve said overstress.

13. The structure recited in claim **10** wherein the connection between said cam and said yoke is such that rotation of the cam approximately 180° pivots the yoke to one side and back to its initial position through a certain number of degrees of angular movement and further rotation of the cam approximately 180° further pivots the yoke to the opposite side and back to its initial position through approximately the same number of degrees of angular movement.

14. The structure recited in claim **10** wherein said yoke has two opposed walls to engage a part of said

operator to pivot the latter, said opposed walls being spaced sufficiently apart from each other, and the part of said operator being sufficiently less in size than the space between the walls, so that the operator can be moved back and forth manually.

15. The structure recited in claim **10** wherein the upper case part has spaced depending walls to limit the axial movement of said second pintle, and said upper case part has an elongated opening transverse to the axis of said second pintle through which said operator extends.

16. In a remote operator for a circuit breaker, a case, a pivotal link movable back and forth from a neutral position and mounted within said case, a pivotal operator mounted within said case, said link having first and second walls movable therewith, said walls being disposed between the pivotal mountings of said operator and link, said operator having a part engaged alternately by one or the other of said walls as said link is moved back and forth, and means oscillating said link back and forth about its pivotal mounting in a first direction and then in a second direction opposite to said first direction to first bring said first wall into driving engagement with said operator part for pivoting the operator from a first to a second position and then to return said link to its neutral position in which said second wall is then in driving position with said operator part at which time motion of said link terminates and upon subsequent initiation of oscillation of said link, said link oscillates initially in said second direction and then in said first direction to first move said second wall into driving engagement with said operator part for pivoting the operator from its second to its first position and then to return said link to its neutral position in which its first wall is now again in driving relation with said operator part at which time motion of said link again terminates.

17. The structure recited in claim **16** and further comprising a substantially straight slot in said link, and said means including a cam rotatable in one direction and having a pin received in said slot, whereby about 180° rotation of the cam oscillates said link initially in said first direction and then in said second and opposite direction and a further cam rotation of about 180° then oscillates said cam initially in said second direction and then in said first direction.

18. The structure recited in claim **17** and further including an electrical motor for rotating said cam in one direction, a first switch for energizing said motor, and a second switch adjacent said cam and controlled by said cam for deenergizing said motor near the end of its return movement to its neutral position.

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