Jan. 30, 1962 E. C. GOODWIN, JR. 3,019,309

INTEGRATED RACKING AND CONTACT CONTROLLING MECHANISM FOR CIRCUIT BREAKERS

Filed Feb. 1, 1960 3 Sheets-Sheet 1

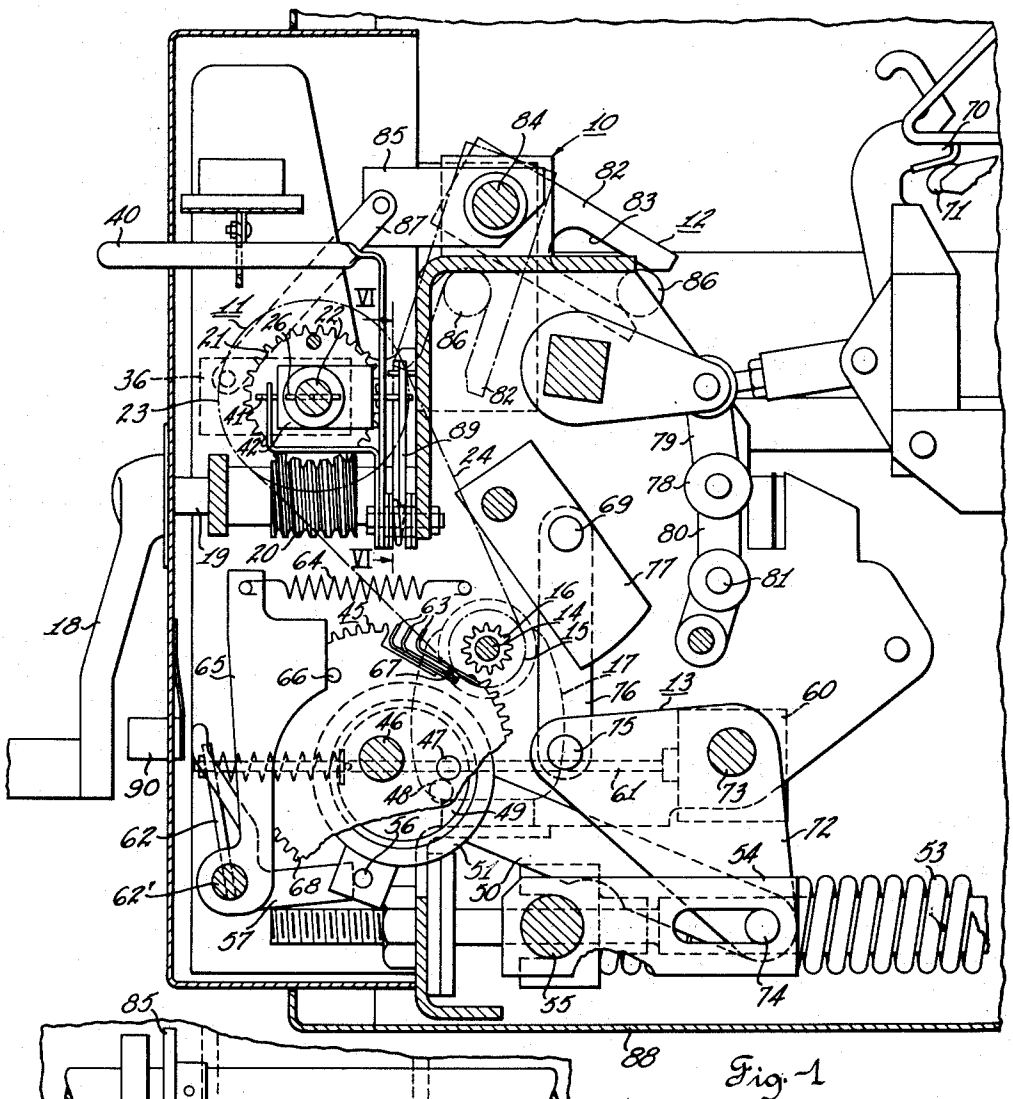


Fig. 1

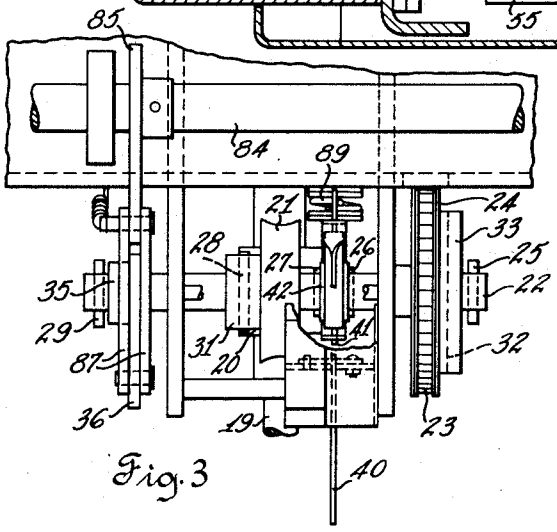


Fig. 3

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Jan. 30, 1962 E. C. GOODWIN, JR 3,019,309

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Filed Feb. 1, 1960 3 Sheets-Sheet 2

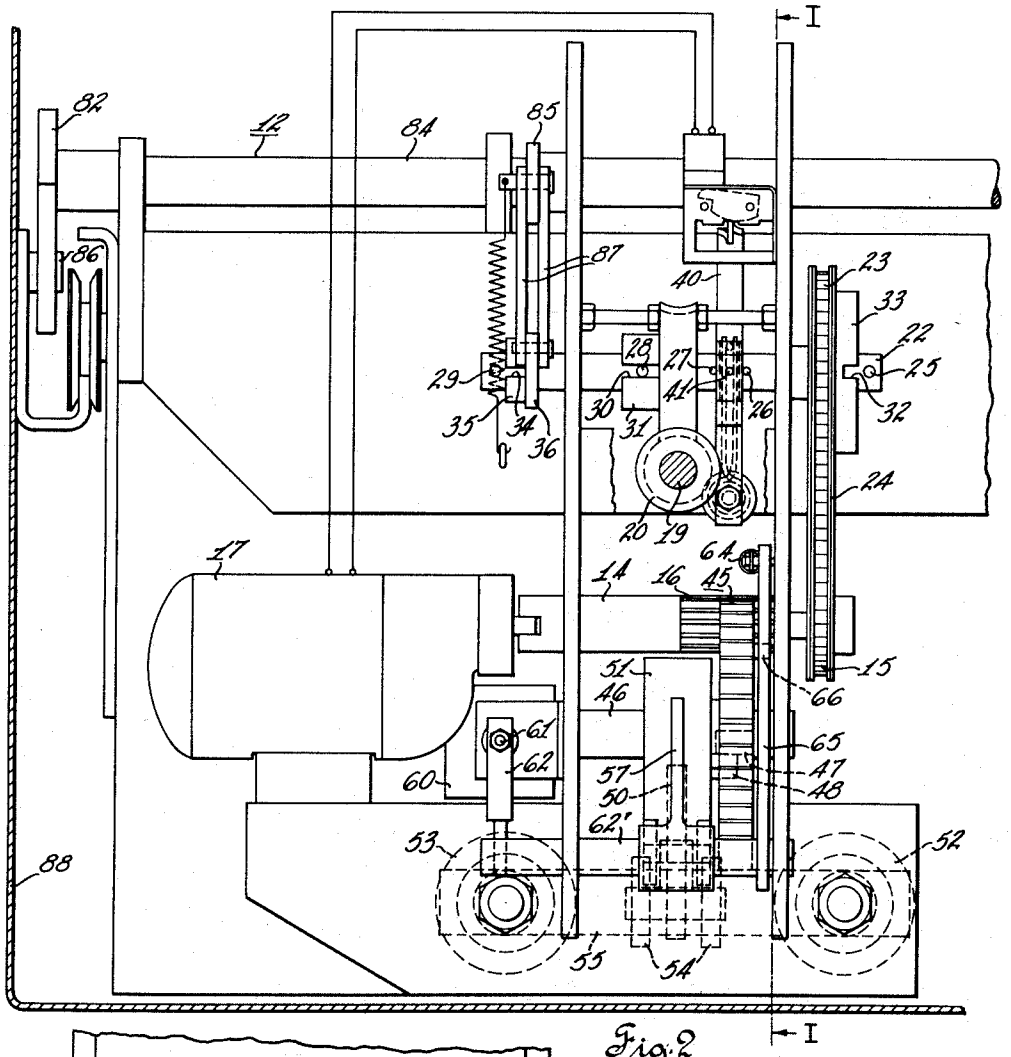


Fig. 2

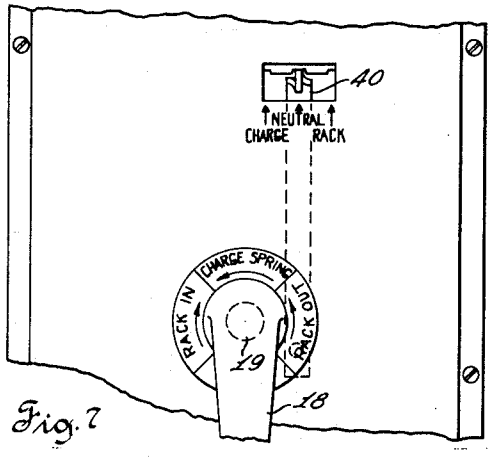


Fig. 7

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Jan. 30, 1962 E. C. GOODWIN, JR 3,019,309

INTEGRATED RACKING AND CONTACT CONTROLLING MECHANISM FOR CIRCUIT BREAKERS

Filed Feb. 1, 1960 3 Sheets-Sheet 3

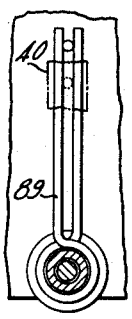


Fig. 6

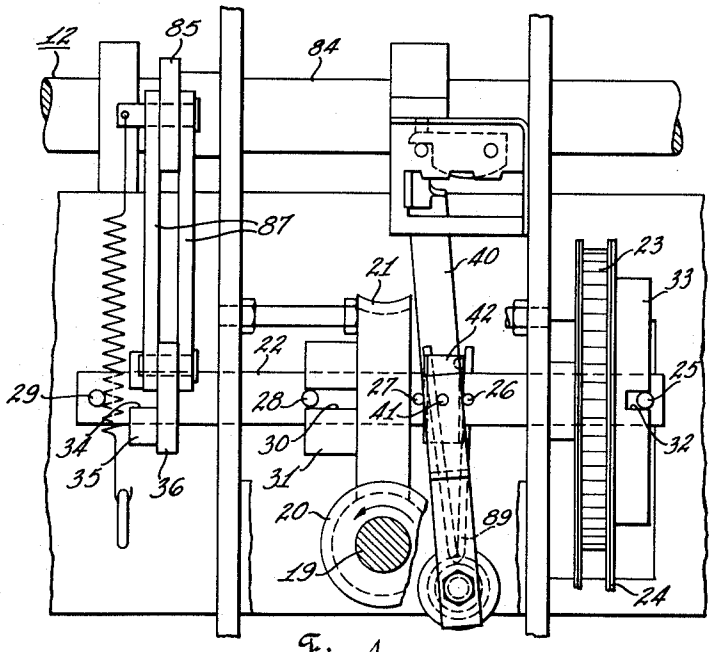


Fig. 4

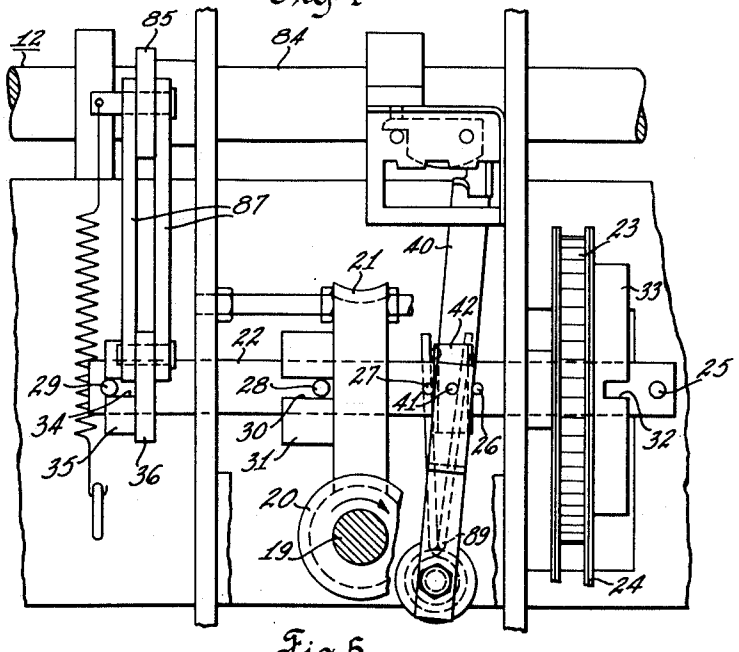


Fig. 5

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3,019,309 INTEGRATED RACKING AND CONTACT CONTROLLING MECHANISM FOR CIRCUIT BREAKERS

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9 Claims. (Cl. 200—50)

This invention relates to circuit breaker structures for mounting in a cubicle and more particularly to a new and improved integrated transmission mechanism for selectively actuating a circuit breaker racking mechanism and an arcing contact controlling mechanism. This integrated action mechanism is particularly concerned with but not limited to manually operated low voltage air circuit breakers of the type used in metal enclosed drawout switchgear.

A low voltage air circuit breaker is composed essentially of a fixed contact structure and a movable contact structure operated by a mechanism which may be either motor, solenoid or manually actuated. These components are mounted on a supporting frame. In order to facilitate the installation of this breaker it may be equipped with suitable wheels and a racking device both attached to the supporting frame. When a breaker of this type is installed in metal enclosed drawout switchgear, it is first placed in the free position with the wheels on the extended drawout supporting structure and then racked through the disconnect and test positions to the connection position, in which position its arcing contacts may be closed.

In accordance with the invention claimed a new and improved mechanism for mounting a circuit breaker structure in a cubicle and controlling its arcing contacts is provided. This mechanism integrates the action for both racking and circuit breaker contact controlling movement in single sequential operations. A driving shaft is utilized for actuating the racking means and the arcing contacts upon rotation thereof. This driving shaft is sequentially detachably connected to two driven shafts for rotation thereof. One of the driven shafts actuates the racking means while the other of the driven means charges a contact closing spring load means.

It is, therefore, one object of this invention to provide a new and improved transmission mechanism.

Another object of this invention is to provide a new and improved integrated transmission mechanism for selectively actuating a circuit breaker racking mechanism and an arcing contact controlling mechanism.

A further object of this invention is to provide a new and improved manually operable lever mechanism which sequentially racks a circuit breaker in a cubicle and charges the closing springs of a pair of arcing contacts.

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 vertical cross sectional view partly in elevation of a circuit breaker structure taken along line I—I of FIG. 2 utilizing a transmission mechanism and employing the present invention;

FIG. 2 is a partial front elevational view of the circuit breaker structure shown in FIG. 1 in the neutral position of the racking and arcing contact controlling mechanism;

FIG. 3 is a partial top view of FIG. 2 showing the circuit breaker racking and arcing contact controlling mechanism;

FIG. 4 is an enlarged partial view of the circuit breaker racking and arcing contact controlling mechanism shown in FIG. 2 in the arcing contact controlling position;

FIG. 5 is an enlarged partial view similar to FIG. 4 showing the circuit breaker and arcing contact controlling mechanism in the racking position;

FIG. 6 is an enlarged detailed view of the spring mechanism for the selector lever shown in FIGS. 4 and 5 taken along line VI—VI of FIG. 1; and

FIG. 7 is an enlarged view of the cover enclosing the racking and arcing contact controlling mechanism showing the possible positions of the selector lever.

Referring more particularly to the drawing by characters of reference FIGS. 1–7 illustrate a circuit breaker **10** utilizing an integrated transmission mechanism **11** for selectively actuating a circuit breaker racking mechanism **12** and an arcing contact controlling mechanism **13**. The transmission mechanism **11** comprises a pinion or driving shaft **14** having fixedly mounted thereon a first gear or sprocket **15** and a second gear or pinion **16**. Shaft **14** is rotated by means of a suitable electric motor **17** or by means of a manually rotatable handle **18**. Rotation of handle **18** delivers energy through shaft **19**, worm **20** and worm gear **21** into shaft **22** to chain sprocket **23**. A flexible drive chain **24** connecting sprockets **23** and **15** causes rotation of driving shaft **14** in the same manner as does motor **17**.

This manually integrated actuating mechanism comprising shaft **19** and worm **20** is supported in such a manner that worm **20** is maintained in continuous engagement with worm gear **21** which is supported by but not permanently attached to shaft **22**. To shaft **22** are fastened pins **25**, **26**, **27**, **28** and **29**. Pin **28** engages a slot **30** in hub **31** of worm gear **21** at all times while pins **25** and **29** may be caused to engage a slot **32** in hub **33** of sprocket **23** and a slot **34** in a hub **35** of rotatably mounted racking crank **36** by displacing shaft **22** to the left and right respectively as shown in FIGS. 4 and 5.

Displacement of shaft **22** is effected by movement of a selector lever **40** acting through a pin **41** and a block **42**. Block **42** is supported by but not attached to shaft **22** and pin **41** extends from block **42** into a loose fitting aperture in lever **40**. Block **42** is contained between pins **26** and **27** on shaft **22**. In the position shown in FIG. 2 handle **18** is inoperative as far as conveying motion to driving shaft **14** since shaft **22** is disengaged from sprocket **23**. In the manual driving position lever **40** is moved from the position shown in FIG. 2 to the left as shown in FIG. 4 so that shaft **22** and sprocket **23** are interconnected. During the time that handle **18** is rotated to drive shaft **14** the shaft of the electric motor **17** is also rotated because they are directly connected together. Further, during the time that motor **17** is driving shaft **14** sprocket **23** and chain **24** are also driven although at this time lever **40** has disconnected shaft **19** from shaft **14**.

Rotation of driving shaft **14** and gear **16** by chain **24** causes rotation of a gear **45** which is in meshing engagement therewith and, for example, may be rotatably mounted on a bearing pin or shaft **46**. Gear **45** is provided with a driving pin **47** positioned to engage with a

corresponding pin 48 on an eccentric 49. Eccentric 49 is supported by shaft 46 for rotation thereon. Clockwise rotation of gear 45 engages pin 47 on gear 45 with pin 48 on eccentric 49 and revolves eccentric 49 clockwise as shown in FIG. 1 about its fixed center, which is the center of shaft 46, driving a connecting rod 50 to the right. Connecting rod 50 is fixedly mounted on a housing 51 supported by eccentric 49 and rotatably movable therewith during at least a part of the cycle of rotation of eccentric 49, as is well known the art.

The motion of connecting rod 50 to the right compresses a pair of load springs (stored energy devices) 52 and 53 as shown in FIGS. 1 and 2 that function as a unit through link mechanism 54 and bar 55. At the instant that springs 52 and 53 are fully charged, latch roll 56 affixed to housing 51 engages a prop latch 57, thus holding the fully charged springs latched and ready to be discharged to perform a useful function, for example, closing the movable cooperating arcing contacts 70 and 71 of a circuit breaker. The prop latch 57 may be released by a solenoid mechanism 60 which upon movement of its armature rod 61 to the right as shown in FIG. 1 actuates prop latch 57 through a lever 62 and shaft 62' to rotate it clockwise releasing latch roll 56, thereby permitting housing 51 and connecting rod 50 to rotate under the force of springs 52 and 53. Once the stored energy or load springs 52 and 53 have been released the springs can again be recharged automatically by motor 17 or manually by handle 18 as explained above.

To prevent overloading of the spring charging system when latch roll 56 engages prop latch 57, gear 45 which is driven by the driving shaft 14 is shaped to disengage from bear 16 on shaft 14 at the fully charged position of the stored energy springs 52 and 53. This disengagement is accomplished by the removal of a segment of the teeth from the periphery of the gear. Flexible teeth 63 (shown in FIG. 1) are provided at the end of the open segment to facilitate reengagement of the gears 16 and 45 at the beginning of each cycle of meshing engagement. As pin 48 on eccentric 49 is moved clockwise to the left as shown in FIG. 1 when connecting rod 50 is released for utilizing the stored energy of springs 52 and 53, gear 45 becomes free to rotate and is caused to reengage with gear 16 and driving shaft 14 by a spring 64 attached to bias lever 65 which acts against a pin 66 fixed to gear 45.

The flexible teeth 63 are detachably mounted along only a portion of a second part of the periphery of gear 45 by means of bolts 67 which may threadly engage with suitable openings along the periphery of the gear structure. Teeth 63 are shown as formed of overlapping metallic strip material of resilient properties which are so arranged as to have spaced tooth gear edges. The span of flexible teeth are arranged in the open segment of the tooth periphery of gear 45 adjacent one end of the normal gear teeth 68 of gear 45. Gear teeth 68 arranged along a first part of the periphery of gear 45 have solid tooth segments while teeth 63 are flexible so as to yield if necessary upon engagement with the teeth on pinion or gear 16 or upon initial movement of shaft 14 to automatically position gears 16 and 45 in proper meshing engagement at the start of each driving cycle of shaft 14. This arrangement of flexible teeth at the beginning part of a span of teeth provides unimpeded reengagement of the charging motor pinion gear 16 with the charging mechanism for springs 52 and 53 immediately after each energy releasing action of the prop latch mechanism 57.

As shown in FIG. 1 the arcing contact mechanism including the pair of cooperating contacts 70 and 71 are in the contact closed position with the stored energy springs 52 and 53 charged. Springs 52 and 53 are connected to the arcing contacts by means of a bell crank 72 pivotally mounted at 73 to the frame of the circuit breaker. One end of bell crank 72 is pivotally connected by pin 74 to link mechanism 54 and by a pin 75 to link 76. Link 76 is pivotally connected at 69 to a rotatable closing cam 77 which acts against toggle roll 78 moving a toggle linkage comprising toggle arms 79 and 80 to the right as shown in FIG. 1 about a releasable center point 81 to close the arcing contacts. When the arcing contacts are in their closed position the toggle is arranged in an overcenter position in the usual manner. The closing cam 77 will remain in its upper position reached when forcing the toggle linkage to its overcenter position until the closing springs 52 and 53 are recharged. Recharging of the closing springs 52 and 53 will rotate bell crank 72 in the counterclockwise direction to the position shown in FIG. 1 thereby drawing the closing cam 77 down to the position shown for another arcing contact closing operation.

When the circuit breaker is mounted in or removed from a cubicle 88 the circuit breaker is racked in and out by the racking mechanism 12. Racking mechanism 12 comprises a pair of pivotally mounted racking cranks 82 (one of which is shown in FIG. 1) each provided with a slot 83 at one end thereof for engaging with fixed pins 86 one of which is shown in FIG. 2 attached to the sides of cubicle 88. Cranks 82 are fixed to a driven shaft 84 and are rotated by an arm 85 also fixed to shaft 84. Arm 85 is actuated by racking crank 36 through racking links 87. Racking crank 36 is rotatably mounted on shaft 22.

In order to actuate the racking mechanism 12 the selector lever 40 is moved to the racking position shown in FIG. 5. In this position shaft 22 is moved to the right and pin 29 engages with slot 34 of hub 35 of arm 36. Upon rotation of shaft 22 arm 36 is rotated to actuate cranks 82 to rack the breaker in or remove it from the cubicle.

FIG. 6 illustrates the spring mechanism 89 of the selector lever 40. In the vertical position shown the selector lever 40 would be in its unbiased position. When the selector lever 40 is moved to its spring charging or racking positions shown in FIG. 7 lever 40 is under bias of spring 89 tending to return the selector lever to its natural or vertical position.

In accordance with the structure described and shown in the drawings when the selector lever is in the neutral or vertical position the electric motor is energized if the charging springs 52 and 53 are not biased as shown in FIG. 1 then motor 17 rotates shaft 14 and pinion 16 and gear 45. Rotation of gear 45 engages pin 47 with pin 48 on eccentric 49 which revolves eccentric 49 clockwise about shaft 46 driving the connecting rod 50 to the right. The motion of the connecting rod 50 to the right compresses springs 52 and 53. At the instant springs 52 and 53 are fully charged, latch roll 56 affixed to connecting rod housing 51 engages prop latch 57 thus holding the fully charged springs latched and ready to be discharged to close the breaker by release of prop latch 57 by the solenoid mechanism 60. Once the stored energy springs have been released and the breaker closed, springs 52 and 53 are again recharged automatically by the motor drive unit, thereby providing a standby supply of stored energy, if the selector lever 40 is in the neutral position.

Manual charging of the stored energy springs 52 and 53 is accomplished by moving the selector lever 40 to the charge position shown in FIG. 4 and rotating handle 18 counterclockwise to engage shaft 22 through pin 25 to sprocket 23. This action now makes the handle an integral part of the charging scheme. Rotation of handle 18 delivers energy through shaft 19, worm 20 and worm gear 21 into shaft 22 and to chain sprocket 23. A flexible drive chain 24 connecting sprocket 23 and sprocket or gear 15 causes rotation of pinion 16 in the same manner as motor 17. The remainder of the sequence for charging and discharging springs 52 and 53 is the same as above described under the motor energized sequence of this structure.

Manual release of the stored energy springs 52 and 53 to close the arcing contacts 70 and 71 is accomplished

by depressing mechanical closing button **90** which rotates prop latch **57** in the same manner as solenoid mechanism **60**. Once released and the breaker contacts closed the springs **52** and **53** may be again recharged manually as previously described.

To rack the circuit breaker structure into its energized position in the cubicle the selector lever **40** is placed in the neutral position and the breaker is moved into the cubicle until the slots in the racking cranks **82** engage with fixed pins attached to the sides of the cubicle. To reach the racking position in the cubicle certain stops or interlocks in the cubicle are overcome in a predetermined manner. Once these interlocks are overcome in given positions in the cubicle the breaker contacts can be closed or opened. The breaker racking action occurs by rotating cranks **82** which are fixed to shaft **84** and are rotated by arm **85**. Arm **85** is actuated by shaft **22** through racking crank **36** and links **87**.

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. A circuit breaker structure for mounting in a cubicle comprising a frame, a pair of cooperating movable arcing contacts mounted on said frame, means for causing relative movement between said contacts, a racking means mounted on said frame for cooperating with the cubicle for varying the position of said frame within the cubicle upon actuation thereof, a dual purpose driving means for actuating said racking means and said contact movement means, and means for selectively connecting said driving means to said racking means and said contact movement means.

2. A circuit breaker structure for mounting in a cubicle comprising a frame, a pair of cooperating movable arcing contacts mounted on said frame, means for causing relative movement between said contacts, a racking means mounted on said frame for cooperating with the cubicle for varying the position of said frame within the cubicle upon actuation thereof, a dual purpose driving means for selectively actuating said racking means and said contact movement means, means for selectively connecting said driving means to said racking means and said contact movement means, and manual means for actuating said driving means.

3. A circuit breaker structure for mounting in a cubicle comprising a frame, a pair of cooperating movable arcing contacts mounted on said frame, spring means for causing relative movement between said contacts, a racking means mounted on said frame for cooperating with the cubicle for varying the position of said frame within the cubicle upon actuation thereof, means for biasing said spring means for causing relative movement between said contacts, a dual purpose driving shaft for selectively actuating said racking means and said spring biasing means upon rotation thereof, and means for selectively connecting said driving means to said racking means and said spring biasing means.

4. A circuit breaker structure for mounting in a cubicle comprising a frame, a pair of cooperating movable arcing contacts mounted on said frame, means for causing relative movement between said contacts, racking means mounted on said frame for cooperating with the cubicle to vary the position of said frame in the cubicle upon actuation thereof, a driving shaft mounted for rotation thereof, a first driven shaft, a second driven shaft, said first driven shaft being detachably connected to said driving shaft for rotation thereby, said second driven shaft being detachably connected to said driving shaft for rotation thereby, means for connecting said first driven shaft to said racking means for actuation thereof, means for connecting said second driven shaft to said contact movement means for causing relative movement of said contacts, and a mechanism for selectively connecting said first and said second driven shafts to said driving shaft.

5. A circuit breaker structure for mounting in a cubicle comprising a frame, a pair of cooperating movable arcing contacts mounted on said frame, means for causing relative movement between said contacts, racking means mounted on said frame for cooperating with the cubicle to vary the position of said frame in the cubicle upon actuation thereof, a manually rotatable driving shaft, a first driven shaft, a second driven shaft, said first driven shaft being detachably connected to said driving shaft for rotation thereby, said second driven shaft being detachably connected to said driving shaft for rotation thereby, means for connecting said first driven shaft to said racking means for actuation thereof, means for connecting said second driven shaft to said contact movement means for causing relative movement of said contacts, and a lever mechanism for selectively connecting said first and said second driven shafts to said driving shaft.

6. A circuit breaker structure for mounting in a cubicle comprising a frame, a pair of cooperating movable arcing contacts mounted on said frame, means for causing relative movement between said contacts, racking means mounted on said frame for cooperating with the cubicle to vary the position of said frame in the cubicle upon actuation thereof, transmission means for actuating said racking means and said contact movement means upon actuation thereof, said transmission means comprising a driving shaft, a first driven shaft, a second driven shaft, said first driven shaft being rotatably connectable to said driving shaft, said second driven shaft being rotatably connectable to said driving shaft, means for connecting said first driven shaft to said racking means for actuation thereof, means for connecting said second driven shaft to said contact movement means for actuation thereof, and a mechanism for selectively connecting said first and said second driven means to said driving means.

7. A circuit breaker structure for mounting in a cubicle comprising a frame, a pair of cooperating movable arcing contacts mounted on said frame, racking means mounted on said frame for cooperating with the cubicle to vary the position of said frame in the cubicle upon actuation thereof, a driving shaft mounted for rotation thereof, a first driven shaft, a second driven shaft, said first driven shaft being detachably connected to said driving shaft for rotation thereby, said second driven shaft being detachably connected to said driving shaft for rotation thereby, means for connecting said first driven shaft to said racking means for actuation thereof, a load device, means for connecting said second driven shaft to a mechanism for biasing said load device, means for connecting said load device to at least one of said contacts for closing said contacts upon release of said load device, and a lever mechanism for selectively connecting said first and said second driven shafts to said driving shaft.

8. A circuit breaker structure for mounting in a cubicle comprising a frame, a pair of cooperating movable arcing contacts mounted on said frame, racking means mounted on said frame for cooperating with the cubicle to vary the position of said frame in the cubicle upon actuation thereof, a driving shaft mounted for rotation thereof, a first driven shaft, a second driven shaft, said first driven shaft being detachably connected to said driving shaft for rotation thereby, said second driven shaft being detachably connected to said driving shaft for rotation thereby, means for connecting said first driven shaft to said racking means for actuation thereof, a spring, means for connecting said second driven shaft to a mechanism for biasing said spring, means for connecting said spring to at least one of said contacts for closing said contacts upon release of said biased spring, and a lever mechanism for selectively

connecting said first and said second shafts to said driving shaft.

9. A circuit breaker structure mounted on a frame for positioning in a cubicle, said structure comprising a pair of cooperating arcing contacts, means for controlling the movement of said contacts, and a racking means, said racking means being mounted on said frame and cooperating with the cubicle to vary said structure's position within the cubicle upon actuation thereof, and a dual purpose integrated transmission means for selectively actuating

said racking means and said contact controlling means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,341,297	Sprenger et al.	Feb. 8, 1944
2,781,427	Rudolph	Feb. 12, 1957
2,792,462	Kozlovic	May 14, 1957
2,866,341	De Changy	Dec. 30, 1958
2,921,998	Pokorny et al.	Jan. 19, 1960