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2,748,209

CIRCUIT INTERRUPTER

Filed Aug. 4, 1951

2 Sheets-Sheet 1

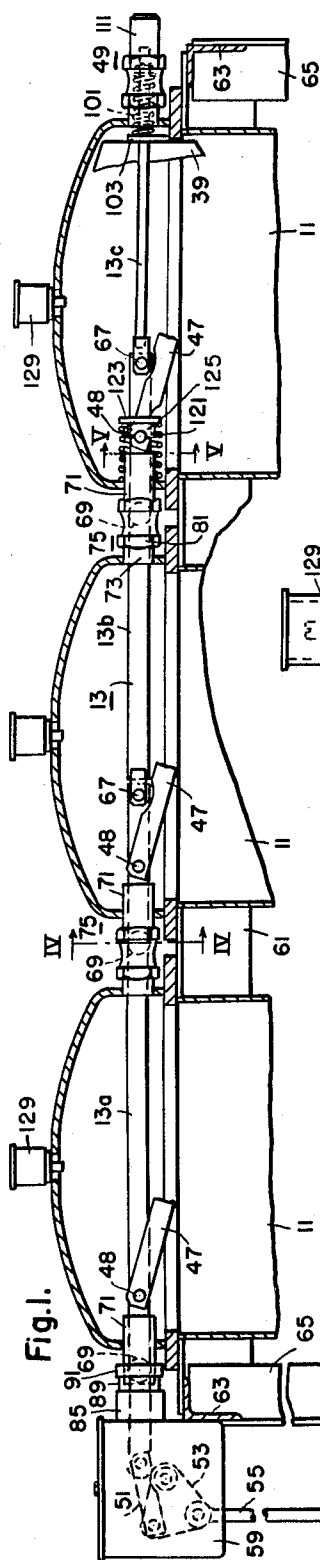


Fig. 1.

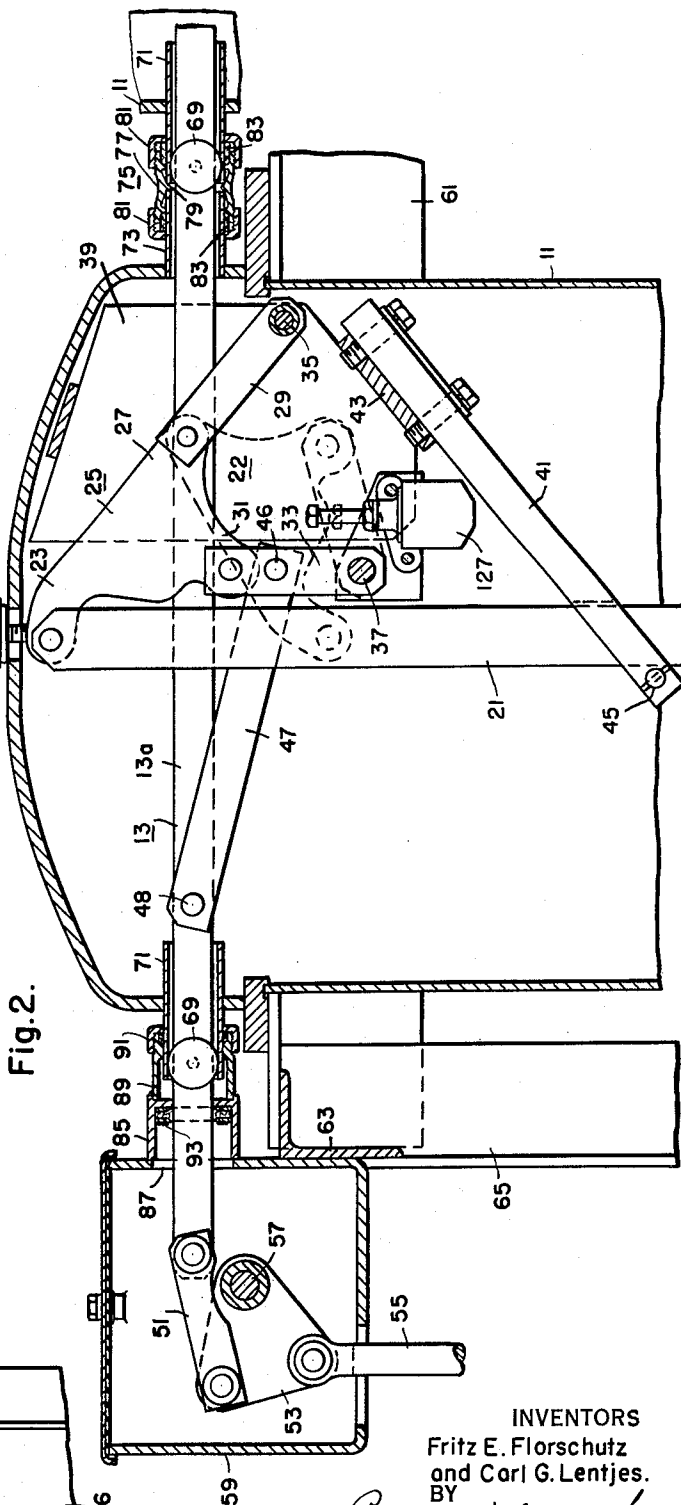


Fig. 2.

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Fig. 3.

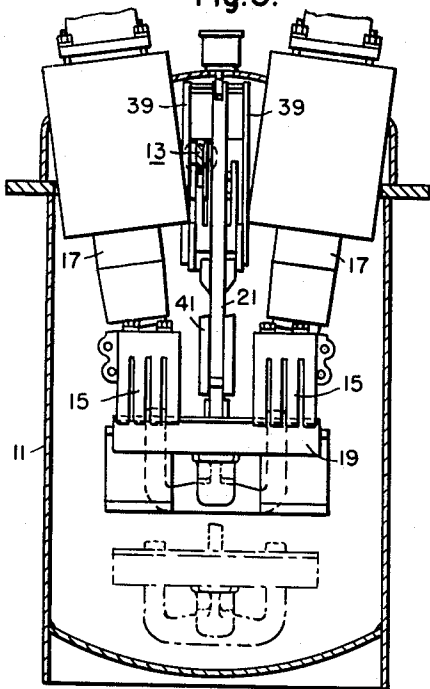


Fig. 4.

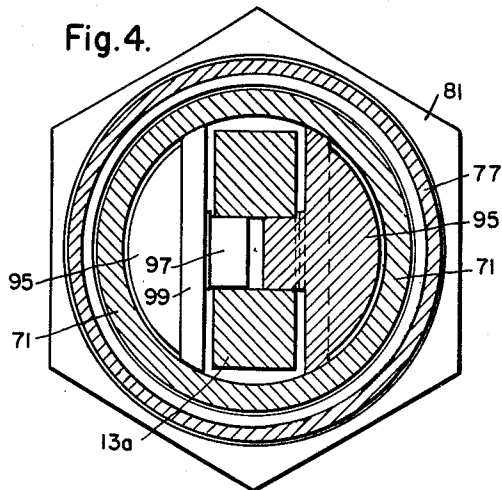


Fig. 5.

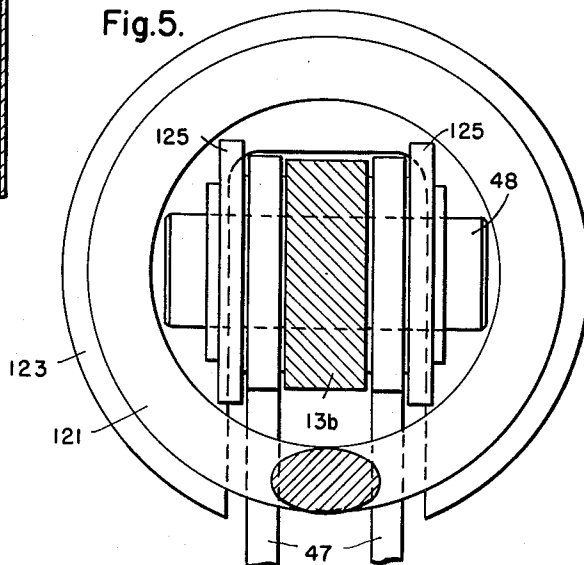
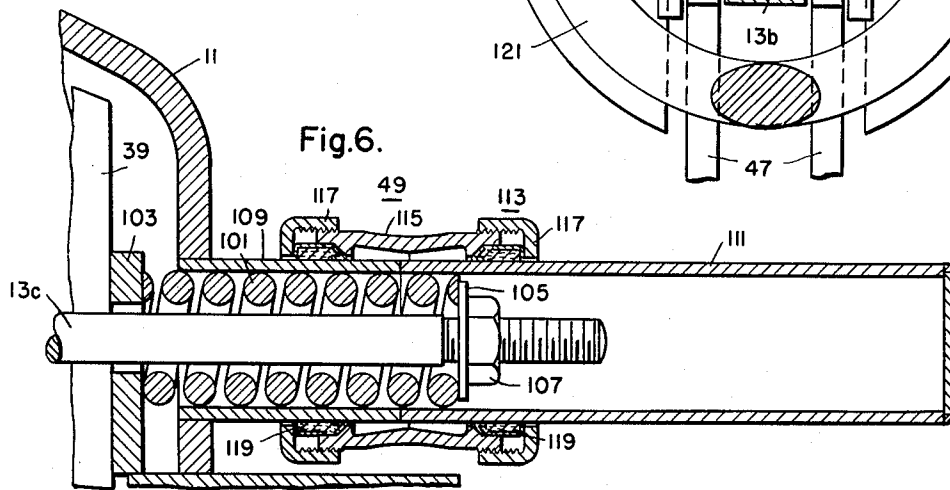


Fig. 6.



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CIRCUIT INTERRUPTER

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12 Claims. (Cl. 200—18)

This invention relates to circuit interrupters and more particularly to circuit interrupters of the oil break type which are adapted for the control of large capacity power transmission circuits.

An object of the invention is to provide a circuit interrupter having a plurality of intercommunicating interrupter receptacles embodying a rod common to all of said receptacles disposed for straight-line motion, the rod having anti-friction means between said receptacles which also serve as baffles to prevent transmission of oil and gas between the receptacles.

The novel features that are considered characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to structure and operation, together with additional objects and advantages thereof, will be best understood from the following detail description of one embodiment thereof when read in conjunction with the accompanying drawings.

In said drawings:

Figure 1 is an elevational view partially in section showing the pull rod extending through the upper portions of the receptacles of a three pole interrupter,

Fig. 2 is an enlarged sectional view of the receptacles of one of the poles showing the pull rod and operating linkage for the moving contact means,

Fig. 3 is an elevational view partially in section of one pole unit of the interrupter embodying the principles of the invention,

Fig. 4 is a sectional view taken on line IV—IV of Fig. 1, one of the spherical segments being shown in elevation,

Fig. 5 is a sectional view taken on line V—V of Fig. 1,

Fig. 6 is a detail sectional view of the adjustable accelerating spring and the housing therefor.

The circuit interrupter is of the three-pole type and each pole is housed in a receptacle or tank 11 substantially filled with oil and having a common pull rod 13 extending horizontally through the upper portions of the tanks 11 for operating the movable contact structure in each of the tanks.

The contact structure for each of the pole units includes stationary contact means 15 (Fig. 3) rigidly secured to the lower ends of terminal bushings 17 and a cooperating movable bridging contact member 19 rigidly secured to the lower end of a lift rod 21. The upper end of the lift rod 21 is pivotally connected to an operating linkage indicated generally at 22. The operating linkage 22 includes a triangular floating lever 25 to one arm 23 of which the lift rod 21 is connected. A second arm 27 of the lever 25 is pivotally connected to one end of a link 29 and the third arm 31 of the lever 25 is pivotally connected to one end of a link 33. The other ends of the links 29 and 33 are pivotally mounted respectively on fixed pivot pins 35 and 37 supported in a frame comprising a pair of spaced plates 39 (Figs. 2 and 3) rigidly supported in the top of the tank 11.

The lift rod 21 is guided in its vertical reciprocating

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movement by means of a guide bar 41 rigidly secured to a cross bar 43 supported by the spaced plates 39. The bifurcated lower end of the guide bar 41 straddles the lift rod 21 and has a pin 45 secured in the forks thereof to guide the rod 21 in its movement.

The link 33 for each of the operating linkages 22 is connected by means of a link 47 to the pull rod 13. The pull rod 13 may be made in one piece or, for convenience in assembly it may be made in sections as illustrated in Fig. 1, with the sections connected together to form a single rod. At its right-hand end (Fig. 1) the pull rod 13 is provided with an adjustable accelerating spring device shown generally at 49 (Figs. 1 and 6) and the left-hand end of the pull rod 13 is connected by means of a link 51 (Figs. 1 and 2) to one arm of a bell crank 53, the other arm of which is connected to the upper end of a breaker operating rod 55. The lower end of the operating rod 55 is connected to a suitable power operating means and tripping means indicated generally at 56 (Fig. 1), preferably of the type disclosed in Patent No. 2,403,082, issued July 2, 1946, to A. W. Hill and J. A. Cumming, and assigned to the assignee of the present invention. Such power means usually embody trip-free means connecting the power means to the breaker operating rod whereby the breaker mechanism is movable to open position free of the power operating means. The trip-free means permits high-speed opening and quick reclosing of the circuit breaker.

The bell crank 53 (Fig. 2) is pivotally supported on a shaft 57 which is mounted in the side members of a housing 59. The housing 59 is mounted on one end of a frame work partially shown in Figs. 1 and 2, which also supports the tanks 11, comprising generally horizontal side members 61 (only one being shown), cross members 63 and vertical supporting members or legs 65 only two of which are shown.

The pull rod 13 (Fig. 1) extends through each of the tanks 11 and is arranged for true straight-line reciprocating movement to actuate the operating linkage 22 in each of the tanks to effect opening and closing movement of the lift rod 21 and movable contact member 19 in each of the tanks. As shown, the pull rod, for convenience in assembly, is constructed in three parts 13a, 13b and 13c which are connected as shown at 67 for unitary movement.

The pull rod 13 is supported for true straight-line movement by means of bearings or rollers 69 in tubes 71, there being a tube 71 welded in an opening in each of the tanks 11. Welded in openings in each of the tanks 11 in axial alignment with the tubes 71 are tubes 73 which are coupled with the tubes 71 by means of couplings 75. The coupling 75 comprises a tubular member 77 having an internal annular stop ring 79 against which the tubes 71 and 73 abut. Cap nuts 81 are threaded on each end of the tubular members and have gaskets 83 disposed between the flanges of the nuts 81 and the ends of the tubular member to form a sealed joint between the tanks 11.

A sealed joint of somewhat different form is provided between the left-hand tank 11 (Figs. 1 and 2) and the bell crank housing 59. A cup-shaped cylindrical member 85 is welded to the housing 59 surrounding an opening 87 therein through which the pull rod 13 passes. The end wall of the member 85 is also provided with an opening which surrounds the pull rod 13 with a very small clearance. Welded to the cup-shaped members 85 is a coupling 89 surrounding the associated tube 71 and having a cap nut 91 thereon. A gasket is disposed between the cap nut 91 and the end of the coupling 89 to form a sealed joint. A gasket 93 surrounding the pull rod 13 is secured to the inner wall of the cup-shaped member 85 to form an oil and gas seal between the left-hand tank 11 and the bell crank housing 59.

The rollers 69 each comprises a pair of spherical seg-

ments 95 (Fig. 4) disposed in the tube 71, one on each side of the pull rod 13 so as to substantially fill the cross-sectional area of the tube. Each segment 95 has a trunnion 97 thereon extending into an opening in the pull rod 13 to support the pull rod in its reciprocating movement. Each of the spherical segments 95 has a narrow slightly raised ring portion 99 adjacent the pull rod 13 to provide a limited bearing surface for supporting the segments and the pull rod on the inner surface of the tube 71. In addition to supporting the pull rod 13 for true straight-line, reciprocating movement, the spherical segments 95 substantially fill the cross-sectional area of the tubes 71 to provide a gas and oil baffle between the tanks 11.

The accelerating spring device 49 (Figs. 1 and 6) comprises a powerful compression spring 101 compressed between a cross bar 103 mounted on the plates 39 of the right-hand pole unit (Fig. 1) and a washer 105 (Fig. 6) supported by an adjusting nut 107 screwed onto the threaded end of the pull rod. The accelerating spring 101 and adjusting nut 107 are enclosed in a sealed housing comprising a tube 109 welded in an opening in the right-hand tank 11 and a tube 111 having one end abutting against the outer end of the tube 109 and the other end closed. The tubes 109 and 111 are maintained in the position shown in Fig. 6 and the joint sealed by means of a coupling 113 similar to the couplings 75 joining the tubes 71 and 73 between the tanks but without the stop ring 79. The coupling 113 comprises a coupling member 115 surrounding the joint of the tubes 109 and 111 and having cap nuts 117 threaded onto the ends thereof. Gaskets 119 are compressed between the flanges of the cap nuts 117 and the ends of the coupling member 115 to form a tight seal.

The tension of the accelerating spring 101 is adjustable by means of the adjusting nut 107 which is accessible by backing off the outer cap nut 117 and withdrawing the sealed tube 111. After the adjustment is made, the tube 111 together with the gasket 119 is replaced and the cap nut 117 drawn up to seal the joint between the tubes.

Additional accelerating spring force may be applied to the pull rod, as required, by the provision of one or more additional springs inside of one or more of the tanks 11, only one of such springs being shown in Fig. 1 of the drawings. It will be understood that additional accelerating springs may be applied in one or all of the tanks as required.

The additional accelerating spring means comprises a compression spring 121 compressed between the inner wall of one of the tanks 11 and a spring seat 123 more clearly shown in Fig. 5. The spring seat 123 is attached to the pull rod 13 by a pair of spaced brackets 125 welded or otherwise suitably secured to the spring seat 123 and mounted on the pin 48 which pivotally connects the links 47 to the pull rods.

When the operating rod 55 is released upon operation of the trip means, such as is fully disclosed in the aforementioned Patent No. 2,403,082, in response to abnormal circuit conditions, the accelerating springs 101 and 121 (Fig. 1) move the pull rod 13 at high speed and in a true straight line toward the right. This movement of the pull rod 13 acts through the connecting links 47 for all of the pole units to move each supporting link 33 clockwise (Fig. 2) to the position shown in dotted lines. This action moves each floating lever 25 downward causing first clockwise and then counterclockwise movement of the supporting links 29 effecting a true straight-line downward movement of the lift rod 21 in each of the pole units to simultaneously separate the bridging contact members 19 (Fig. 3) from the stationary contacts 15 of each of the pole units.

The interrupter is closed following an opening operation by the power operating means 56 (Fig. 1) which, when energized, pulls downwardly on the operating rod 55. This movement of the operating rod 55, transmitted through the bell crank 53 and link 51, draws the pull rod 13 toward the left (Figs. 1 and 2). This movement of

the pull rod through the links 47 reverses the movement of the operating linkages 22 to raise the lift rods 21 and close the contact means for each of the pole units. The moving parts are decelerated at the ends of the opening and closing operations respectively by suitable shock absorbers 127 and 129 (Fig. 2).

It will be seen that the bearings or rollers 69 support the pull rod for true, straight-line motion, reduce the friction of the movement of the pull rod and form substantial gas and oil baffles between the tanks and between the bell crank housing and the adjacent tank.

Having described the invention in accordance with the provisions of the patent statutes, it is to be understood that various changes and modifications may be made in the structural details and combination of elements disclosed without departing from some of the essential features of the invention.

We claim as our invention:

1. In a circuit interrupter, the combination of a plurality of enclosed receptacles, bearing means forming closed passages between said receptacles, a member extending through said receptacles and said bearing means, roller means in each of said bearing means supporting said member for straight-line reciprocating movement, said roller means substantially closing each of said bearing means to thereby form baffles substantially preventing flow through said bearing means from one to another of said receptacles.

2. In a circuit interrupter, the combination of a plurality of receptacles, tubular bearing means having imperforate walls extending between said receptacles, a member extending through said receptacles and said tubular bearing means, supporting means for said member comprising a pair of spherical segments disposed one on each side of said member in said tubular bearing each of means supporting said member for straight-line reciprocating movement, said spherical segments together with said member substantially closing each of said tubular bearing means to form a baffle between said receptacles.

3. In a circuit interrupter, the combination of a plurality of interrupter enclosing receptacles, each of said interrupters having a rod attached thereto disposed for vertical straight-line movement, tubular bearing means having an imperforate wall extending between the walls of adjacent receptacles, a reciprocating member extending through all of said receptacles and said tubular bearing means, anti-friction means in each of said tubular bearing means supporting said reciprocating member between adjacent receptacles for horizontal straight-line movement, said anti-friction means forming baffles between adjacent receptacles, and a linkage in each of said receptacles connected to said reciprocating member and to said rod for translating the horizontal straight-line movement of said reciprocating member to vertical straight-line movement of said rod.

4. In a circuit interrupter, the combination of a plurality of interrupter enclosing tanks, imperforate tubular bearing means disposed between the walls of adjacent tanks, a pull rod extending through all of said tanks and through said tubular bearings, supporting means in each of said tubular bearings between the walls of adjacent tanks supporting said pull rod for straight-line movement, said supporting means comprising a pair of spherical segments disposed on opposite sides of said pull rod, each of said spherical segments having bearing means supporting said pull rod, said pull rod and said spherical segments substantially closing said tubular bearing means.

5. In a circuit interrupter, the combination of a plurality of interrupter enclosing tanks, means defining closed passages extending only between the walls of adjacent tanks, a pull rod extending through said tanks and through said passages, stored energy means connected to said pull rod for moving said rod in one direction to effect opening of said interrupter, means connected to said pull rod for moving said rod in the opposite

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direction to effect closing of said interrupter, rollers disposed in each of said passages mounting said pull rod in said passages between adjacent receptacles for straight-line movement, and said rollers substantially closing said passages to form baffles between said tanks.

6. In a circuit interrupter, the combination of a plurality of interrupter enclosing receptacles, hollow members having imperforate walls extending between adjacent receptacles, a pull rod extending through said receptacles and said hollow enclosed members, bearing means supporting said pull rod in said hollow enclosed members for true straight-line reciprocating movement, and means connected to said pull rod for actuating said pull rod to effect opening and closing of said interrupter.

7. In a circuit interrupter, the combination of a plurality of enclosed receptacles, communicating means forming closed passages extending between the walls of adjacent receptacles, a pull rod extending through said receptacles and said communicating means, bearing means comprising rollers supporting said pull rod in said communicating means between said receptacles for true straight-line movement, stored energy means disposed to move said pull rod in one direction to effect opening of said interrupter, and means connected to said pull rod for moving said pull rod in the opposite direction to effect closing of said interrupter.

8. In a circuit interrupter, the combination of a plurality of interrupter enclosing receptacles, each of said interrupters having a lift rod attached thereto disposed for true vertical straight line movement, tubular means having imperforate walls extending only between the walls of adjacent receptacles, a reciprocating pull rod extending through all of said receptacles and said tubular means, bearing means supporting said pull rod in said tubular means for true horizontal straight-line movement, and a linkage in each of said receptacles connected to said pull rod for translating the true horizontal straight-line movement of said pull rod to true vertical straight-line movement of said lift rod.

9. In a circuit interrupter, the combination of an enclosing tank, bearing means comprising tubular members having imperforate walls on opposite sides of said tank, a pull rod extending through said enclosing tank and said bearing means for operating said interrupter, rollers disposed in said bearing means at opposite sides of said enclosing tank supporting said pull rod for straight line motion, said rollers and said pull rod substantially closing said bearing means to form baffles at each side of said enclosing tank.

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10. In a multi-pole circuit interrupter comprising a plurality of pole units, housing means for said interrupter having barrier means separating said pole units, bearing means comprising tubular members having imperforate walls disposed between said pole units, a pull rod extending through said pole units and through said bearing means for operating said pole units, and rollers in said bearing means between said pole units supporting said pull rod for straight line reciprocating motion.

11. In a multi-pole circuit interrupter comprising a plurality of pole units, housing means for enclosing said interrupter and having barrier means separating said pole units, imperforate tubular bearing means mounted in said barrier means forming closed passages between said pole units, a pull rod extending through said pole units and through said tubular bearings for operating said pole units, rollers disposed in said bearings between said pole units supporting said pull rod for straight line reciprocating motion.

12. In a circuit interrupter, the combination of a plurality of interrupter enclosing receptacles, each of said interrupters having a rod disposed for up and down movement, tubular bearing means adjacent the walls of adjacent receptacles, a reciprocating member extending through all of said receptacles and said tubular bearing means, said tubular bearing means supporting said reciprocating member for horizontal straight-line movement, and a linkage in each of said receptacles connected to said reciprocating member and to said rod for translating the horizontal straight-line movement of said reciprocating member to up and down movement of said rod, said linkage including a plurality of movable members, one of which is a bodily movable link supported entirely by being pivoted to said reciprocating member at a point which moves in a horizontal straight line and by being pivoted to another movable member of the linkage at a movable point.

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