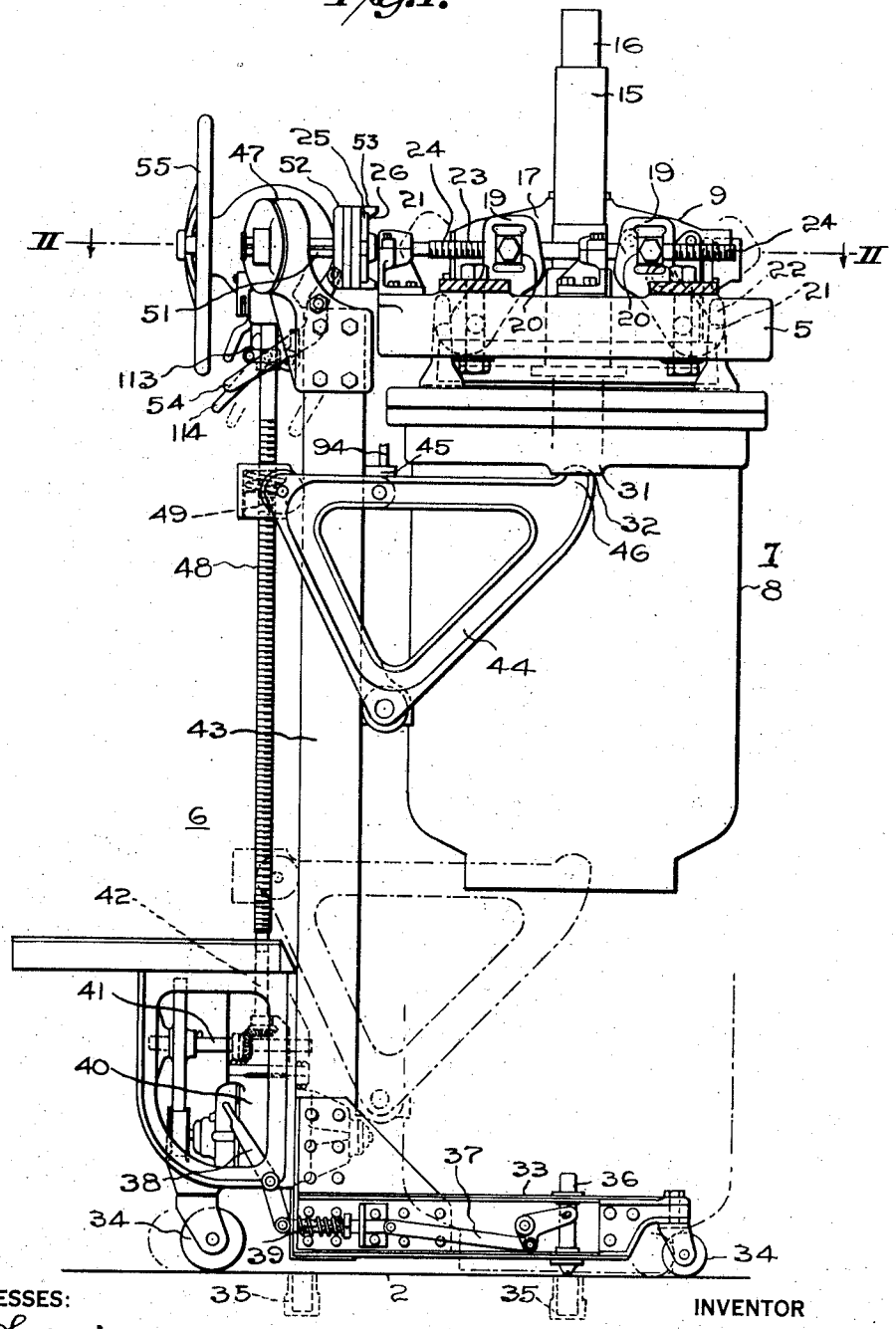
April 12, 1927. 1,624,361

J. W. W. OW

LIFTING TRUCK FOR CIRCUIT BREAKER TANKS

Filed April 15, 1925 4 Sheets-Sheet 1

Fig. 1.



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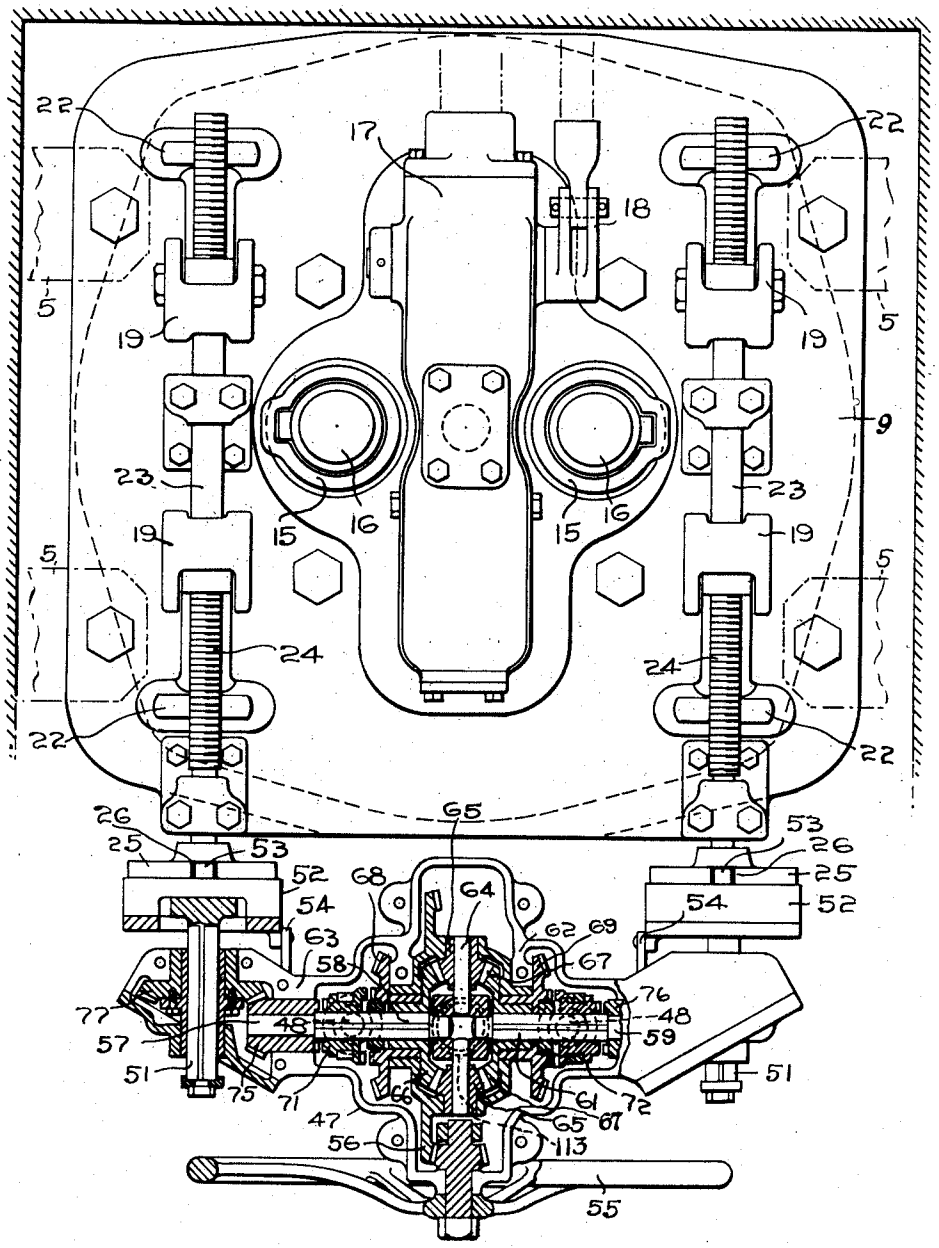
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LIFTING TRUCK FOR CIRCUIT BREAKER TANKS

Filed April 15, 1925 4 Sheets-Sheet 2

Fig. 2.



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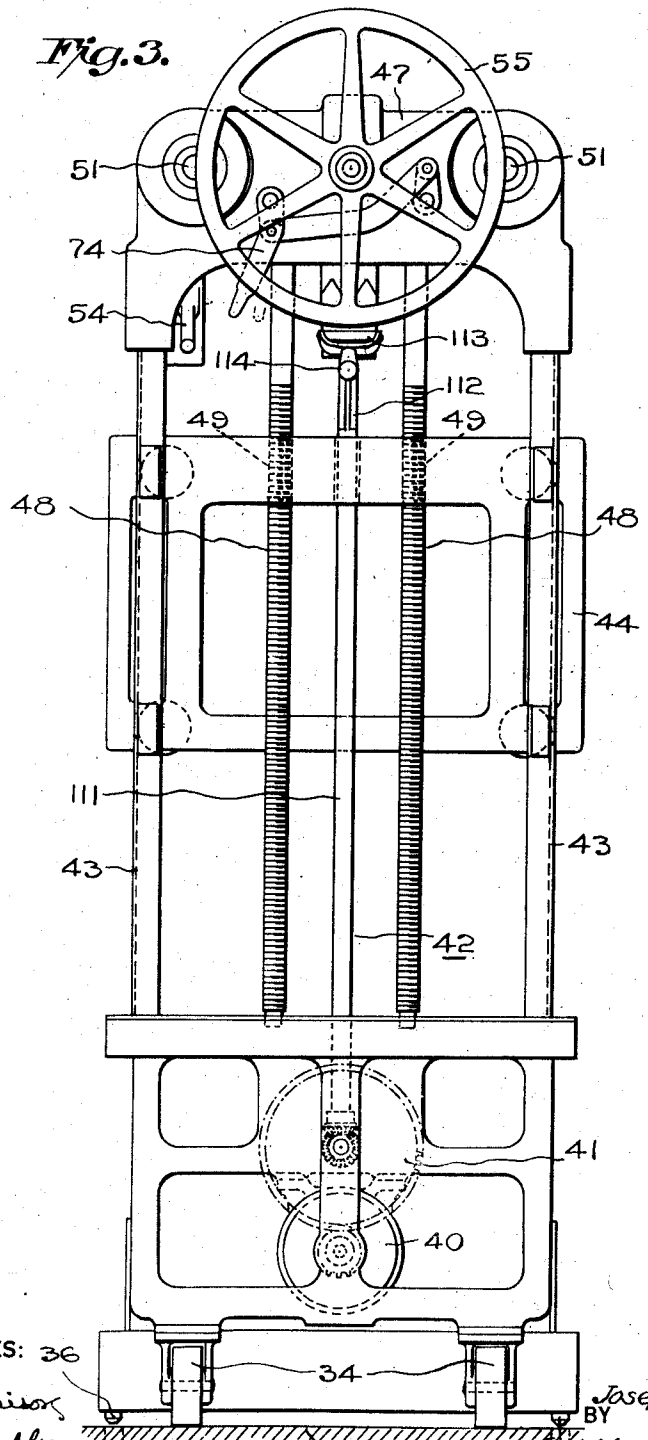
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LIFTING TRUCK FOR CIRCUIT BREAKER TANKS

Filed April 15, 1925 4 Sheets-Sheet 3

Fig. 3.



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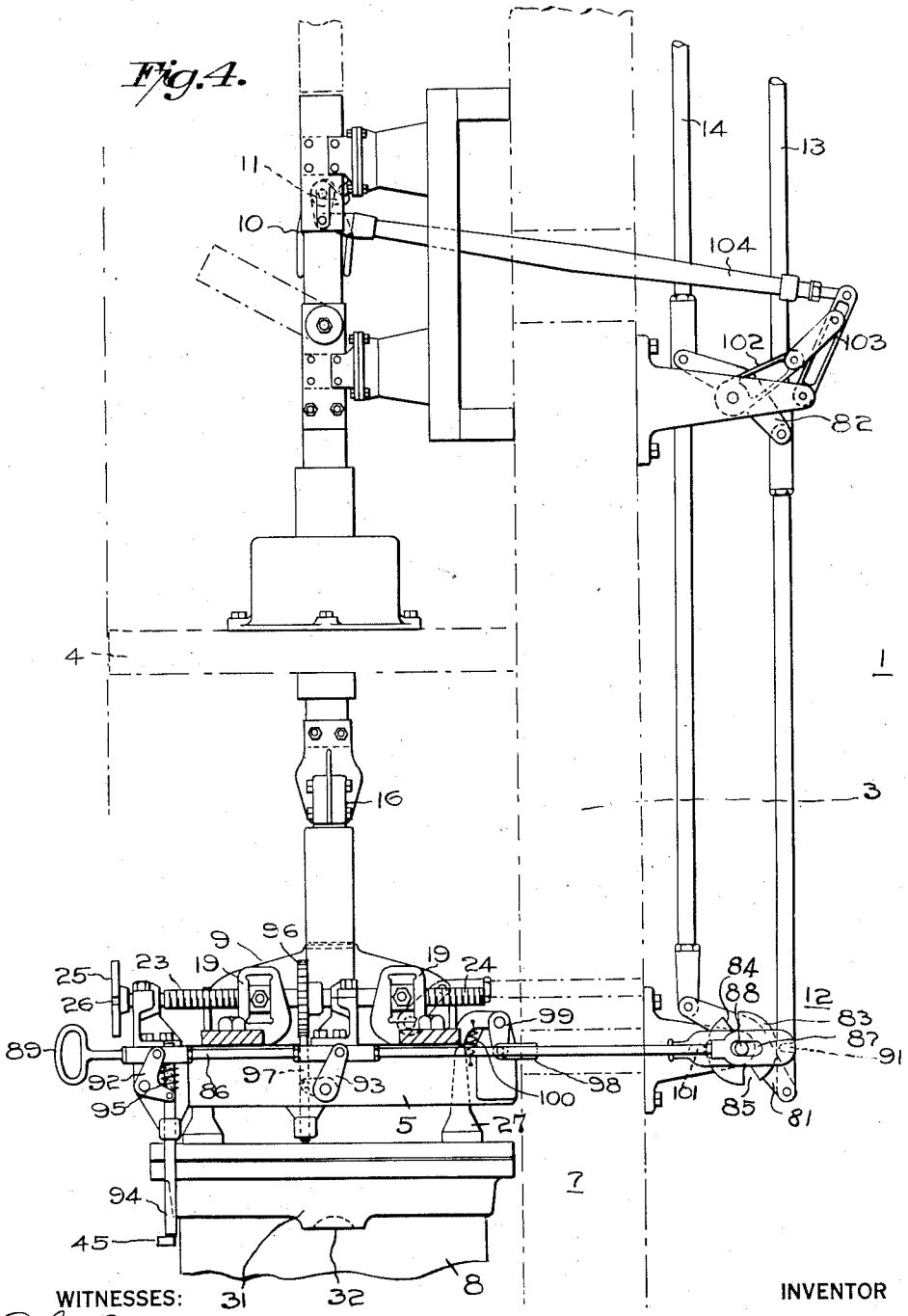
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April 12, 1927. J. W. W. OW 1,624,361

LIFTING TRUCK FOR CIRCUIT BREAKER TANKS

Filed April 15, 1925 4 Sheets-Sheet 4

Fig. 4.



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UNITED STATES PATENT OFFICE.

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LIFTING TRUCK FOR CIRCUIT-BREAKER TANKS.

Application filed April 15, 1925. Serial No. 23,400.

My invention relates to power house equipment and particularly to tank lifters of the truck type and interlocks therefor.

One object of my invention is to provide a tank lifter that shall raise and also adjust or clamp a tank in position after it has reached its elevated position.

Another object of my invention is to provide a tank-lifting and adjusting device that shall have a source of power that may be selectively utilized for elevating a portion of a circuit breaker tank or the like and for adjusting or clamping the tank in elevated position.

It is also an object of my invention to provide a tank-lifting and adjusting device of the truck type that shall be easily positioned with respect to the element to be manipulated.

Another object of my invention is to interlock the clamping means on a circuit breaker with the disconnecting switches adjacent thereto and the tank-lifting and adjusting device, so that the latter may perform its adjusting feature only when predetermined portions of a circuit interrupter and the disconnecting switch are in their proper position.

It is a further object of my invention to provide an adjusting device for a plurality of groups of clamps such that the tension on all groups of clamps is equalized.

The tank lifting and adjusting device shown and described in this application constitutes the subject-matter of the application of C. Aalborg, Serial No. 91,776, filed March 2, 1926, and which is assigned to the Westinghouse Electric and Manufacturing Company.

As a matter of safety for workmen engaged in manipulating large circuit interrupters, it is customary to have the circuit interrupters interlocked with suitable disconnecting switches in such manner that the circuit interrupters cannot be operated unless the disconnecting switches are in their open position. I provide additional interlocking means such that the tank-lifting and adjusting device cannot perform its clamping operation until in proper position, unless the disconnecting switches are open and the tank member of the circuit interrupter is in its proper position.

In the accompanying drawings,

Figure 1 is an elevational view of a circuit interrupter and my improved tank-lifting and adjusting device in operative connection thereto.

Fig. 2 is a plan view, partially in section, of the circuit interrupter and the tank-lifting and adjusting device taken along the section line II—II of Fig. 1.

Fig. 3 is a rear end view of the tank-lifting and adjusting device, and

Fig. 4 is a fragmentary view of the circuit interrupter and disconnecting switch showing the interlocking connection therebetween.

Referring to Figs. 1 and 4, a power house 1 has a floor 2, a vertical wall 3 having a horizontal partition 4 and a horizontal support 5 extending from the side wall 3. A tank-lifting and adjusting device 6 embodying my invention is supported by the floor 2.

The power house is provided with a circuit interrupter 7 comprising a tank member 8 and a cover member 9 that are mounted on the support 5, a suitable disconnecting switch 10 mounted on the wall 3 and suitable interlocking means 12 for interconnecting the disconnecting switch 10, the circuit interrupter 7 and the tank-lifting and adjusting device 6.

The tank member 8 of the circuit interrupter 7 contains insulating fluid for the circuit interrupter and is adapted to be lowered by the tank lifting and adjusting device 6 in order to expose the contact members of the circuit interrupter for repairs and inspection and then raised to normal position.

The power house 1 may be of any conventional construction, such as brick, concrete and the like, in which the wall 3 extends for a considerable distance in order to accommodate a plurality of units, each of which comprises a circuit interrupter 7, a disconnecting switch 10 having a latch 11 and an interlocking device 12. The number of such units may be multiplied indefinitely in accordance with the size of the power house. The description of a single unit will suffice for the purposes of the present specification.

In such power houses, it is customary to operate the circuit breakers 7 by means of pull rods 13 and 14 controlled from an upper floor of the power house (not shown). The pull rods 13 and 14 constitute portions of the interlock 12 as will be more fully

hereinafter described. For the sake of simplicity, the mechanical connections between the pull rods 13 and 14 and the moving contact member of the circuit interrupter have been omitted, as they form no part of the present invention.

Referring particularly to Figs. 1 and 2, the cover member 9 of the circuit interrupter 7 is firmly secured to the supports 5 and is intended to remain in fixed position. The cover member 9 is provided with bushings 15 for conductors 16 and with an upwardly extending housing 17 to provide clearance space for the circuit breaker operating mechanism (not shown), which may be operated by a lever 18 suitably connected to the pull rods 13 and 14.

The cover member 9 also supports a plurality of groups of oppositely extending clamps 19, the lower edges of which are notched, as at 21, to engage slots in ears 22 formed on the tank member 8 for securing the latter in operative position. Each pair of clamps 19 is actuated by a horizontally extending shaft 23, portions of which are oppositely threaded, as at 24, for the purpose of actuating the clamps 19 during rotational movement of the shafts 23. The upper portions of the clamps 19 comprise aligning nuts 20 that are internally threaded for engaging the threads 24. Accordingly, reversal of the direction of rotation of the shafts 23 causes the clamps 19 to respectively engage or disengage the ears 22 on the tank member and clamp the latter in place.

The ends of the shafts 23 are provided with couplings 25 for a purpose to be hereinafter described. The couplings 25 may have a continuous periphery or be notched, as at 26, if desired, in order to co-operate with a gripping mechanism to be hereinafter described.

Referring particularly to Fig. 4, in addition to the ears 22, the tank 8 is provided with an upwardly extending lug 27 that extends to a point above the level of the support 5, and with bosses 31 having seats 32 therein for engagement with the tank lifting and adjusting device 6.

Referring particularly to Figs. 1 and 3, the tank-lifting and adjusting device 6 comprises a platform 33 that is mounted on suitable rollers 34 that rest on the floor 2 of the power house 1. The floor 2 is provided with a plurality of openings 35 that co-operate with adjustable pins 36 carried by the tank-lifting and adjusting device for positioning the latter with respect to the circuit interrupter 7. The pins 36 are connected through a link-and-toggle mechanism 37 to a hand lever 38 and are biased in their raised position by a coil spring 39. If the tank lifting and adjusting device 6 is in its proper position when the lever 38 is given a clockwise turning movement, the toggle mechanism 37 is locked and the pins 36 are depressed to enter the openings 35 in the floor 2.

A source of power 40, such as an electric motor, is mounted to the rear of the platform 33 and is connected, by a gear train 41, to a vertically disposed telescopic drive shaft 42. A heavy frame, comprising guide members 43, extends upwardly from the platform 33 for supporting a carriage 44 that comprises a boss 45, and forwardly extending arms that terminate in bosses 46 for engaging the depressions 32 in the bosses 31 of the tank member 8 and thereby support the latter when it is in motion.

The guide members 43 terminate in a header 47, from which downwardly extending screw threads 48 are driven for engaging internal threads 49 in the carriage 44 and actuating the latter in accordance with the direction of rotation of the screw threads 48.

The header 47 also carries a pair of horizontally extending squared shafts 51 that terminate in suitable gripping devices 52 for engaging the coupling members 25 on the shafts 23. The gripping devices 52 carry resiliently supported lugs 53 for engaging the notches 26 in the coupling member 25. A hand lever 54 is carried by the header member 47 for directly moving the gripping members 52 in the direction of their supporting shafts 51.

The header member 47 contains a differential gearing that is driven by the shaft 42, or by a hand wheel 55, for selectively driving the screw threads 48 to raise or lower the carriage 44, or to drive the shafts 51 for tightening or loosening the groups of clamps 19.

Referring particularly to Fig. 2, the shaft 42 and the hand wheel 55 each engage a ring gear 56. The shaft 42 engages the ring gear 56 by means of a gear connection disposed within the header 47 below the plane of Fig. 2, and is indicated by dotted concentric circles. The ring gear 56 is adapted to freely rotate about a shaft 57 that is squared for a portion of its length, as at 58. The shaft 57 does not extend through the entire length of the header 47, but is complemented, at the right of the center of the header member 47, by a shaft 59 having a squared portion 61. Suitable bearing surfaces 62 and 63 are provided for supporting the shafts 57 and 59. The ring gear 56 turns within the bearing surfaces 62 and 63 and the outside of the shafts 57 and 59.

The ring gear 56 supports a pair of stub shafts 64 that, in turn, carry pinion 65. The pinion 65 engages oppositely disposed gears 66 and 67 that fit upon the squared portions 58 and 61 of the shafts 57 and 59, respectively. The shafts 57 and 59 are, accordingly, driven by the gears 66 and 67, respective-

ly, but are capable of a differential action with respect to each other such that the shafts 57 and 59 will respectively deliver equal torques. Ring gears 68 and 69 are loosely mounted exteriorly of the hubs of the gears 66 and 67, respectively, whereby the hubs of the several gears are free to rotate relatively to each other except for frictional engagement, which is negligible when considered in connection with the amount of torque to be delivered by the shafts 57 and 59. Ring gears 68 and 69 are adapted for engaging and driving the screw threads 48.

Driving clutches 71 and 72 are mounted for longitudinal movement on the squared portions 58 and 61 of the shafts 57 and 59, respectively, and rotate therewith. Referring to Fig. 3, a hand-lever system 74 is mounted exteriorly of the header member 47 for sliding the driving clutches 71 and 72 inwardly and outwardly along the shafts 57 and 59 simultaneously. When the driving clutches 71 and 72 are moved inwardly, they engage the ring gears 68 and 69, respectively and actuate the screw threads 48.

The outer ends of the shafts 57 and 59, respectively, are surrounded by and rotate within beveled gears 75 and 76, respectively, that, in turn, are connected to beveled gears 77 mounted on the squared shafts 51. When the driving clutches 71 and 72 are moved outwardly by manipulation of the lever system 74, they disengage the ring gears 68 and 69, respectively, and engage the gears 75 and 76, respectively, thereby causing the squared shafts 51 to rotate. If the gripping members 52 are in engagement with the couplings 25, the shafts 23 are rotated, thereby drawing the clamping members 19 into engagement with the ears 22. By reason of the differential action in the gear train just outlined. the pressure exerted by the several shafts 23 on the several groups of clamps 19 will be equal. Danger of breaking one set of clamps 19 by drawing it up too snugly before an associated set of clamps 19 are sufficiently taut, is thereby eliminated.

Referring to Fig. 4, the interlocking device 12 comprises the pull rods 13 and 14 previously mentioned that jointly control a pair of levers 81 and 82 that are pivotally supported on the wall 3. The lever 81 actuates a flange 83 having, in the periphery thereof, a pair of depressions 84 and 85. A horizontally extending rod 86 is provided with a slot 87 that fits over the shaft 88 on which the crank 81 is mounted. One end of rod 86 terminates in a handle 89 and is provided, at its other end beyond the slot 87, with a lug 91 that slides upon the periphery of the disc 83 and is adapted to enter the depression 85 under conditions hereinafter more fully described. By reason of the engagement between the periphery of the flange 83 and the lug 91, the rod 86 is biased to the right of the figure when the pull rods 13 and 14 are in such position that the disconnecting switch 10 is closed.

A pair of bell cranks 92 and 93 are mounted on the cover member 9 of the circuit interrupter 7 and are connected to the rod 86. Bell crank 92 is attached to a rod 94 that, in turn, is biased in a downward direction by a spring 95 that bears against an undersurface of the cover member 9, whereby the rod 86 is always biased to the right of the drawing.

The bell crank 93 controls a ratchet 96 mounted on the shaft 23 through a pawl 97 in such manner that the form cannot be turned so long as it engages the pawl 97. Upon movement of the rod 86 to the left, as viewed in the drawing, which can only take place when the lug 91 is in the depression 85, which, for automatic operation, necessitates the compression of spring 95 by reason of the engagement between boss 45 and the rod 94, the pawl 97 is moved out of engagement with the ratchet 96 and the shaft 23 can rotate freely in either direction. However, since the rod 86 can be moved to the left, either by the manipulation of the pull rods 13 and 14 or the handle 89, only when the disconnecting switch 10 is in its open position, as indicated by the registry of lug 91 in depression 85, the shaft 23 cannot be turned until the disconnecting switch 10 is opened.

A second rod 98 is pivotally supported on the cover member 9, behind the rod 86 as viewed in Fig. 4, by a bell crank 99 that is biased in a counter-clockwise direction by a spring 100. The end of the bell crank 99 engages the end of the lug 27 carried by the tank 8 when the latter is in its clamped position, thereby tending to move the rod 98 to the left of the figure when the tank is in proper position. The rod 98 carries a lug 101 that co-operates with the depression 84 in the flange 83. The rods 86 and 98 are independently mounted on the shaft 88. When the tank member 8 is removed, the engagement between the lug 101 and the depression 84 prevents manipulation of the pull rods 13 and 14.

The crank 82 actuates an arm 102 that forms a part of a toggle mechanism 103 for actuating a connecting rod 104 attached to the latch 11 of disconnecting switch 10. When the relative positions of the pull rods 13 and 14 are changed from that shown in the drawing, the crank 81 turns in a counter-clockwise direction, thereby turning the arm 102 in such manner as to cause the toggle mechanism 103 to collapse and to move the connecting rod 104 to the left of the figure, thereby manipulating the latch 11 and then opening the disconnecting switch 10. However, since the pull rods 13 and 14 must

be in the open position of the disconnecting switch 10 when the clamping shafts 23 are operated, it follows that the disconnecting switch 10 is operatively interlocked with the clamping mechanism of the tank lifting and adjusting device. Also, since the pull rods 13 and 14 cannot be manipulated until the tank member 8 is in its proper position, the disconnecting switch 10 is interlocked with the circuit interrupter itself.

Referring to Fig. 3, the telescopic driving shaft comprises a lower main section 111 that extends upwardly thru the carriage 44 and terminates in a squared portion 112. A collar or extension 113 is disposed over the squared portion 112 and is adapted for longitudinal movement therealong by means of a lever 114 pivotally mounted on the header 47. The outer edge of the collar 113 meshes with the ring gear 56, only when the operator keeps the handle 114 in its upper position. By reason of the telescopic connection on the shaft 42, the attendance of the operator during the operation of the device 6 is insured.

In the operation of a circuit interrupter embodying my invention, the pull rods 13 and 14 are first manipulated to unlatch and open the disconnecting switch 10 and to operate the circuit interrupter 7 to its open circuit position. The tank-lifting and adjusting device 6 is then positioned by causing the pins 36 to engage the openings 35 in the floor 2. The handle 114 is raised and the screw threads 48 are then rotated until the arms 46 firmly engage the boss 31 in the tank member 8 and the boss 45 engages the rod 94. The gripping members 52 are then caused to engage the coupling members 25 by manipulation of the hand lever 54. The shafts 23 are then turned in such manner as to loosen the clamps 19 and, when the clamps 19 are free from the ears 22, the screw threads 48 are actuated in order to lower the carriage 44 until the tank member 8 rests upon the platform 33. The pins 36 are then drawn from the openings 35 and the truck moves the tank member 8 away from the cover member 9 leaving the operating parts of the circuit interrupter open for inspection or repair.

When it is desired to replace the tank, the foregoing operations are repeated in their reverse order and where necessary the direction of rotation of the motor 40 is reversed.

It will thus be seen that I have provided a tank-lifting and adjusting device for circuit interrupters that both lowers and raises an element of the circuit interrupter and is capable of adjusting or clamping that element in place. At the same time, operation of the tank-lifting and adjusting device to clamp the circuit breaker element in place when the disconnecting switches are closed, is prevented. Likewise, manipulation of the controlling pull rods for the circuit interrupter is prevented when the tank member is removed. I have also devised an improved means for positioning the tank-lifting and adjusting device relative to the circuit interrupter.

I do not wish to be restricted to the specific arrangement of parts herein set forth, as various modifications thereof may be effected without departing from the spirit and scope of my invention. I desire, therefore, that only such limitations shall be imposed as are indicated in the appended claims.

I claim as my invention:

1. The combination with a tank-lifting and adjusting element, a circuit interrupter element and a disconnecting switch element, of interlocking means for controlling the operation of the tank-lifting and adjusting element in accordance with the position of another element.

2. The combination with a tank-lifting and adjusting element, a circuit interrupter element and a disconnecting switch element, of interlocking means for controlling the operation of the tank-lifting and adjusting element in accordance with the position of the disconnecting switch element.

3. The combination with a circuit interrupting element, a tank-lifting and adjusting element and a supporting surface therefor, of means for positioning the tank-lifting and adjusting device on the supporting surface with relation to the position of the circuit interrupting element.

4. The combination with a circuit interrupting element, a tank-lifting and adjusting element, and a supporting surface therefor and having an opening therein, of means carried by the tank-lifting and adjusting element for cooperating with an opening in the supporting surface for positioning the tank-lifting and adjusting element with reference to the circuit interrupting element.

5. The combination with a tank-lifting and adjusting device for electrical apparatus, of a supporting surface therefor having an opening therein for co-operation with the tank-lifting and adjusting device for positioning the latter.

6. The combination with a disconnecting switch and clamping means for a circuit interrupter, of interlocking means for controlling the operation of the clamping means in accordance with the position of the disconnecting switch.

7. The combination with a tank-lifting and adjusting device, a circuit interrupter comprising a movable tank, and a disconnecting switch, of interlocking means for controlling the operation of the tank-lifting and adjusting device in accordance with the positions of the disconnecting switch and the tank.

8. The combination with a tank-lifting and adjusting device, a circuit interrupter

comprising a movable tank, and a disconnecting switch, of interlocking means for preventing the operation of the tank lifting and adjusting device unless the disconnecting switch and the tank are in predetermined positions.

9. The combination with a circuit interrupter comprising a tank, a tank lifting and adjusting device comprising a carriage and a disconnecting switch, of means for controlling the operation of the disconnecting switch when the carriage is in operative position relative to the tank.

10. The combination with a circuit interrupter comprising a tank, a tank-lifiting and adjusting device comprising a carriage and a disconnecting switch, of means for controlling the operation of the tank lifting and adjusting device dependent upon the condition of the disconnecting switch and upon the position of the carriage relative to the tank.

11. The combination with a tank lifting and adjusting device, a circuit interrupter comprising a movable tank, and a disconnecting switch, of interlocking means for controlling the operation of the disconnecting switch in accordance with the positions of the tank lifting and adjusting device and the tank.

In testimony whereof, I have hereunto subscribed my name this 8th day of April, 1925.

JOSEPH W. W. OW.