

March 23, 1954

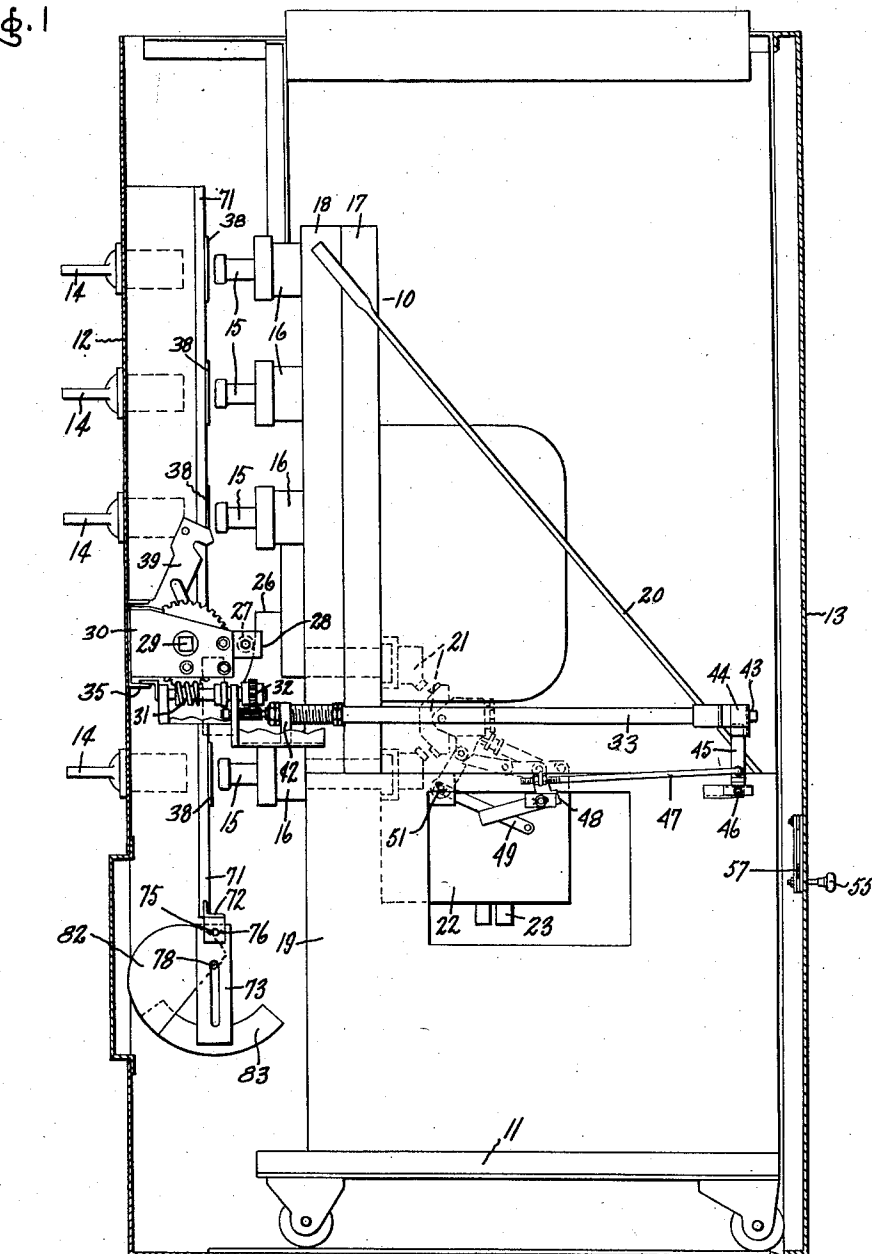
W. N. LESTER ET AL
SWITCHGEAR CARRIAGE ORBITAL CAM RACKING
AND INTERLOCKING MECHANISM

2,673,260

Filed Dec. 20, 1949

4 Sheets-Sheet 1

Fig. 1



Inventors:
William N. Lester,
Emil E. Hebbel, Jr.,
by *Ernest K. Britton*
Their Attorney.

March 23, 1954

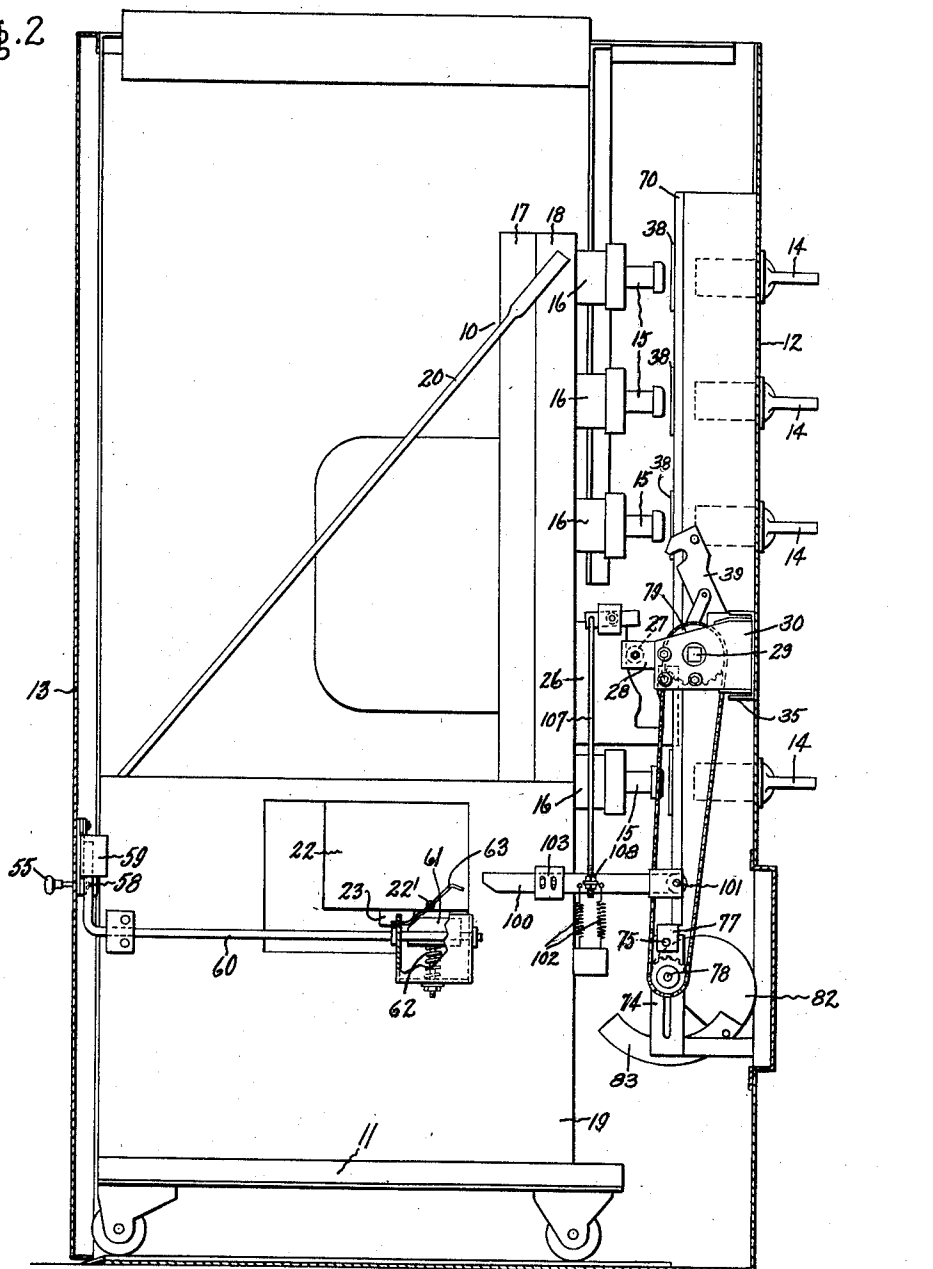
W. N. LESTER ET AL
SWITCHGEAR CARRIAGE ORBITAL CAM RACKING
AND INTERLOCKING MECHANISM

2,673,260

Filed Dec. 20, 1949

4 Sheets-Sheet 2

Fig. 2



Inventors:
William N. Lester,
Emil E. Hebbel, Jr.

by

Ernest C. Britton
Their Attorney.

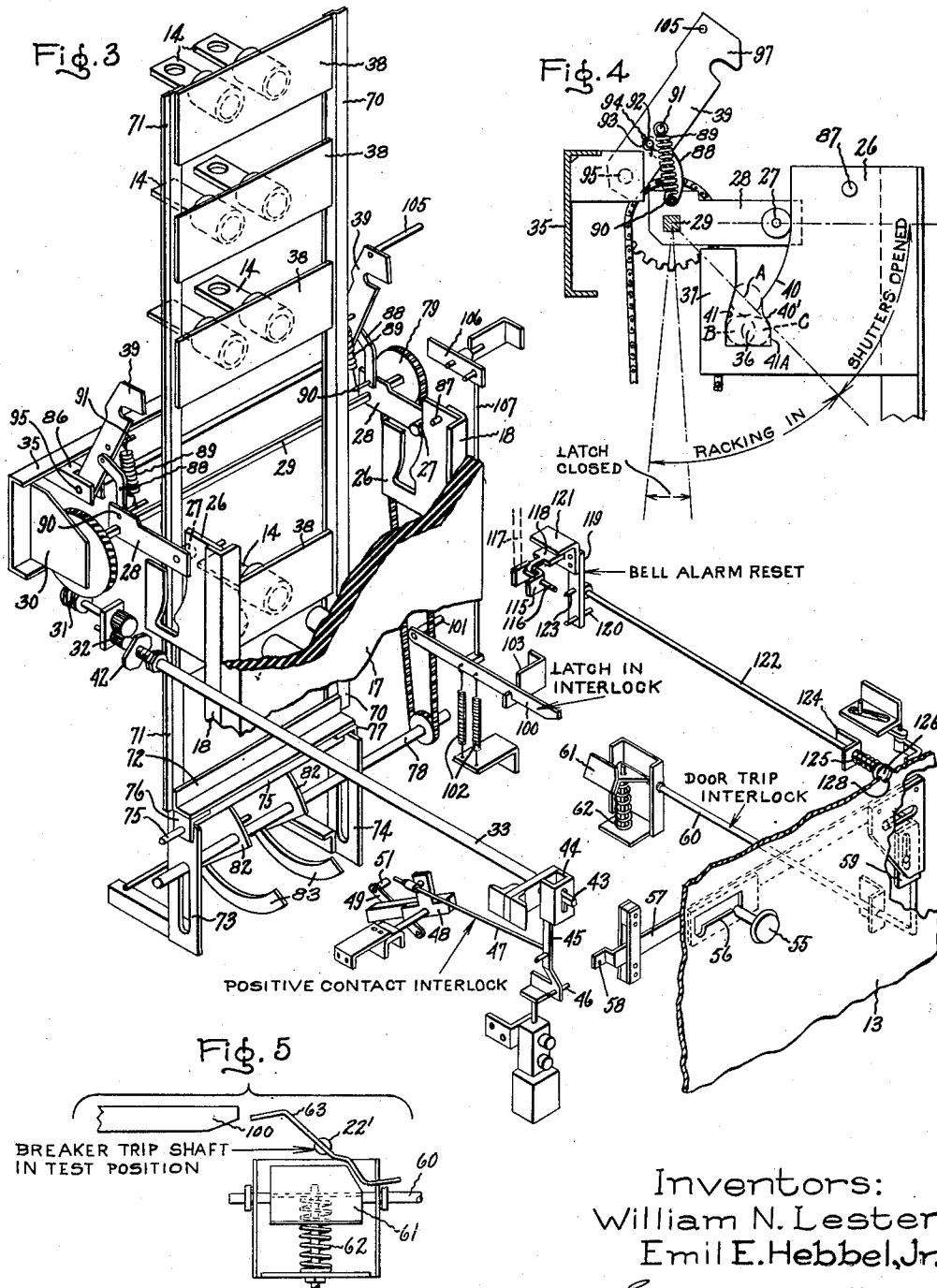
March 23, 1954

W. N. LESTER ET AL
SWITCHGEAR CARRIAGE ORBITAL CAM RACKING
AND INTERLOCKING MECHANISM

2,673,260

Filed Dec. 20, 1949

4 Sheets-Sheet 3



Inventors:
William N. Lester,
Emil E. Hebbel, Jr.
by *Crest C. Britton*
Their Attorney.

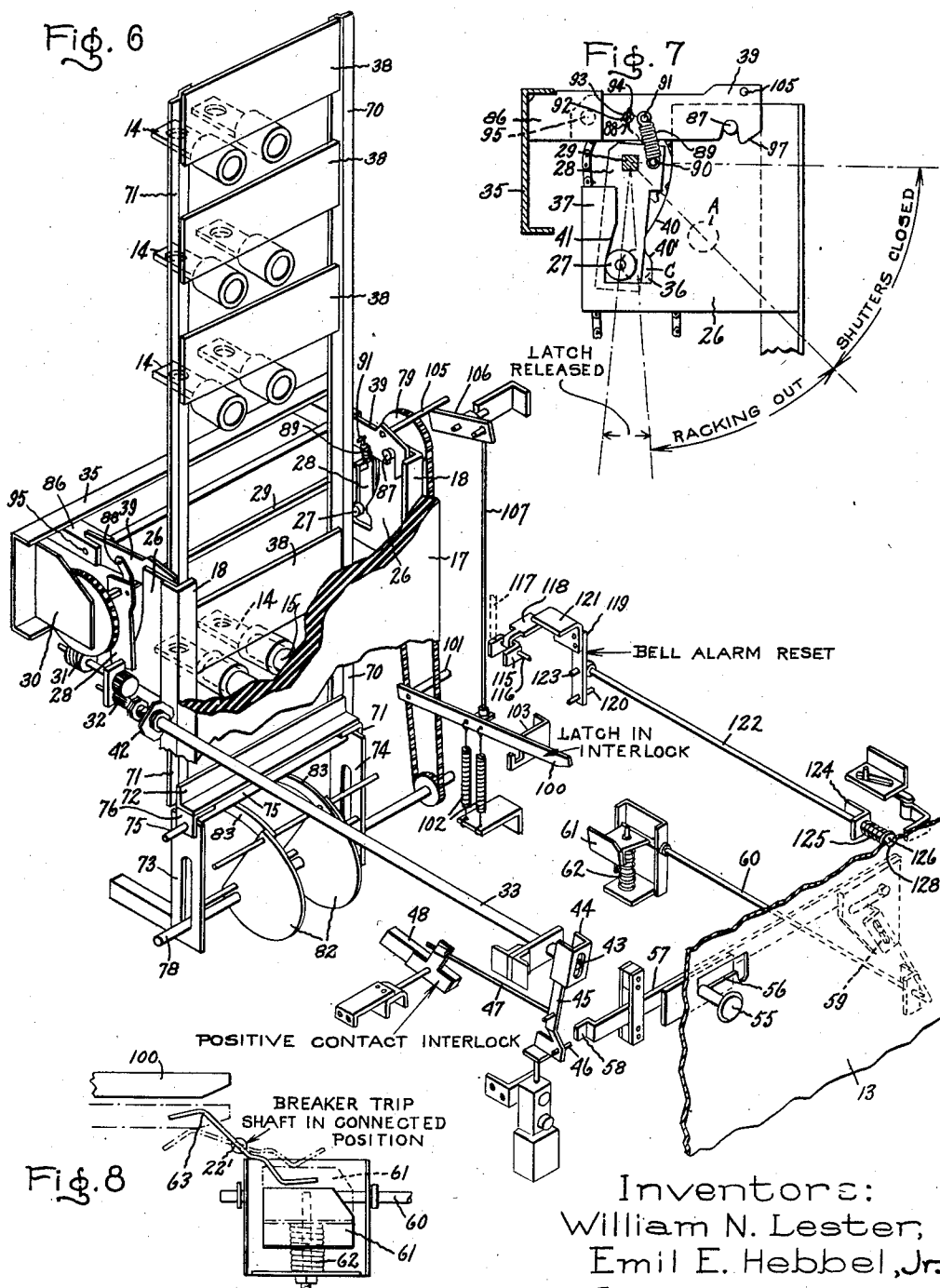
March 23, 1954

W. N. LESTER ET AL
SWITCHGEAR CARRIAGE ORBITAL CAM RACKING
AND INTERLOCKING MECHANISM

2,673,260

Filed Dec. 20, 1949

4 Sheets-Sheet 4



Inventors:
William N. Lester,
Emil E. Hebbel, Jr.,
by Ernest C. Britton
Their Attorney

UNITED STATES PATENT OFFICE

2,673,260

SWITCHGEAR CARRIAGE ORBITAL CAM
RACKING AND INTERLOCKING MECH-
ANISM

William N. Lester, Philadelphia, and Emil E.
Hebbel, Jr., Milmont Park, Pa., assignors to
General Electric Company, a corporation of
New York

Application December 20, 1949, Serial No. 134,062

14 Claims. (Cl. 200—50)

1

The invention provides improved carriage racking and interlocking mechanism particularly suitable for enabling truck mounted power circuit breakers to be completely separated from a metal enclosing cubicle, as well as pushed manually to an intermediate test position in the cubicle having primary circuit terminals mounted at the back and a hinged door for closing the front after the circuit breaker with its main contacts open is racked in or out of connected engagement with the primary circuit terminals.

One object is to provide an improved fixed axis reversible orbital cam follower and releasable carriage hook cam racking mechanism for stopping the breaker carriage in the intermediate test position as well as racking the breaker in and out of its connected position.

Another object is to introduce predetermined sequential lost motions into the carriage racking mechanism so as to enable a positive carriage latch mechanism as well as a primary terminal insulating automatic shutter mechanism to be sequentially operated in conjunction with the racking-in and racking-out mechanism.

Another object is to variably space the racking cam faces on the opposite sides of an elongated opening in a racking cam plate on the carriage having a hook end so as to provide a predetermined limited lost-motion of the orbital cam follower operating shaft between the reverse racking operations of the carriage, as well as a predetermined lost motion before the racking-in operation and substantially the same lost-motion after the racking-out operation. In this way the orbital cam follower operating shaft may be rotated uniformly by means of power amplifying worm gearing or the like to produce the sequential lost motion operations of the positive carriage latch mechanism and the terminal insulating shutter mechanism as well as the heavy orbital cam forces required for reversely racking the breaker in and out.

Another object is to provide an improved positive carriage latch mechanism actuated to the latching position by the carriage racking mechanism during the final stage of the racking-in operation for positively holding the circuit breaker in its connected position against heavy short circuit stresses in conjunction with the racking mechanism and to the latch releasing position before the reverse racking-out occurs.

Another object is to provide interlocking mechanism for insuring against closing of the circuit breaker after racking-in unless the positive carriage latch is in its holding position.

2

Another object is to provide an improved sliding insulating barrier or shutter mechanism actuated by the sequential lost-motion carriage racking mechanism during the sequential lost motions thereof before and after the reverse racking actions so as to cover and thereby isolate the primary circuit terminals in the back of the cubicle as soon as the breaker is racked out to the test position and to uncover these terminals before the breaker is racked into the inserted or connected position.

Another object is to provide an improved door lock and breaker interlocking mechanism that will operate the breaker trip mechanism whenever the cubicle door is unlocked except when the breaker is racked out to the test position with the primary circuit terminals isolated by the sliding shutter mechanism.

Another object is to provide an improved circuit breaker positive contact interlock that will prevent the breaker from being racked either in or out in case the breaker contacts should remain welded together or otherwise remain closed after operation of the trip mechanism.

Further objects and advantages of the invention will appear in the following description of the accompanying drawing in which Fig. 1 is a side view of a truck mounted power circuit breaker, with contacts open, in the test position inside a metal enclosing cubicle with one side of the cubicle removed to reveal the structural details and arrangement of the improved switchgear carriage orbital cam follower and carriage hook cam racking and interlocking mechanism of the present invention; Fig. 2 is a similar view of the opposite side of the circuit breaker with the opposite side of the metal enclosing cubicle removed to show further structure details and arrangement of the racking and interlocking parts; Fig. 3 is a schematic perspective view showing the cooperating parts of the improved circuit breaker carriage sequential lost-motion racking and interlocking mechanism of the present invention when the circuit breaker is stopped inside the cubicle in the test position with contacts open; Fig. 4 is a partial side view on an enlarged scale of the improved fixed axis orbital cam follower and carriage hook cam racking mechanism and also of the positive carriage latch mechanism operated in conjunction therewith and shows the relation of the parts in the test position similar to Figs. 1, 2 and 3; Fig. 5 is a partial side view on an enlarged scale showing the cooperating relation of the circuit breaker trip shaft in the test position with parts of the door trip interlock and

the carriage holding latch interlock; Fig. 6 is a schematic perspective view of the entire racking and interlocking mechanism similar to Fig. 3 but showing the relation of the various parts after the circuit breaker is racked into its connected position and contacts either open or closed; Fig. 7 is a partial side view similar to Fig. 4 showing the relative positions of the fixed axis orbital racking cam follower and carriage hook cam as well as the positive carriage latch after the circuit breaker has been racked into its connected position inside the cubicle; Fig. 8 is a partial side view similar to Fig. 5 showing the relative positions of the breaker trip shaft interlocking mechanism when the breaker is in the connected position and the cubicle door is latched closed.

As shown in Fig. 1, a typical power circuit breaker indicated generally by the reference numeral 10 is mounted on the wheeled truck 11 capable of being pushed into the intermediate test position in the metal enclosing cubicle 12 having a swinging door 13 at the front and a row of spaced-apart primary circuit contact sockets 14 mounted at the back of the cubicle for receiving into contact therewith the row of correspondingly spaced-apart circuit breaker terminal studs 15 when the breaker 10 is racked into its connected position. The circuit breaker terminal studs 15 are shown mounted in insulating bushings 16 carried by the panel 17 mounted on the angle iron supports 18 extending from the truck side walls 19 and braced by the rods 20. The separable contacts 21 and the operating and trip mechanism 22 of the typical circuit breaker 10 that is carried by the truck or carriage 11 are only schematically indicated, as the racking and interlocking improvements of the present invention may be used with any ordinary form of truck-mounted heavy-duty circuit breaker equipped with trip mechanism and provided with a lateral trip shaft or the like for opening the breaker contacts similar to the rotatable trip shaft 22' shown in Fig. 2, for example, a breaker such as shown in Patents 1,935,428 or 1,945,389. In the test position, the breaker 10 may be freely operated to open or close its contacts 21 by means of trip shaft 22', shown in Fig. 2, and the closing solenoid 23 after any necessary inspection, test, adjustment, or repair.

Racking mechanism

In accordance with the present invention, the circuit breaker carriage 11 is racked between the test position inside the metal enclosing cubicle 12 as shown in Fig. 1 and its connected position by means of a pair of hooked racking cam plates 26 that are carried in spaced-apart alignment by the angle supports 18 at the inner end of carriage 11 so as to releasably engage with the pair of spaced-apart aligned fixed axis orbital racking cam followers 27. These orbital cam followers 27 are shown in the form of rollers mounted at the ends of radial arms 28 extending in alignment from the operating shaft 29 that is rotatably supported in suitable bearing brackets 30 with the operating shaft 29 extending across the back of the cubicle for operation by the power amplifying worm gearing 31 and spur gearing 32 when the racking drive shaft 33 is rotated by means of a socket crank or the like applied to the non-circular end 43 thereof. The brackets 30 are carried by a reinforcing channel frame 35 mounted at the back of the enclosing cubicle 12.

As more clearly shown in the enlarged view of Fig. 4, each specially formed hooked racking cam

plate 26 is provided with a constrictive bight extending athwart the arcuate path of the cam follower 27 for releasably engaging the cam follower to provide for lost motion in the racking of the carriage 11 each way between two positions upon reverse arcuate movements of the cam follower 27. Thus, the bight a specially formed undulant opening 36 extending between the back of the hook and the front hooked end 37 and variably spaced cam faces are formed inside the hook so as to cooperate with the orbital cam follower 27 in providing predetermined lost-motion arcuate movement of cam follower 27 for raising or opening the insulating shutters 38 before racking the circuit breaker 10 from the test position to the connected position and a substantially equal reverse lost-motion arcuate movement for lowering or closing the shutters 38 after the circuit breaker 10 is reversely racked from the connected position to the test position. For this purpose the cam plate 26 is provided with an arcuate back cam face 40 that serves upon engagement with cam follower 27 to stop the carriage 11 in the test position and also provides slightly over 40 degrees of angular lost movement of the operating shaft 29 for raising or opening the shutters 38 before the orbital cam follower 27 passes through the narrow part of the opening 36 and engages with the reentrant or hump-backed cam face 41 formed on the inside of the hook end 37 with the orbital cam follower 27 in the dotted-line position A. After such lost-motion raising of shutters 38, continued rotation of the operating shaft 29 will then exert a powerful camming action on the front cam face 41 inside of the hooked end 37 and thereby rack the circuit breaker carriage 11, with breaker contacts 21 open, from the test position to its connected position wherein the circuit breaker terminal studs 15 are in full connected engagement with the primary circuit contact socket terminals 14. A traveling nut type of stop mechanism 42 serves to limit the rotation of the racking drive shaft 33 required to move cam 27 from its full-line position shown in Fig. 4 to its final dotted-line rack-in position B. During the final phase of the racking-in operation, the positive carriage latch mechanism 39 is operated to the latching position as more fully described hereafter.

Racking-out of the circuit breaker carriage 11 is accomplished by reverse rotation of the racking drive shaft 33. This results in a lost-motion arcuate movement of the cam follower 27 from its final racking-in, dotted-line position B to its initial racking-out, dotted-line position C. During this lost-motion movement of cam follower 27, the positive carriage latch mechanism 39 is released as described more fully hereinafter. Upon continued arcuate movement of the cam follower 27, the racking-out operation is obtained by movement of the cam follower 27 along the hump-backed cam face 40' which, together with arcuate cam face 40, forms the back of the hook cam plate. As soon as the cam follower 27 is returned substantially to its dotted-line position A at the narrow part of opening 36, the racking-out operation is completed and the continued arcuate movement of cam follower 27 along the arcuate cam face 40 to its original full-line position provides the lost-motion required for lowering operation of the shutter mechanism 38 into position to insulate the row of primary circuit sockets 14 at the back of the enclosing cubicle 12 while the circuit breaker carriage 11 remains in the test position. A comparison of Figs. 4 and 7

5

will show that due to the lost motion provided by the constrictive bight of the hook 26, the orbital racking cam follower 27 can rack the circuit breaker carriage each way between two positions upon unequal reverse arcuate movements of the cam follower, since the arcuate cam follower movement required to effect racking-in operation is less than the arcuate cam follower movement required to effect racking-out operation.

Positive contact interlocking mechanism

However, in further accordance with the present invention, access to the non-circular end 43 of racking drive shaft 33 will be effectively prevented by means of an extensible perforate enclosure or telescoping cover 44 carried on an arm 45 pivoted on pin 46 and connected through an adjustable link 47 with a bell crank 48 that is engaged by the positive contact interlocking arm 49 in case the contacts of the circuit breaker 10 are closed in the test position or in the connected position. For this purpose the interlocking arm 49 is removably mechanically connected with the circuit breaker operating mechanism 22 so as to pivot about the axis 51 to the position in which the member 49 is shown in Fig. 1 when the contacts 21 of the circuit breaker are in the open position, thereby enabling the extensible cover 44 to be retracted into the position in which it is shown in Fig. 1 so as to expose the non-circular end 43 of the drive shaft 33 for application of the racking crank. However, when the circuit breaker contacts 21 are closed, the positive contact interlock member 49 is raised to engage the bell crank 48 and thereby hold the cover 44 outwardly sufficiently to prevent application of the racking crank to the non-circular end 43 of the racking drive shaft 33. The interlocking member 49 likewise engages the bell crank 48 to produce this same result when the circuit breaker truck 11 is racked into the connected position of the circuit breaker 10 and the circuit breaker contacts 21 are closed. Thus the positive contact interlock member 49 operates the cover 44 to render the racking mechanism ineffective as long as the circuit breaker contacts 21 are closed in either the test or the connected position. This effectively insures against opening or closing the power circuits at the primary disconnects 14 and 15 in case the circuit breaker contacts 21 should become welded together or otherwise remain in the closed position after the circuit breaker trip shaft 22' has been operated to open the breaker either by hand or by means of the usual automatic current-responsive devices, not shown.

Door latch interlocking mechanism

In further accordance with the present invention, a door latch interlock is provided for selectively operating the trip shaft 22' of the circuit breaker 10 to insure the breaker contacts being open whenever the door 13 of the enclosing cubicle 12 is unlatched with the circuit breaker carriage 11 racked into its connected position. For this purpose, as shown in Figs. 3 and 6, the door 13 is provided with a latch operating handle 55 extending through the end recessed slot 56 in the door to move the latch bar 57 between its unlatched position shown in Fig. 3 and its latched position shown in Fig. 6 wherein the offset end 58 engages with the side of the cubicle to latch the door 13 closed. As the door 13 is thus latched, the slotted bracket 59 is moved by the latch bar 57 so as to rotate the rod 60 and

6

lower the interlock tripping finger 61 against the bias of spring 62. As a result, the tripping finger 61 is lowered out of the path of the slanting tripping arm 63 carried by the trip shaft 22' when the circuit breaker is in its connected position, as shown in Fig. 8. However, whenever the circuit breaker contacts 21 are closed with the breaker in the connected position and the locking handle 55 is operated to unlock the door 13, then the tripping finger 61 will be raised by spring 62 to its dotted-line position shown in Fig. 8 wherein the lower end of the slanting tripping arm 63 is engaged by the tripping finger 61 so as to rotate the trip shaft 22' to trip the breaker to the open position. However, in case the breaker 10 has been racked to the test position, the door lock tripping mechanism becomes ineffective since the tripping finger 61 in its raised position no longer engages with the double-ended tripping arm 63, as shown in Fig. 5. Under these conditions, the breaker may be freely opened and closed irrespective of whether the door is closed and latched or open and unlatched as long as the breaker carriage remains in the test position.

Contact insulating shutter mechanism

The row of insulating shutters 38 are correspondingly spaced apart to overlap and shield the row of stationary primary circuit contact sockets 14 mounted at the back of the cubicle 12 when the shutters are lowered, as shown in Figs. 1, 2, and 3, and to expose these sockets for engagement by the cooperating row of spaced-apart circuit terminal studs 15 when the shutters are raised, as shown in Fig. 6. As shown in Fig. 3, the shutters 38 are carried between two sliding frame members 70 and 71 having their outer edges engageable with suitable guide supports provided in the back of the cubicle 12. A cross member 72 is connected between the bottom ends of the two sliding frame members 70 and 71 and carries the two slotted guide members 73 and 74, as well as the transverse cam follower rod 75 extending between the brackets 76 and 77. The shutter operating cam shaft 78 extends through the slots in the guide members 73 and 74 and is operatively connected with the main cam operating shaft 29 by means of the chain and sprocket drive mechanism 79 so as to be rotated simultaneously therewith but at a somewhat greater angular speed. The shutter operating cam shaft 78 carries the spaced-apart cam members 82 that are shaped to raise the shutters 38 from their shielding position shown in Fig. 3 to their non-shielding position shown in Fig. 6 during the substantially 40-degree angular movement of the main operating shaft 29 required to effect lost-motion movement of the racking cam follower 27 from its full-line position along the arcuate cam face 40 to its dotted-line position A, shown in Fig. 4. The two shutter-operating cams 82 are provided with the arcuate extensions 83 for engaging the cam follower rod 75 to maintain the shutters in their raised position shown in Fig. 6 during the continued racking-in movement of the main operating shaft 29 required to position the racking cam follower 27 in its final rack-in position shown in full-line in Fig. 7. These arcuate cam extensions 83 likewise serve to maintain the shutters 38 in their raised position shown in Fig. 6 during the reverse racking-out operation of the main cam shaft 29 until the racking cam follower 27 reaches its dotted-line position A to

complete the racking-out of the circuit breaker to the test position. Thereafter, continued reverse rotation of the operating shaft 29 moves the cam follower 27 along the arcuate cam face 40 to provide the lost-motion in the camming action required for lowering the shutters 38 to their shielding position shown in Fig. 3.

Positive carriage latch mechanism

Each of the positive carriage latches 39 is pivotally mounted on the reinforcing channel 35 by means of a clevis block 86 so as to engage during the final stage of the racking-in operation of the circuit breaker carriage 11 with a pin 87 extending inwardly from the racking cam plate 26, as shown in Fig. 7. To accomplish this, each positive carriage latch 39 is operatively connected with a corresponding one of the radial arms 28 carrying the racking cam follower 27 by means of a lost-motion link connection 88 and a resilient spring connection 89. The connections of the link 88 and spring 89 are such as to provide for lost motion operation of latch 39 by spring 89 during the final stage of the latching-in operation. Thus, the spring 89 is connected between the pin 90 on the arm 28 and the pin 91 on the latch 39. The link 88 is connected at one end with the pin 90 and the other end of the link 88 carries a laterally projecting pin 92 that extends through an enlarged opening 93 in latch 39 so as to obtain a substantial amount of lost-motion in the link connection. The cotter pin 94 serves to prevent disengagement of the pin 92 from the enlarged opening 93. Moreover, as shown in Fig. 4, the lateral displacement of the pin 91 from the pin 92, on latch 39, as well as the displacement of the axis of main operating shaft 29 from the pivot axis 95 of the latch 39 insures that the spring 89 has its maximum tension when the racking cam follower 27 is in its drawout position. As the cam follower 27 is rotated in the racking-in direction to move the racking plate 26 to its position shown in Fig. 7, the latch 39 is correspondingly rotated to bring the sloping end 97 of latch 39 into the path of the pin 87 carried by the racking plate 26. Thus, in the final stage of the racking-in operation, the sloping end 97 rides over the pin 87 and the spring 89 serves to draw the latch 39 into its final latching position in which it is shown in Fig. 7 due to the lost motion provided by the link 88.

Upon initiating the racking-out operation by reverse angular movement of the operating shaft 29, the lost-motion link 88 serves to raise the latch 39 out of engagement with the pin 87 during the lost-motion movement of the racking cam follower 27 between the opposite cam faces 41 and 41A. In this way the positive carriage latch 39 is released before the cam follower 27 engages with the hump-back cam face 40' to effect the racking-out movement of the carriage 11.

Positive latch interlock mechanism

In further accordance with the present invention, interlocking means are provided for preventing closure of the circuit breaker 10 in its connected position until after the positive carriage latch 39 is operated into its latching position in which it is shown in Fig. 7. For this purpose, as shown in Figs. 2, 3, and 6, the latching-in interlock member 100 is pivotally mounted at one end on the supporting pin 101 and is biased by springs 102 into engagement with the stop 103 so as to extend into the path of the

upper end of the sloping tripping arm 63 carried by the circuit breaker trip shaft 22', as shown most clearly in Fig. 2. Consequently, when the circuit breaker 10 is racked in, the upper end of the tripping arm 63 is engaged by the interlock member 100 to maintain the trip shaft 22' in the trip position during the remainder of the racking-in operation until the positive carriage latch 39 is operated to its latching position during the final stage of the racking-in operation. In order to move the latching-in interlock member 100 out of the path of the upper end of the tripping arm 63, the righthand latch 39 is provided with a laterally extending pin 105 for engaging the centrally pivoted lever 106 to raise the connecting rod 107 that is adjustably connected with the latching-in interlocking member 100 by means of the adjusting nuts 108 as shown in Fig. 2. As a result, when the latch 39 rides over the pin 87 substantially into its latching position, shown in Fig. 7, the latching-in interlocking member 100 will be raised out of engagement with the upper end of the trip arm 63 and thereby free the breaker operating mechanism 22 for closing the breaker. This improved latching-in of the carriage and interlocking of the breaker insures that in case the breaker is closed on a severe short circuit such as might produce forces sufficient to move the circuit breaker out of its connected position, the latches 39 are always in their latching position so as to effectively hold the breaker in the connected position and thereby prevent opening of the circuit at the disconnect contact elements 14 and 16.

Bell alarm reset mechanism

When the circuit breaker 10 is provided with the usual form of switch for closing a bell alarm circuit as soon as the circuit breaker is automatically operated to the open position, a reset mechanism may be provided, if desired, as shown in Figs. 3 and 6. For this purpose, a bracket 115 may be pivoted on the fixed pivot pin 116 for raising the reset plunger 117 of the bell alarm switch mechanism when the operating finger 118 of the bracket is depressed. In order to depress finger 118, a lever 119 is pivoted on pin 120 disposed at right angles to the pivot pin 116 and provided with the overhanging plate 121 for engaging the depressing finger 118 when the rod 122, one end of which is operatively connected to arm 119 by the pivot pin 123, is pushed inwardly. The other end of the push rod 122 is slidably mounted in the bracket 124 with the biasing spring 125 interposed between the operating button 126 carried at the end of rod 122 and the bracket 124. A suitable opening 128 is provided in the door 13 to afford access to the pushbutton 126 while the door is closed. Thus the alarm switch reset mechanism is effective while the breaker is in its connected position, as shown in Fig. 6, and the cubicle door 13 is closed.

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

1. A carriage racking mechanism having in combination, a fixed axis orbital racking cam follower a hook cam mounted on the carriage and provided with a constrictive bight extending athwart the arcuate path of the cam follower for releasably engaging the cam to rack the carriage each way between two positions upon unequal reverse arcuate movements of the cam follower, and a latch for holding the carriage in one of said positions having operating

9

connections with the orbital cam follower for releasing the latch before racking the carriage from said one position.

2. A carriage racking mechanism having in combination, a fixed axis orbital racking cam follower having operating means for reversely moving the cam follower each way through a quadrant and a hook cam mounted on the carriage to position the back of the hook cam for tangentially engaging the cam follower at one limit of the quadrant to stop the carriage and thereby position the opposite insides of the hook athwart the arcuate path of the cam for engagement by the cam follower to rack the carriage each way between two positions during said reverse quadrantal movements of the cam follower, and a latch for holding the carriage in one of said positions having operating connections with the orbital cam follower for releasing the latch before racking the carriage from said one position.

3. A carriage racking mechanism having in combination, a rotatable operating shaft having a pair of spaced-apart arms carried thereby in radial alignment and each having a laterally projecting orbital racking cam follower carried thereby and a pair of cam hooks mounted on the carriage in spaced-apart relation and each provided with a constrictive bight extending athwart the arcuate path of the corresponding cam for releasably engaging the orbital racking cam followers to rack the carriage each way between two positions upon unequal reverse angular movements of the shaft and a latch for holding the carriage in one of said positions having operating connections with the rotatable operating shaft for releasing the latch before racking the carriage from said one position.

4. A carriage racking mechanism having in combination, a hook mounted on the carriage and provided with variably spaced cam faces inside the hook, a rotatable operating arm having a fixed axis and provided with an orbital cam follower for engaging with the back of the hook to stop the carriage in a predetermined position and for sequential engagement with the variably spaced cam faces inside the hook to effect lost motion rotation of the arm before racking the carriage in one direction and lost motion rotation of the arm before and after racking the carriage in the reverse direction and a latch for holding the carriage against movement in said reverse direction and having operating connections with the rotatable operating arm for releasing the latch before racking the carriage in the reverse direction.

5. A carriage racking mechanism having in combination, an upright hook plate mounted on the carriage and provided with oppositely hump-backed inside edges forming a restricted opening between the back and front of the hook, an orbital cam follower having a width sufficient to pass through the restricted opening inside the hook, and means including a rotatable operating shaft for positioning the cam follower in one angular position of the shaft to override the opening in the hook and engage with the back of the hook to stop the carriage and thereby effect lost motion rotation of the shaft in a predetermined direction before passing through the restricted opening to engage the cam follower with the front of the hook to rack the carriage in the corresponding direction and substantially equal reverse lost motion of the shaft in the opposite direction upon passing through the restricted open-

10

ing after engaging the cam follower with the back of the hook to rack the carriage in the opposite direction.

6. A metal-enclosed switchgear truck racking mechanism having in combination, a pair of cam hook members mounted in opposing spaced-apart alignment at the inner end of the truck to position the openings into the insides of the cam hooks substantially vertically, and means including a rotatable shaft having a pair of radial arms provided with laterally projecting cam follower elements in spaced alignment for engaging in the horizontal position of the arms with the back cam of the vertically open cam hook members to stop the truck in a predetermined position and for angular lost-motion movement between the opposite insides of the cam hook members to rack the truck each way between the predetermined position and another position.

7. In combination, a metal enclosed removable electrical device provided with disconnect means including fixed contacting elements, racking mechanism for the device including a reversible orbital cam follower having a fixed axis and a co-operating releasable racking hook cam carried by the device and provided with an arcuate back cam face for effecting reverse substantially equal angular lost motions of the cam follower after racking the device out of and before racking the device into connected relation with the fixed contacting elements, and an insulating barrier operatively connected to the orbit cam follower for movement during said reverse substantially equal lost-motion movements thereof to and from a position to insulate the fixed contacting elements.

8. In combination, a metal enclosure provided with a row of disconnect contacts and having removable switchgear operable into engagement therewith, racking mechanism for the switchgear including a reversible orbital cam follower having a fixed axis and a cooperating releasable racking hook cam carried by the switchgear and provided with an arcuate back cam face for effecting substantially equal angular lost motions of the cam follower after racking the switchgear out of and before racking the switchgear into engagement with the disconnect contacts, and an insulating shutter slidably mounted for movement transverse the row of contacts and having an operating cam connected to the orbital cam follower for moving the shutter to and from a position to insulate the disconnect contacts during said reverse substantially equal lost-motion movement of the orbital cam follower.

9. In combination, a metal enclosure provided with a vertical row of spaced-apart disconnect contacts and having removable switchgear operable into engagement therewith, an insulating shutter having correspondingly spaced-apart elements slidably mounted for joint vertical movement adjacent the row of contacts between one position to cover a corresponding contact and another position to uncover the corresponding contact, drawout mechanism for the switchgear including a reversible orbital cam follower having a fixed axis inside the enclosure and a cooperating releasable racking hook carried by the switchgear and provided with an arcuate face on the inside of the hook for engagement by the orbital cam follower to effect reverse substantially equal angular lost motion of the cam follower after racking the switchgear out of and before racking the switchgear into engagement with the disconnect contacts, and a cam mechanism operatively connected with the orbital cam follower

for moving the shutter between the uncovering and the covering positions of the elements thereof during said reverse substantially equal lost motion movements of the orbital cam follower.

10. In combination, a carriage racking mechanism having a reversely rotatable operating shaft and lost-motion mechanism for providing lost-motion angular movement of the operating shaft between the opposite racking of the carriage to and from a predetermined position, and a latch for separately holding the carriage in the predetermined position and having connections with the operating shaft for releasing the latch during said lost-motion angular movement thereof.

11. In combination, a carriage racking mechanism having a fixed axis orbital racking cam follower and a hook cam mounted on the carriage for releasably engaging with the cam follower to rack the carriage to one position and having the opposite insides of the hook cam spaced apart to effect lost motion angular movement of the cam follower therebetween before racking the carriage from the one position, and a latch for independently holding the carriage in the one position and having operating connections with the racking cam follower for releasing the latch during said lost-motion angular movement of the orbital cam follower.

12. In combination, a carriage racking mechanism having a fixed axis orbital racking cam follower and a hook cam mounted on the carriage for releasably engaging with the cam follower to effect lost-motion angular movement of the cam follower between the opposite racking of the carriage to and from a predetermined position, and a latch having a spring connection with the racking cam follower for biasing the latch to hold the carriage in the predetermined position and having a lost-motion link connection with the racking cam follower for releasing the latch during said lost-motion angular movement thereof.

13. A metal-enclosed circuit breaker drawout mechanism having in combination, a pair of cam hook members mounted in opposing spaced-apart alignment at the inner end of the circuit breaker to open the cam hooks vertically, means in-

cluding a rotatable shaft having a pair of radial arms provided with laterally projecting elements in spaced alignment for engaging in one radial position with the one side of the hook cam members to stop the circuit breaker in an intermediate position and for angular lost-motion movement between the opposite sides of the cam hook to reciprocate the circuit breaker each way between the intermediate position and a final position upon opposite rotation of the shaft and means including a pair of independently rotatable hooks, each having a lost-motion resilient operating connection with a corresponding arm for positively latching the circuit breaker in the final position independently of the racking hook members.

14. In combination, a drawout circuit breaker having a trip element and provided with racking mechanism for racking the breaker between the drawout position and the connected position, a latch operated by the racking mechanism to a holding position for independently holding the circuit breaker in the connected position, a movable interlocking member having means biasing the member to a position for engaging the trip element of the circuit breaker in the connected position, and connections operated by the latch for moving the member to another position only when the latch is operated to the holding position.

WILLIAM N. LESTER.
EMIL E. HEBBEL, Jr.

References Cited in the file of this patent UNITED STATES PATENTS

Number	Name	Date
633,552	Kenny	Sept. 19, 1899
670,506	Dent	Mar. 26, 1901
1,566,935	Trencham et al.	Dec. 22, 1925
1,584,623	McCoy	May 11, 1926
1,729,864	Brown	Oct. 1, 1929
2,258,150	Scott	Oct. 7, 1941
2,324,543	Scott	July 20, 1943
2,391,460	Howard	Dec. 25, 1945
2,414,555	Pierson et al.	Jan. 21, 1947
2,450,705	Williams	Oct. 5, 1948
2,544,314	Hebbel	Mar. 6, 1951