

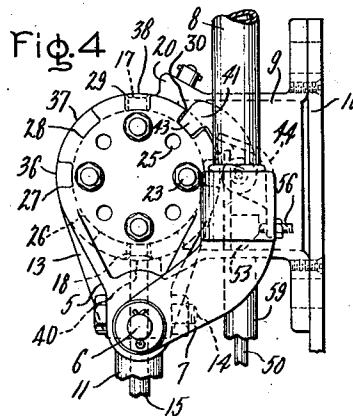
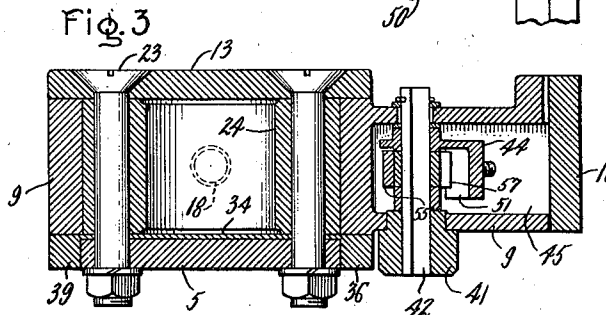
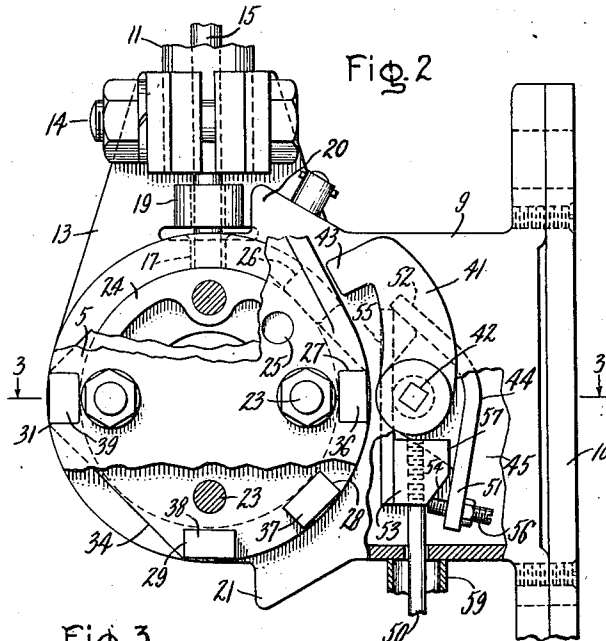
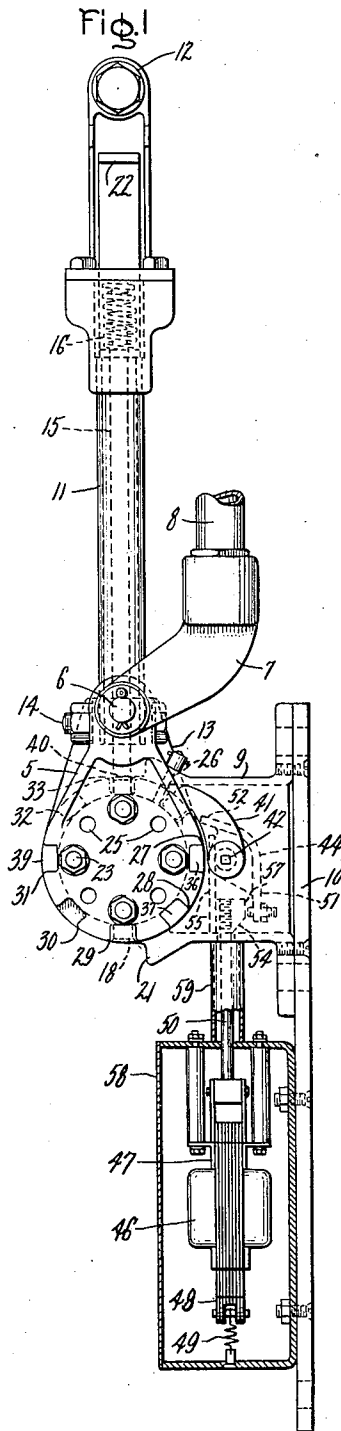
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P. M. ENGEL

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OPERATING MECHANISM

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Inventor:
Phillip M. Engel,
by *Harry E. Dunham*
His Attorney.

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OPERATING MECHANISM

Phillip M. Engel, Lansdowne, Pa., assignor to
General Electric Company, a corporation of
New York

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7 Claims. (Cl. 188—69)

My invention relates to improvements in operating mechanisms, especially for electric switches and the like, and more particularly to improvements in apparatus for precluding the operation of such mechanisms under conditions that might be hazardous to human life or dangerous to associated equipment.

Disconnecting switches, when used in relatively high voltage circuits, are generally mounted on a suitable supporting structure at a height above ground or operating level sufficient to provide safety for the operating personnel. In such mountings the operation of the switches is frequently effected through one or more cranks and interconnecting links. This linkage is often actuated to open and close the switch by either manual or power operated mechanisms comprising a suitably mounted rotatable member connected to the linkage and in normally operated mechanisms an operating lever provided with a handle. Since the chief function of disconnecting switches is to isolate certain apparatus so that it may be inspected, repaired and maintained without hazard to personnel or danger to equipment, it is absolutely necessary that, when the switches are moved to the open position, some way be provided to prevent a chance closing operation in order to avoid the dangers attendant therewith. Moreover, in general such switches are not intended to open a live circuit or to complete a circuit. Obviously to be satisfactory the operation preventive means must not be adversely affected by the weather particularly as the operating mechanisms and switches are often mounted in the open. Moreover, such preventive means must not only be fool-proof in the sense, at least, that a natural impulse to act cannot result in a false operation of the switch but also if the means itself should, for any reason, fail, then it must fail safe, that is, in such a way as automatically to effect the desired preventive action. Since simplicity and economy of structure are factors which contribute to the adoption of any safety measure, it is important that these factors be present in switch operation preventive means in order to facilitate their use.

One object of my invention is to provide for an operating mechanism, especially for disconnecting switches and the like, an operation preventive means which, upon failure while in the non-preventive condition, will immediately assume the preventive condition. Another object of my invention is to provide an operation preventive means which cannot offhand be placed in the non-preventive condition by human ac-

tion or be adversely affected by weather conditions. A further object of my invention is to provide an operation preventive means which is relatively simple in structure and economical in cost. These and other objects of my invention will hereinafter appear in more detail.

In accordance with my invention, I provide an operation preventive means comprising two interlocking members, one of which can be moved to the unlocking position in response to the energization of suitable actuating means, such as an electromagnet, so that, in case of the failure of such actuating means, the operation preventive action is immediately restored. Further, in accordance with my invention, the actuating means is so inaccessibly arranged that it cannot be manually operated to eliminate the preventive action. Also, in accordance with my invention, I provide an operation preventive means which is readily adaptable to manual operating mechanisms of the type used in the art.

My invention will be better understood from the following description when considered in connection with the accompanying sheet of drawings, and its scope will be pointed out in the appended claims.

In the accompanying drawing Fig. 1 is an elevation partly in section of an operating mechanism embodying my invention and showing the operation preventive condition; Fig. 2 is an elevation partly in section of a part of the embodiment of my invention shown in Fig. 1 to a larger scale with the mechanism in the non-preventive condition; Fig. 3 is a section on the line 3—3 of Fig. 2 and Fig. 4 is a partial view similar to Fig. 1 showing the operating mechanism in a different position with the operation preventive action in effect.

For the purpose of illustrating my invention, I have shown in Fig. 1, part of a switch-operating mechanism of the manually operated type although my invention is equally applicable to power-operated mechanisms. In this figure I have illustrated only as much of the operating mechanism as is necessary to an understanding of my invention since such mechanisms are well known to the art. In the operating mechanism, shown in Fig. 1 in the switch-closed position, a rotatably mounted member, such as a crank 5, is pivotally connected at 6 through a coupling 7 to a linkage of the pipe type comprising a link 8 which is, in turn, connected to the switch or device to be operated by other links and cranks in a manner well known to the art. The crank 5 is rotatably mounted in a suitable bearing

bracket 9 which, as shown, is secured to a backing plate 10 for mounting on any suitable supporting structure. Mounted so as to effect rotation of the crank 5 is an operating lever 11 which is provided with a handle 12. As shown, the operating lever 11 is a pipe member suitably clamped in a socket member 13 as by a bolt 14.

For holding the lever 11 in predetermined positions, for example the switch open and closed positions, there may be provided a manually releasable bar interlock comprising a rod 15 slidably mounted within the operating lever 11 and biased as by a spring 16 to enter holes 17 and 18 in the top and bottom respectively of the bearing bracket 9. As shown, more clearly in Fig. 2 the lower end of the rod 15 is slidably mounted in a cylindrical boss 19 on the socket 13. For limiting the angular movement of the operating lever 11, projections 20 and 21 may be provided on the bearing bracket 9 in the path of movement of the boss 19. For disengaging the rod 15 under its bias, there is attached to the rod a finger operable release member 22.

In order to have simultaneous rotation of the crank 5 and the operating lever 11, the socket member 13 and the crank 5 may be secured together as by bolts 23 which extend through a bearing 24 journaled in the bearing bracket 9. For effecting angular adjustment of the crank 5 relatively to the socket member 13, additional bolt holes 25 may be provided, for example, in the crank 5. In order to hold the crank 5 against rotation, it may be provided with suitably engageable means such as a plurality of equi-angularly spaced recesses or notches 26—33, respectively. In order to prevent a holding operation, except in predetermined angular positions, certain notches, such as 27, 28, 29, 31 and 33 may be filled by a filler plate 34 which, as shown, is provided with five projections 36—40, respectively, and is mounted between the bearing 24 and the crank 5 so that these projections fill certain notches in the crank as will be clear from Figs. 1, 2 and 4. This arrangement of the socket, filler plate and crank takes care of both right and left-hand mounting of the lever 11.

In accordance with my invention, I provide rotatable means for locking or holding the crank 5 in predetermined positions. As shown, this means comprises a rotatable member, such as a latch 41, journaled in the bearing bracket 9 and mounted to turn with a shaft 42 so that a projecting portion or nose 43 on the latch is moved into and out of engagement with the desired notches in the crank 5 not filled by the projections on the filler plate 34, for example notch 26 in the switch-closed position of the operating lever 11, as shown in Figs. 1 and 2, and notch 30 in the switch-open position of the operating lever, as shown in Fig. 4.

Further, in accordance with my invention, I provide means for actuating the latch 41 to and from the holding position so arranged as to preclude a manual release of the latch. As shown, this means includes an element 44 also secured to the shaft 42 so as to rotate therewith but so mounted within a chamber 45 in the bearing bracket 9 as to be not readily accessible. However, in accordance with my invention, I provide means for actuating the element 44 so as to effect movement of the latch 41 into and out of engagement with predetermined notches in the crank 5. As shown more clearly in Fig. 1, this means is of the electromagnetic type comprising a coil 46 arranged to energize a stationary mag-

netic structure 47 and an armature 48 of the plunger type which may be biased to the unattracted position shown in Fig. 1 by a spring 49 in addition to the effect of gravity. Connected to the armature 48 so as to move therewith is an operating rod 50 the actuation of which in the upward direction is effective to release the latch 41 from the engaged notch and the downward movement of which is effective to move the latch into engagement with a notch and maintain it so engaged as long as the electromagnet is deenergized. In this way I provide a fail safe type of apparatus such that, if the electromagnetic release fails, the latch is returned to the safe, or holding, position.

In order to obtain a positive movement of the latch 41 both to and from the latching position I make use of both the upward and downward movements of the armature by providing the element 44 with two arms 51, 52 which are arranged in the path of movement of a member 53 carried by the operating rod 50. This member is provided with an inclined cam face 54, as shown more clearly in Fig. 2, which in the attracted position of the armature, a position which may be termed the initial position, permits the clockwise rotation of the latch 41 into the disengaged position. The disengagement is positively effected by an extension 55 on the member 53 which engages the arm 52 of the element 44 during the upward movement of the armature. When the electromagnet is deenergized, the armature 48 moves downward under its bias to the final position shown in Fig. 1 and the inclined face 54 engages the arm 51 of the element 44 positively to move the latch into the engaged position and maintain it there as long as the electromagnet is deenergized. For ease of adjustment, the arm 51 of the element 44 may be provided with an adjustable abutment 56 which slides along the inclined cam face 54 of the member 53 and in the engaged position of the latch abuts the vertical face 57 of the member 53 to maintain the latch in the engaged position.

Further, in accordance with my invention, in order to preclude a manual release of the member 52 by moving the armature vertically upward, I completely enclose the electromagnet within a suitable housing 58. This housing also includes an extension 59 between the housing and the chamber 45 of the bearing bracket 9 to enclose the operating rod 50. Thus, without disassembling the apparatus, it is impossible to produce a manual release of the latch 41 and consequently any offhand, or impulsive action, cannot place the switch-operating mechanism in condition for an operation that would be dangerous to personnel and apparatus.

Assuming the parts positioned as shown in Fig. 1, the nose 43 of the latch 41 is in engagement with the notch 26 of the crank 5 to hold the operating lever and mechanism in the position corresponding to the closed position of the switch, and the armature 48 of the electromagnet is in the final or holding position with the vertical face 57 of the holding member 53 against the abutment 56 to prevent clockwise movement of the latch 41. In this position the armature 48 cannot be moved manually without disassembling the apparatus so that inadvertent operation by hand is precluded. If, however, it is safe to have an operating action of the lever 11 to move the mechanism into the switch open position, then the electromagnet may be energized, and this energization may be under any suitable control

and electrical interlock which of itself constitutes no part of my invention. However, when the electromagnet is energized, the member 53 is moved to the initial position shown in Fig. 2 with the projection 55 thereof in engagement with the arm 52 of the element 44. This produces a clockwise movement of the latch 41, and the abutment 56 on the arm 51 of the element 44 is free to slide downward along the vertical plane surface 57 and the inclined plane surface 54. As long as the electromagnet is energized, the latch 41 will be maintained in the released position. If now the release member 22 is raised to pull the rod 15 from the hole 17 in the bearing bracket 9, the lever may be rotated counterclockwise to the position shown in Fig. 4 whereupon the release of the member 22 will cause the rod 15 to engage the opening 18 in the lower side of the bearing bracket. If, as a result of this movement or subsequently thereto the electromagnet is deenergized, then the fall of the armature to the final position will turn the latch 41 counterclockwise so that its nose 43 engages the notch 30 in the crank 5. Inasmuch as the notches 27, 28 and 29 are blanked by the projections 36, 37 and 38 on the filler plate 34, the release of the armature 48 will not effect the latching engagement of the latch 41 until an open notch, such as 30, comes under the nose 43 of the latch 41. It is, accordingly, impossible to effect the holding operation of the mechanism in a partially operated position thereof. In other words, no locking or holding can occur between the full "on" and the full "off" position.

While I have shown and described my invention in considerable detail, I do not desire to be limited to the exact arrangements shown, but seek to cover in the appended claims all those modifications that fall within the true spirit and scope of my invention.

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

1. In locking apparatus for a switch-operating mechanism having a rotatably mounted member, means for holding said member in a predetermined angular position comprising a rotatably mounted element, means for positively turning said element into and out of engagement with said member comprising a device normally biased for movement in one direction from an initial position to a final position and slidably engageable with said element during said movement to turn the element in a direction to cause it to engage and hold said member and movable in the opposite direction from said final position to said initial position positively to release said element from said member, and means for effecting the movement of said device from said final position to said initial position.

2. In locking apparatus for a switch-operating mechanism having a rotatably mounted member, means for holding said member in a predetermined angular position comprising a rotatably mounted element, means for positively turning said element into and out of engagement with said member comprising a device normally biased for movement in one direction from an initial position to a final position and slidably engageable with said element during said movement to turn the element in a direction to cause it to engage and hold said member and movable in the opposite direction from said final position to said initial position positively to release said element from said member, electromagnetic means for effecting movement of said device from said

final position to said initial position, and means for housing said electromagnetic means and said element whereby to preclude the manual release of said element while said device is in the final position.

3. In locking apparatus for a switch-operating mechanism having a rotatably mounted member, means for holding said member in a predetermined angular position comprising a rotatably mounted element having two arms, means for turning said element in a direction to engage and hold said member in the predetermined position comprising a linearly movable device having a first portion slidably engageable with one of said arms and normally biased for movement in one direction from an initial position to a final position to turn said element in the direction to engage and hold said member, said device having a second portion engageable with the other of said arms on a reverse movement of the device from said final position to said initial position to release said element from said member, and means for effecting said reverse movement of said device.

4. In locking apparatus for a switch-operating mechanism having a rotatably mounted member, means for holding said member in a predetermined angular position comprising a rotatably mounted element having two arms, means for turning said element in a direction to engage and hold said member in the predetermined position comprising a linearly movable device having a first portion slidably engageable with one of said arms and normally biased for movement in one direction from an initial position to a final position to turn said element in the direction to engage and hold said member, said device having a second portion engageable with the other of said arms on a reverse movement of the device from said final position to said initial position to release said element from said member, electromagnetic means for effecting said reverse movement of said device, and means for housing said electromagnetic means and said two arms whereby to preclude a manual release of said element while said device is in the final position.

5. In locking apparatus for a switch-operating mechanism having a rotatably mounted member, means for holding said member in a predetermined angular position comprising a rotatably mounted element having two arms, means for turning said element in a direction to engage and hold said member in the predetermined position comprising a substantially vertically movable device normally biased downward from an initial position and having an inclined cam face slidably engageable with one of said arms upon such downward movement to a final position to turn said element in a direction to engage said member and in the final position to maintain such engagement, said device having a portion engageable with the other of said arms on upward movement of the device from said final position to said initial position to release said element from said member, and means for effecting the upward movement of said device.

6. In locking apparatus for a switch-operating mechanism having a rotatably mounted member, means for holding said member in a predetermined angular position comprising a rotatably mounted element having two arms, means for turning said element in a direction to engage and hold said member in the predetermined position comprising a substantially vertically mov-

able device normally biased downward from an initial position and having an inclined cam face slidably engageable with one of said arms upon such downward movement to a final position to turn said element in a direction to engage said member and in the final position to maintain such engagement, said device having a portion engageable with the other of said arms on upward movement of the device from said final position to said initial position to release said element from said member, electromagnetic means for effecting the upward movement of said device, and means for housing said electromagnetic means and said two arms whereby to preclude a manual release of said element while said device is in the final position.

7. In locking apparatus for a switch-operating mechanism having a rotatably mounted notched member, means for holding said member in a plurality of predetermined angular po-

sitions comprising a latch rotatable in one direction to engage different notches in said member depending upon the angular position thereof, means for effecting the rotation of said latch in said one direction comprising an element rotatable with the latch, actuating and holding means normally biased for movement in one direction from an initial position to a final position to effect the engagement of said latch with one of the notches of said member and in the final position to prevent further rotation of said element, electromagnetic means for effecting a reverse movement of said actuating and holding means from the final position to the initial position to release said latch from said member, and means for housing said electromagnetic means and said actuating and holding means whereby to preclude a manual release of said latch.

PHILLIP M. ENGEL.