Dec. 25, 1951 H. J. CRABBS 2,579,799

SWITCH

Filed April 30, 1945 3 Sheets-Sheet 1

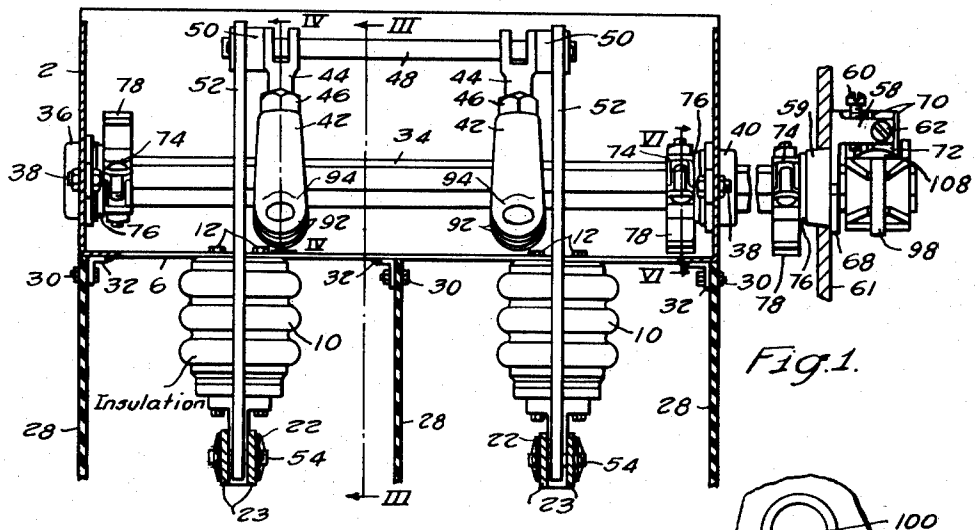


Fig. 1.

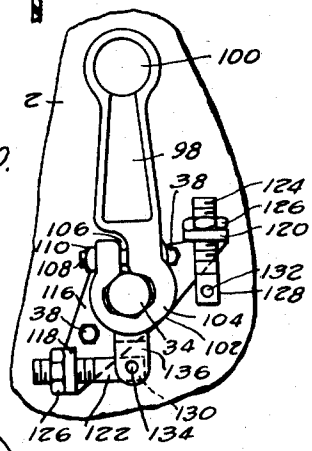


Fig. 10.

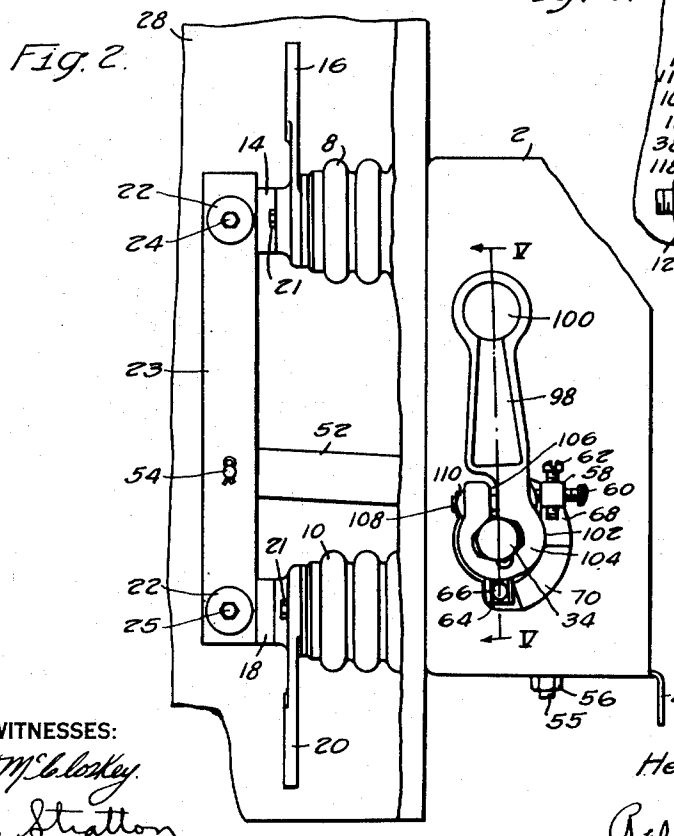


Fig. 2.

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Fig. 3.

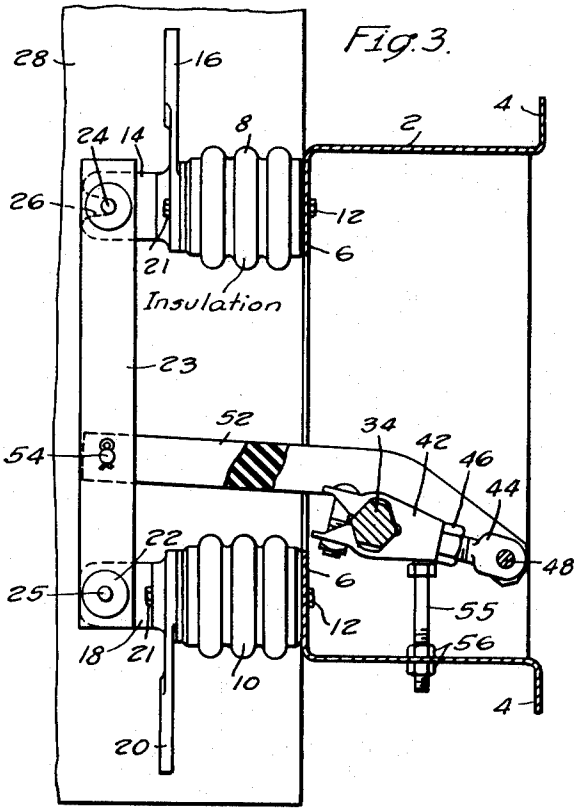


Fig. 5.

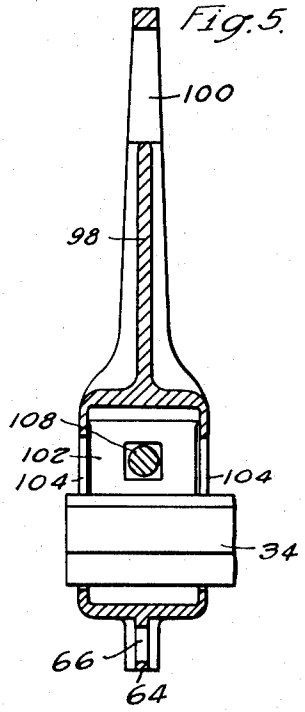


Fig. 6.

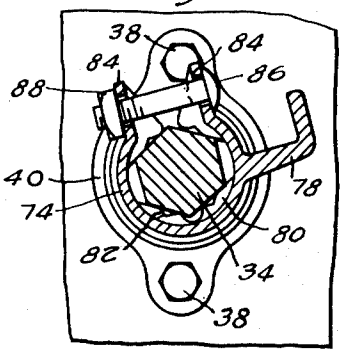
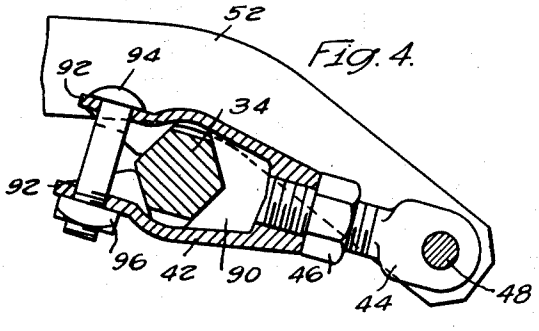


Fig. 4.



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Fig. 7.

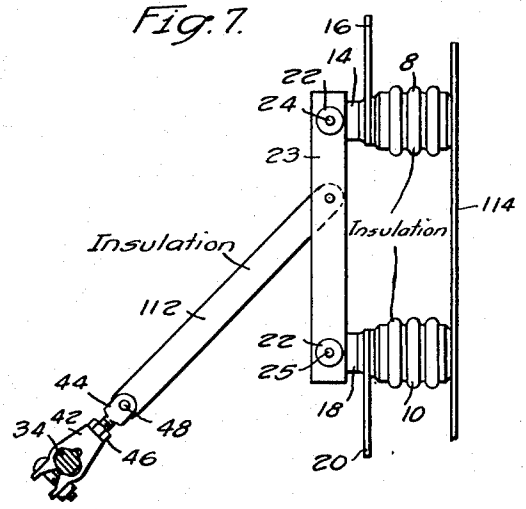


Fig. 8.

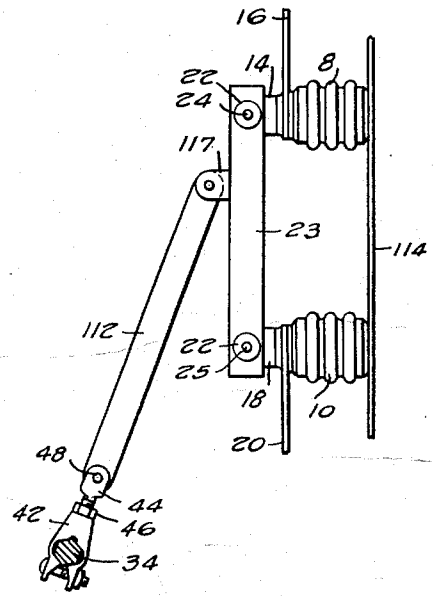
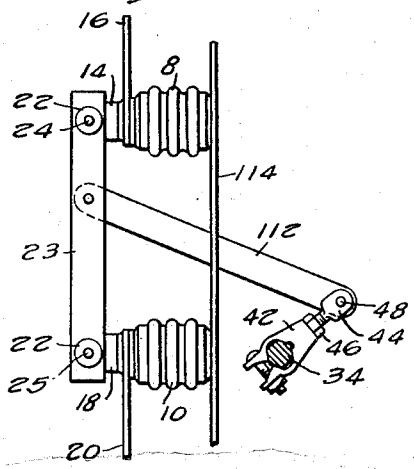


Fig. 9.



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UNITED STATES PATENT OFFICE

2,579,799

SWITCH

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Application April 30, 1945, Serial No. 591,078

13 Claims. (Cl. 200—162)

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This invention relates to electric switching mechanisms in general, and especially to operating mechanisms for disconnect switches.

Electric switching devices may be mounted in a great variety of ways, and for any given manner of mounting the switch device its operating mechanism may be associated therewith in a great number of ways. This invention is specifically disclosed herein as embodied in disconnect switches, and these switches may be mounted horizontally or vertically, on panels or walls or in metal enclosures, and for each mode of mounting the switch, the operating mechanism may be provided at the front or rear of the switches for direct operation or for operation at a remote point, and the mechanism may be arranged to operate at either side of the switch.

Heretofore, it has generally been necessary in the manufacture of switch mechanisms to handle each type of installation as a separate job with each requiring special involved layout and subassembly drawings, and with each type of installation requiring special parts and special drilling and machining operations. Consequently to stock these mechanisms has required a great number of different stock parts and a relatively large amount of space.

One object of this invention is to provide novel switch operating mechanism having a relatively few simple standard parts which may be used in making up a plurality of different types of mechanisms.

Another object of this invention is to provide novel switch operating mechanism comprising component parts which may be easily assembled in a plurality of different relations without requiring any special drilling or tapping operations.

Another object of this invention is to provide novel simplified elements of switch operating mechanism which are capable of ready assembly with other elements in a plurality of different relations.

Heretofore the operating linkage for disconnect switches has usually been mounted in front of the switches to permit the linkage between the switch blade and countershaft to go into toggle and thereby lock the switch closed. Such an arrangement while suitable for some mountings is undesirable for wall mounting as the counter-shaft must be supported a considerable distance out from the wall beyond the switch.

Accordingly, another object of this invention is to provide a novel toggle linkage for operating electric switches which is capable of being mounted at the rear of such switches.

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Another object of this invention is to provide novel readily adjustable means for operating a plurality of switches from a common operating shaft.

Another object of this invention is to provide a novel operating member for a switch operating shaft which may easily be secured to the shaft at a plurality of different angular positions.

Another object of this invention is to provide switch operating mechanisms with novel means for locking the mechanism in an operated position.

Another object of this invention is to provide a novel journal for switch actuating shafts having locking means for the shaft associated with the journal.

These and other objects of this invention will be more apparent upon consideration of the following description of preferred embodiments when taken in connection with the attached drawings, in which:

Figure 1 is a top view, partly in section, illustrating a switch and actuating mechanism constructed in accordance with this invention;

Fig. 2 is a side view of the switch shown in Fig. 1 with one barrier plate broken away;

Fig. 3 is a transverse section of the switch shown in Fig. 1 taken substantially on the line III—III thereof;

Fig. 4 is a partial transverse section on an enlarged scale taken substantially on the line IV—IV of Fig. 1;

Fig. 5 is an enlarged section view taken through the operating handle substantially on the line V—V of Fig. 2;

Fig. 6 is an enlarged partial sectional view taken on the line VI—VI of Fig. 1;

Fig. 7 is a schematic view illustrating a different mounting for the operating mechanism;

Fig. 8 is similar to Fig. 7 but illustrating still another mounting arrangement for the operating mechanism;

Fig. 9 is similar to Figs. 7 and 8 but shows still another arrangement of operating mechanism; and

Fig. 10 is an end view of the switch operating shaft illustrating a modified stop and lock arrangement.

Referring to the drawings, there is illustrated a disconnect switch mounted on a substantially restangular supporting frame 2 which may be of integral sheet metal construction having at one side opposed outwardly extending flanges 4 for securing the frame on a support, and having at the other side thereof opposed inwardly ex-

tending flanges 6 on which the supporting insulators for the disconnect switches are adapted to be mounted. The supporting insulators 8 and 10 for each switch are adapted to be secured to flanges 6 in any desired manner, for example, as by bolts 12.

Each insulator 8 is adapted to support a break contact tongue 14 having an integral terminal pad 16 for the connection of a line conductor thereto, and each insulator 10 is adapted to support a hinge contact tongue 18 having an integral terminal pad 20 for connection of another line conductor to the switch. Contact tongues 14 and 18 may be secured to the outer ends of insulators 8 and 10 in any desired manner, for example, as by bolts 21. A split switch blade 23 is provided for each switch, having the sides thereof disposed at opposite sides of the contact tongues of its switch, and each blade is pivotally mounted by a pivot bolt 25 on a hinge tongue 18, with the opposite end of the switch having the sides thereof held together by a bolt 24 adapted to enter a notch 26 provided in its break contact tongue 14. Bolts 24 and 25 connecting the sides of each split switch blade 23 are provided with resilient cup washers 22, for providing pressure contact of the sides of the blade with its contact tongues.

A pair of identical disconnect switches are illustrated, but, as will hereinafter be further pointed out, any desired number of identical switches may be mounted on support 2. It will be observed that the blades of these switches being pivotally mounted on hinge contact tongues 18 may be pivotally moved about pivot bolts 25 to cause the opposite ends thereof to be moved into and out of engagement with break contact tongues 14. Preferably barrier plates 28 of insulating material, such as fiber, asbestos board or a molded insulating material, are provided at opposite sides of each switch. The barrier plates are preferably secured by bolts 30 to supporting brackets 32, which, in turn, are secured in any desired manner, for example, as by welding, to support 2.

A common actuating shaft 34 is provided for operating all of the disconnect switch blades 23, and this shaft is supported in the embodiment of the invention shown in Figs. 1 to 6 at the opposite side of supporting flanges 6, at the rear of the disconnect switches. The actuating shaft may be supported by bearings 36 and 40 secured in opposite walls of support 2, for example, as by bolts 38. A pair of actuating cranks 42 are secured in a manner to be hereinafter further described, on actuating shaft 34, and each crank includes an outer portion 44 threadedly mounted on the inner part of the crank so as to be longitudinally adjustable, and is provided with a lock nut 46 to secure it in longitudinally adjusted position. The outer ends of crank portions 44 are forked and apertured to receive a connecting rod 48, on which spacing washers 50 are provided to space connecting links 52 from the actuating cranks. Connecting links 52 are preferably of an insulating material in order to insulate the switch blades from the operating mechanism, being of fiber or a molded insulating material. The connecting links are apertured at opposite ends to be pivotally mounted on connecting rod 48 at one end, and on a pin 54 at the other end to pivotally connect the links to switch blades 23 and rod 48, respectively. A stop bolt 55 is provided in an aperture in support 2 at a position to be engaged by a crank 42 at the closed circuit position of the disconnect switches, and the stop bolt may be

held at an adjusted position by nuts 56 provided on the bolt at opposite sides of support 2.

It will be observed that bearing 36 for the actuating shaft is cup-shaped in form, having a closed end and prevents longitudinal movement of the actuating shaft to the left, as viewed in Fig. 1. Bearing 40 for the shaft is provided with a through opening for extension of the shaft therethrough, so that an operating handle may be mounted on the outer end. A bearing 59 for the shaft is provided adjacent the operating handle and is of a special form to cooperate with the handle for defining the limits of movement thereof, and to cooperate therewith for locking the shaft and switches at open and closed circuit positions. Bearing 59 is shown as being mounted in a wall member 61 which may comprise a part of the wall of an outer enclosure for the switch and operating mechanism. Of course, where the switches are not mounted within such an outer enclosure, bearing 59 may be mounted in place of bearing 40 directly on support 2, in any event, bearing 59 should be provided adjacent the operating handle. The base flange 68 of bearing 59 is provided with an integral lateral extension 58 having threaded apertures therethrough at substantially right angles with respect to each other, for threadedly receiving stop screws 60 and 62. Base flange 68 of bearing 59 is also provided with a laterally extending flange having spaced parallel arcuate flanges 70 integral therewith and parallel to base flange 68 and forming a channel 72 therebetween, for receiving an extension 64 integral with operating handle 98 during an intermediate portion of its movement.

In the closed circuit position of the switches illustrated in Figs. 1 to 6 of the drawings, it will be observed that a line connecting the centers of connecting rod 48 and pivot pins 54 on the switch blades, lies at or slightly below the axis of shaft 34, so that actuating cranks 42 and connecting links 52 form a toggle at or beyond an overcenter position, which acts to positively prevent opening of the switch blade, for example, under heavy current conditions. The parts are permitted to obtain this overcenter position due to the angular form of connecting links 52 to clear actuating shaft 34, and due to their being offset by washers 50 from actuating cranks 42. At this closed circuit position of the switches, they may be padlocked against operation by the insertion of a padlock in aperture 66 provided in handle extension 64, so that the handle will be prevented from counterclockwise movement to open the switches, by engagement of the padlock with the adjacent ends of flanges 70 on journal 59. Furthermore, at the closed position of the switches illustrated in Figs. 1 to 6, the operating handle will engage the end of stop screw 60 to limit movement in the circuit closing direction, and when the handle is moved counterclockwise to open the switches, the full open position will be defined by engagement of handle extension 64 with stop screw 62, and at this open position, a padlock can be inserted in aperture 66 to prevent closing of the switch. It will be observed that it is impossible to padlock the switch at any other position because opening 66 will be concealed within channel 72, and, consequently, will be inaccessible.

A modified form of stop means and means for locking operating handle 98 which is capable of somewhat closer adjustment than the arrangement shown in Figs. 1 to 3 and 5, is illustrated

in Fig. 10, wherein bearing 59 is provided with a flange 116 elongated in form and having adjacent its opposite ends laterally outwardly extending supporting portions 118 and 120. Each of the supporting portions 118 and 120 are provided with threaded openings for receiving stop screws 122 and 124, respectively. The stop screws may be secured at adjusted positions by lock nuts 126, and the inner ends of the screws are flattened as at 128 and 130 and apertured as at 132 and 134, so as to be received in the split projection 136 integral with handle 98, when the handle is in its extreme positions. The split projection 136 on handle 98 is also apertured so that when a flattened end of a stop screw is received therein, the apertures in projection 136 will line up with the aperture in that particular stop screw so that a padlock may be inserted through the aligned apertures to lock the switch in its extreme position. This arrangement is somewhat more flexible than that shown in Figs. 1, 2, 3, and 5 in that with the switches at their closed circuit positions stop screw 122 may be adjusted so as to accurately align its aperture 134 with the apertures in handle extension 136, and then locked in place by nut 126, after which handle 98 may be operated to move the switches to the desired open circuit position, and screw 124 adjusted to define this position and locked in place by its nut 126.

In order to obtain the necessary flexibility of the operating mechanism, so that relatively few parts are needed to obtain different mounting arrangements, and so that the mechanism may be readily assembled and easily adjusted, the actuating shaft is in the form a regular polygon, preferably a hexagon, in order to easily obtain the desired adjustments. For the purpose of rotatably mounting actuating shaft 34, it is provided with journals 74 having a circular portion 76 adapted to be received in bearings 36, 40, or 59, and with an integral hook portion 78 for a purpose to be described. Journals 74 are provided with a shaft-encircling portion which is split and has the ends 84 turned outwardly, as shown in Fig. 6, and is provided at opposite sides of the shaft-encircling portion with integral inwardly extending flanges 80 which are notched as at 82 to receive the hexagonal shaft at a plurality of different relative angular positions. As illustrated in Fig. 6, journals 74 may be longitudinally slidable onto actuating shaft 34 at twelve different angular positions. The reasons for this adjustment feature of journals 74 is that hook portions 78 thereof are adapted for cooperation with a complementary hooked portion provided on a door for a housing within which the switches may be mounted, so as to prevent opening of the door unless the switches have first been operated to open circuit position. In slidably mounting journals 74 onto actuating shaft 34, they may be moved along the shaft to positions where the journal portions 76 thereof enter the bearings and then be secured in such position by a single bolt 86 passing through an aperture provided in the out-turned ends 84 of the journal, and having a nut 88 cooperating therewith.

Actuating cranks 42 are identical in form, and the inner portions thereof have opposite sides 90 split at the inner ends and configurated to provide substantially hexagonal shaped apertures therein. The outer ends 92 of the split sides of the inner portions of the actuating cranks 42 are apertured for the reception of a securing bolt 94 having a nut 96 thereon. Since the apertures in actuating crank 42 for receiving actuating shaft 34 are hexagonal in form, the crank may be longitudinally slidable onto the shaft at six different angular positions and moved along the shaft to the desired positions, and then secured against longitudinal displacement by tightening bolts 94. In assembling the mechanism, actuating cranks 42 are slid onto the shaft between journals 74, and then each of these parts secured in its desired position by means of its single clamping bolt. It will be observed that actuating cranks 42 are automatically positioned at the same angle with respect to the actuating shaft 34 simply by sliding them onto the shaft at the same relative position. After the actuating cranks 42 are mounted on the shaft and connected by rod 48 and links 52 to the disconnect switch blades, the shaft is rotated to the closed circuit position shown in Figs. 1 to 6, and adjustment may then be made in the event the switch blades are not fully closed by adjusting the length of each crank 42 by threading or unthreading the outer parts 44 thereof. Obviously any desired number of switches may be operated by the single shaft 34 merely by providing a shaft 34 and rod 48 of appropriate length, providing additional actuating cranks 42, if desired, and providing an actuating link 52 for each switch. The two-pole switch construction illustrated is balanced with respect to actuating cranks 42, and if a greater number of switches are to be actuated from shaft 34, it is preferred that an actuating crank 42 be provided adjacent the link 52 for each switch. The construction described above may be assembled as a unit in the factory, and this unit shipped to the ultimate user completely adjusted. For this purpose, stop bolt 55 is provided so that during shipment and final installation, undue stress may not be placed on links 52 which are of a relatively fragile material compared to the other parts of the mechanism. It will also be observed that actuating handle 98 may be provided at either end of the unit; for example, instead of being at the right, as viewed in Fig. 1, it may be mounted at the left by merely interchanging shaft bearings 36 and 40 to permit extension of the shaft at the left side of Fig. 1. Furthermore, although the switch is latched closed by the toggle arrangement of actuating cranks and connecting links, provision is made for padlocking the switch at open and closed positions to prevent unauthorized operation thereof. Although the operating handle 98 is illustrated as being provided with a hook eye for operation by a hook stick or the like, it is apparent that it may be directly manually operated, and for this purpose the outer end of operating handle 98 may be provided with a hand grip portion instead of the hook eye 100.

Inasmuch as it may be desired to have the operating handle 98 at various positions, such as vertical, horizontal, or at some other angle when the switch is closed, it too is formed for mounting on the actuating shaft at a plurality of different angular positions. The inner end of operating handle 98 is provided with a circular wall portion 102 having at opposite sides inwardly extending flanges 104 shaped to provide a hexagonal opening and being split at 106, so as to be capable of being drawn tightly onto the shaft by a bolt 108 extending through the split portions thereof, and having a nut 110 cooperating therewith. As shown on Fig. 2, the longitudinal axis of handle 98 is displaced at an angle, preferably at an angle 15° from a line which is normal to the adjacent

side of the hexagonal formation of the opening in the handle. This means that if the handle is turned over it can be mounted on shaft 34 at six different angular positions which lie intermediate the six different positions it can be mounted on shaft 34 when applied thereto from the other side of the handle, thus making twelve different angular positions at which the handle may be mounted on the shaft.

The mechanism described above is equally adapted for mounting at the front of disconnect switches as illustrated in Fig. 7, where the switches are shown as being mounted on a base plate 114, and actuating cranks are connected to the switch blades by straight connecting links 112, also of insulating material like the links 52 previously described. The arrangement illustrated in Fig. 7 may be used where the link 112 occupies a position at an angle of 45° to 80° with the switch blade at its closed position. It will be observed that the actuating crank and link 122 are at an overcenter position in Fig. 7 so as to latch the switches closed.

In Fig. 8, an arrangement similar to that shown in Fig. 7 is illustrated, except that a lateral extension 117 is provided on each blade, and to which links 112 are pivoted so that in the closed position of the switches, links 112 may occupy a position at an angle of 0° to 45° with respect to the switch blades.

In Fig. 9, there is illustrated rear mounted mechanism similar to that illustrated in Figs. 1 to 6 except that straight connecting links 112 are employed, and it will be observed that this mechanism is incapable of going to an overcenter toggle position, and for this reason the arrangement of Figs. 1 to 6 is preferred.

In the foregoing, there is described switch operating mechanism which is not only capable of bringing the operating linkage between the operating shaft and switch blade into toggle at the closed position of the switch when the mechanism is mounted at the front of the switch, but also by a special arrangement it is possible to accomplish this with the mechanism illustrated in Figs. 1 to 6 when it is mounted at the rear of the switch. This is particularly desirable where the switches are to be operated directly by a hook-eye lever or handle directly mounted on the actuating shaft in the manner illustrated, as the toggle acts as a safeguard against the switch vibrating open or blowing open on heavy short-circuit currents. Moreover, although switches having the mechanism mounted at the front may be employed for many uses; for example, in cubicles, cells, or cabinets, it is extremely awkward for wall mounting where the actuating shaft must be positioned some distance out from the wall, and, in some cases, space requirements require that the operating mechanism be mounted at the rear of the switches. As previously pointed out, the switch and its mechanism may be completely assembled and adjusted in the factory and shipped as a self-contained unit ready to be mounted and connected in the circuit in which it is to be used. Furthermore, it is easily susceptible of assembly in that each part mounted on the actuating shaft may be mounted at various relative angular positions merely by sliding onto the shaft and may be then secured at the position desired along the length of the shaft by a single bolt. For installations where bearing 59 is mounted directly on switch base 2, stop bolt 55 is not needed, because stop screw 60 accomplishes the same purpose. However, where the bearing 59 is to be mounted on a separate support, the stop bolt 55 is required for the reasons previously explained.

It will be observed that the mechanism is readily built up with relatively few parts, and can as readily be taken apart and rebuilt into many entirely different arrangements for switches having varying numbers of poles, or which are to be operated with the mechanism at various locations relative to the switch, all using a predetermined number of standard parts. This renders the arrangement extremely universal in character and suitable for wide application. It is apparent that inasmuch as various arrangements may be easily built up with a few parts, these parts being limited in number, can easily be stocked at the factory, and spare parts required in the field are reduced to a minimum. Furthermore, no drilling, tapping, or other machining operations are required to assemble or install the mechanism, except for those parts which are rigidly secured to the unitary support, supporting housing or other supporting structure on which the switch unit is to be mounted. In spite of the ease of assembly and the relatively few parts needed to obtain different arrangements, small angular and linear adjustment changes may be easily made, thus simplifying installation of the switches and mechanism and at the same time insuring proper final adjustment. The arrangement for padlocking the switches in two different positions is accomplished by standard parts of simple form, and is substantially foolproof. It will be observed that the angle of throw of the switch operating handle may be varied by adjusting stop screws 60 and 62, and that the handle itself is easily mountable on the operating shaft so that it will occupy any desired angular position with respect to the mounting base, when the switch is at its open or closed circuit position.

Having disclosed preferred embodiments of the invention in accordance with the patent statutes, it is desired that this invention be not limited to these particular structures inasmuch as it will be obvious to persons skilled in the art that many changes and modifications may be made without departing from the broad spirit and scope of the invention.

I claim as my invention:

1. An article of manufacture, comprising, a base, a plurality of switches supported on one side of said base, each of said switches comprising separable contacts one of which is mounted for movement toward and away from said base into and out of engagement with the other of said contacts, a common operating shaft rotatably mounted on said base at the other side thereof, at least two spaced cranks on said shaft, a common actuating rod connecting said cranks adjacent their outer ends, a link for each of said switches connecting the movable contact thereof to said rod, and said links being bent to clear said shaft so as to permit said links and cranks to move to a position overcenter and lock said switches at their closed positions.

2. In a switch construction, a base, a plurality of switches supported on said base, each of said switches comprising separable contacts one of which is mounted for movement into and out of engagement with the other of said contacts, a common operating shaft, at least two spaced cranks on said shaft adjacent their outer ends, a common actuating rod connecting said cranks,

and a link for each of said switches connecting the movable contact thereof to said rod.

3. A unitary switch construction, comprising, a base, a plurality of switches supported on one side of said base, each of said switches comprising separable contacts one of which is mounted for movement toward and away from said base into and out of engagement with the other of said contacts, a common operating shaft rotatably mounted on said base at the other side thereof, at least two spaced cranks on said shaft, a common actuating rod connecting said cranks adjacent their outer ends, a link of relatively fragile insulating material for each of said switches connecting the movable contact thereof to said rod, said links being bent to clear said shaft so as to permit said links and cranks to move to a position overcenter and lock said switches at their closed positions, and stop means on said base positioned to engage one of said cranks for preventing movement beyond said overcenter position.

4. In a switch construction, at least one switch comprising separable contacts one of which is movable into and out of engagement with the other, an actuating shaft which is non-circular in section, an actuating crank having an opening shaped so as to be longitudinally slidable onto said shaft to an operating position and to closely fit said shaft so as to be non-rotatable on said shaft, means for securing said crank against longitudinal movement on said shaft from its operating position, a link connecting said crank and movable contact, spaced journal members for said shaft each of which has an opening shaped so as to be longitudinally slidable onto said shaft and to closely fit said shaft so as to be non-rotatable thereon, each of said journal members having a circular journal portion, at least one of said journal members having an interlock portion thereon, spaced bearing supports for said shaft, and means for securing said journal members against longitudinal movement on said shaft at positions where said journal portions are received in said bearing supports comprising a shaft encircling clamp portion on each of said journal members.

5. In a switch construction, at least one switch comprising separable contacts one of which is movable into and out of engagement with the other, an actuating shaft which is non-circular in section, an actuating crank having an opening shaped so as to be longitudinally slidable onto said shaft to an operating position and to closely fit said shaft so as to be non-rotatable on said shaft, means for securing said crank against longitudinal movement on said shaft from its operating position, a link connecting said crank and movable contact, spaced journal members for said shaft each of which has an opening shaped so as to be longitudinally slidable onto said shaft and to closely fit said shaft so as to be non-rotatable thereon, each of said journal members having a circular journal portion, at least one of said journal members having an interlock portion thereon, spaced bearing supports for said shaft, means for securing said journal members against longitudinal movement on said shaft at positions where said journal portions are received in said bearing supports, comprising a shaft encircling clamp portion on each of said journal members, an operating handle having an opening shaped so as to be longitudinally slidable onto either end of said shaft to a position adjacent one of said bearing members and to closely fit said shaft so as to be non-rotatable thereon, means for securing said handle against longitudinal movement along said shaft, and stop means on said one bearing member for limiting movement of said handle in opposite directions.

6. In a switch construction, a base, a plurality of switches supported on said base, each of said switches comprising separable contacts one of which is mounted for movement into and out of engagement with the other of said contacts, a common operating shaft having a section in the form of a regular polygon, a plurality of cranks each having an opening shaped to closely fit said shaft so as to be longitudinally slidable onto said shaft at a plurality of different angular positions at each of which said cranks are non-rotatable on said shaft, an operating member having a differently shaped opening shaped to closely fit said shaft so as to be longitudinally slidable onto said shaft at a number of different angular positions greater than the number of angular positions at which said cranks may be mounted and at each of which it is non-rotatable on said shaft, and means for securing said operating member against longitudinal movement along said shaft.

7. In a switch construction, at least one switch comprising separable contacts one of which is movable into and out of engagement with the other, an actuating shaft, linkage means connecting said movable contact and shaft, an operating member rigidly secured to said shaft adjacent a support for said shaft, stop means on said support engageable with a portion of said operating member for defining one extreme position of said switch, said operating member having a rigid radial extension which is apertured to receive a padlock, and an arcuate groove formed on said support for receiving said extension at least at points in its path of movement intermediate extreme switch positions of said switch, whereby said aperture is exposed at least at said one extreme switch position for insertion of a padlock to prevent movement of said operating member toward the other extreme position.

8. Switch operating mechanism comprising an operating shaft having a non-circular section, means adapted to be secured to said shaft comprising a plurality of different members, each of said members having a substantially encircling clamp portion having spaced flanges inwardly extending from opposite sides of said clamp portion for defining an opening shaped so that said members are longitudinally slidable onto said shaft but non-rotatable relative to said shaft, and a single bolt for tightening the clamp portion of each member on said shaft to prevent any relative movement thereof with respect to said shaft.

9. Switch operating mechanism comprising an operating shaft having a section in the form of a regular polygon, means adapted to be secured to said shaft comprising a plurality of different members including switch and shaft operating members, each of said members having an encircling clamp portion defining an opening of a shape similar to said shaft section so that said members are longitudinally slidable onto said shaft at a plurality of different angular positions corresponding to the number of sides of said polygon, one of said different members having its longitudinal axis intersecting at least one side of the polygon defined by its opening and extending at an acute angle to a line normal to such one side such that said one member is longitudinally

slidable onto said shaft at a plurality of still different angular positions when turned over, and a single bolt for tightening the clamp portion of each member on said shaft to prevent movement thereof along said shaft.

10. Switch operating mechanism comprising an operating shaft having a section in the form of a regular polygon, means adapted to be secured to said shaft comprising at least one switch-actuating crank member and a shaft-operating member, each of said members having an encircling clamp portion defining an opening of a shape similar to said shaft section so that said members are longitudinally slidable onto said shaft at a plurality of different angular positions corresponding to the number of sides of said polygon, said shaft-operating member having its longitudinal axis intersecting at least one side of the polygon defined by its opening and extending at an acute angle to a line normal to such one side such that said shaft-operating member is longitudinally slidable onto said shaft at a plurality of still different angular positions when turned over, and a single bolt for tightening the clamp portion of each member on said shaft to prevent movement thereof along said shaft.

11. Switch operating mechanism comprising an operating shaft having a section in the form of a regular polygon, means adapted to be secured to said shaft comprising at least one switch-actuating crank member, shaft journal members having interlocking means thereon, and a shaft-operating member, each of said members having an encircling clamp portion defining an opening of a shape similar to said shaft section so that said members are longitudinally slidable onto said shaft at a plurality of different angular positions corresponding to the number of sides of said polygon, said shaft-operating member having its longitudinal axis intersecting at least one side of the polygon defined by its opening and extending at an acute angle to a line normal to such one side such that said shaft-operating member is longitudinally slidable onto said shaft at a plurality of still different angular positions when turned over, and a single bolt for tightening the clamp portion of each member on said shaft to prevent movement thereof along said shaft.

12. Switch operating mechanism comprising an operating shaft having a non-circular section, means adapted to be secured to said shaft

comprising a plurality of different members, each of said members having a substantially U-shaped clamp portion adapted to receive said shaft, said portion having at each side thereof flanges extending inwardly from the bight and leg portions thereof defining between said leg portions an opening shaped so that said members are longitudinally slidable onto said shaft but non-rotatable relative to said shaft, and a single bolt engaging the outer ends of said leg portions for tightening the clamp portion of each member on said shaft to prevent any relative movement thereof with respect to said shaft.

13. Switch operating mechanism comprising, an operating shaft bearing a non-circular cross section, an operating lever adapted to be secured at one end to said shaft and having a clamp portion substantially entirely encircling said shaft except for a split portion on the side of said shaft adjacent said operating lever, flanges extending inwardly from each side of said clamp portion at least at opposite sides of said shaft for defining an opening shaped so that said lever is longitudinally slidable on said shaft but non-rotatable thereon, and a single bolt engaging said clamp portion at its split part for tightening the clamp portion on the shaft.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
503,865	Lovelace	Aug. 22, 1893
506,297	Alexander	Oct. 10, 1893
521,055	Shartle	June 5, 1894
553,477	Spicer	Jan. 21, 1896
626,822	Baseman	June 13, 1899
801,341	Schrader	Oct. 10, 1905
858,014	Paige	June 25, 1907
1,306,119	Pharo	June 10, 1919
1,496,884	Jacobs	June 10, 1924
1,584,732	Christensen	May 18, 1926
1,637,520	Dodge	Aug. 2, 1927
1,693,126	Van Ryan et al.	Nov. 27, 1928
1,747,320	Rea	Feb. 18, 1930
1,776,936	Sweet	Sept. 30, 1930
1,817,904	Alsaker et al.	Aug. 11, 1931
1,826,734	Christensen	Oct. 13, 1931
1,872,051	Watts	Aug. 16, 1932
1,905,784	Alsaker et al.	Apr. 25, 1933