

May 23, 1933.

H. J. L. FRANK

1,910,205

SWITCH

Original Filed Sept. 15, 1922

4 Sheets-Sheet 1

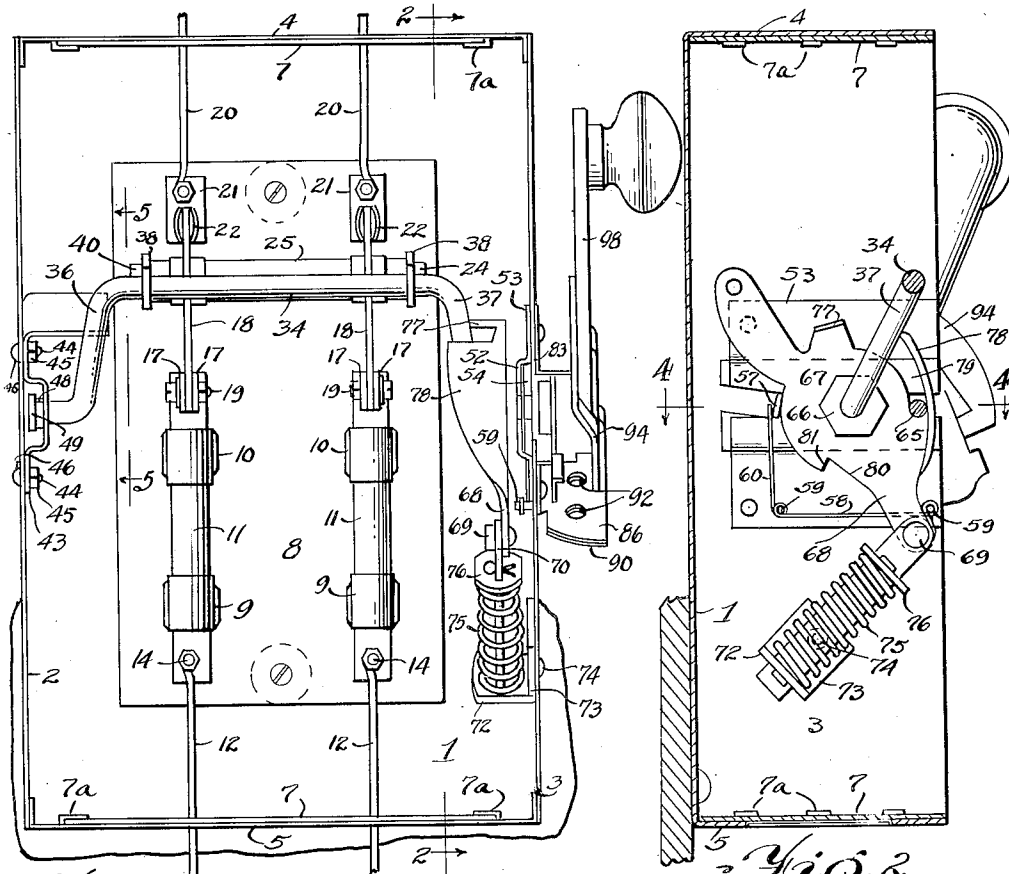


Fig. 1

Fig. 2

Fig. 3

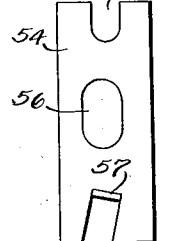


Fig. 10

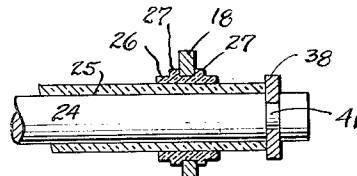
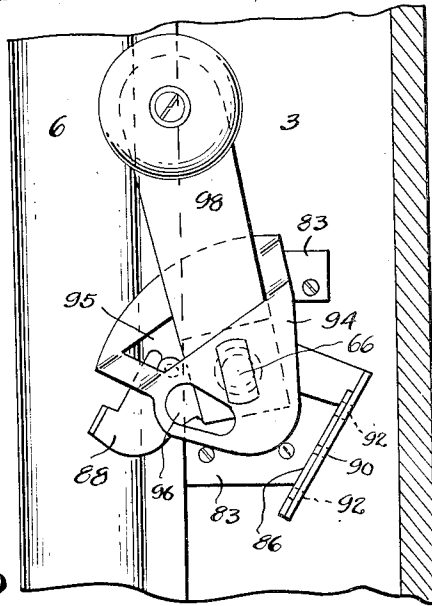


Fig. 7

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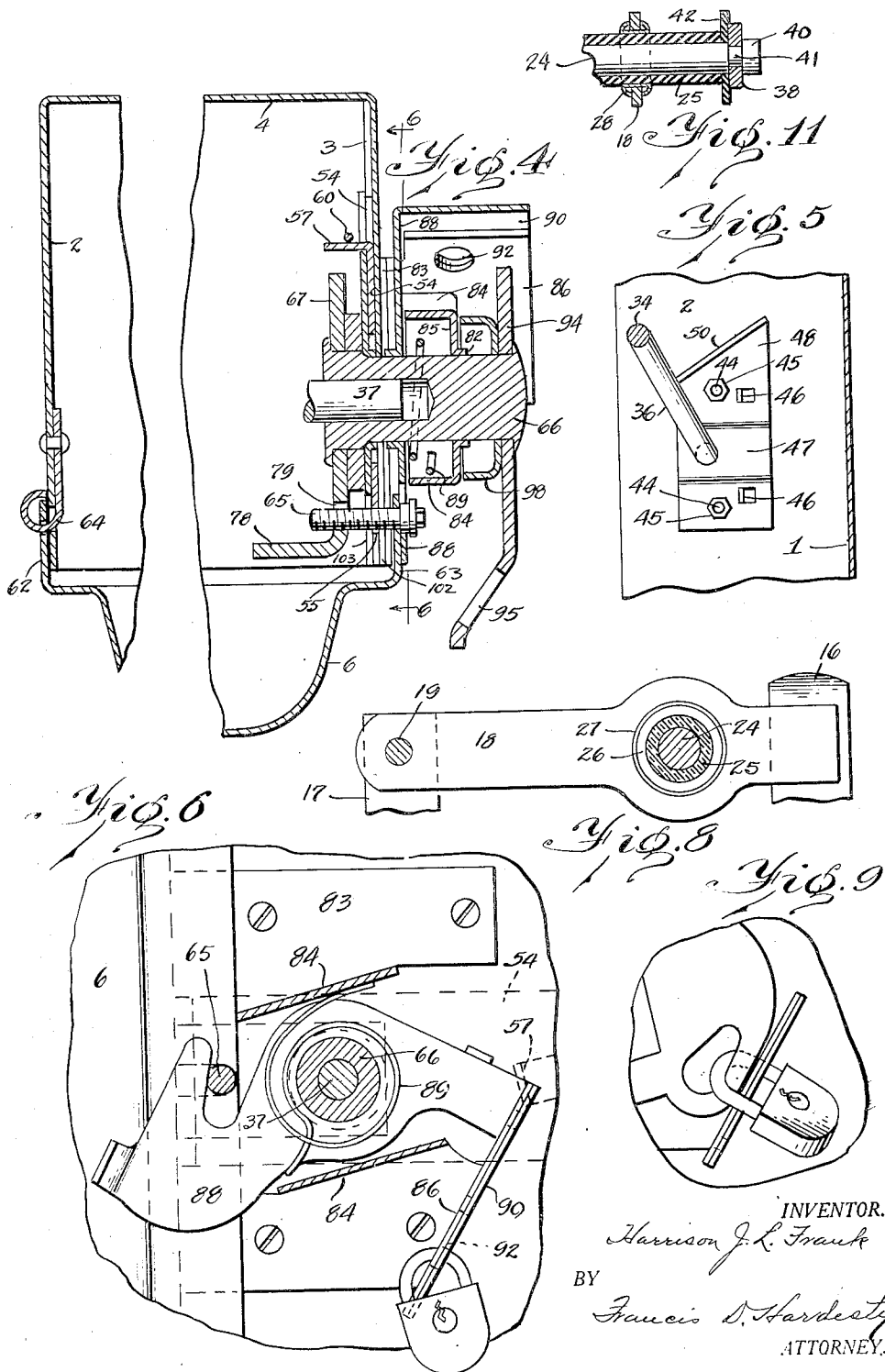
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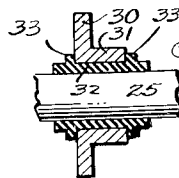
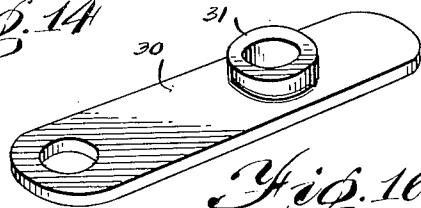
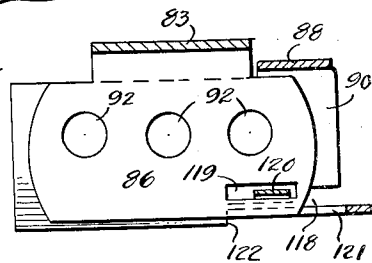
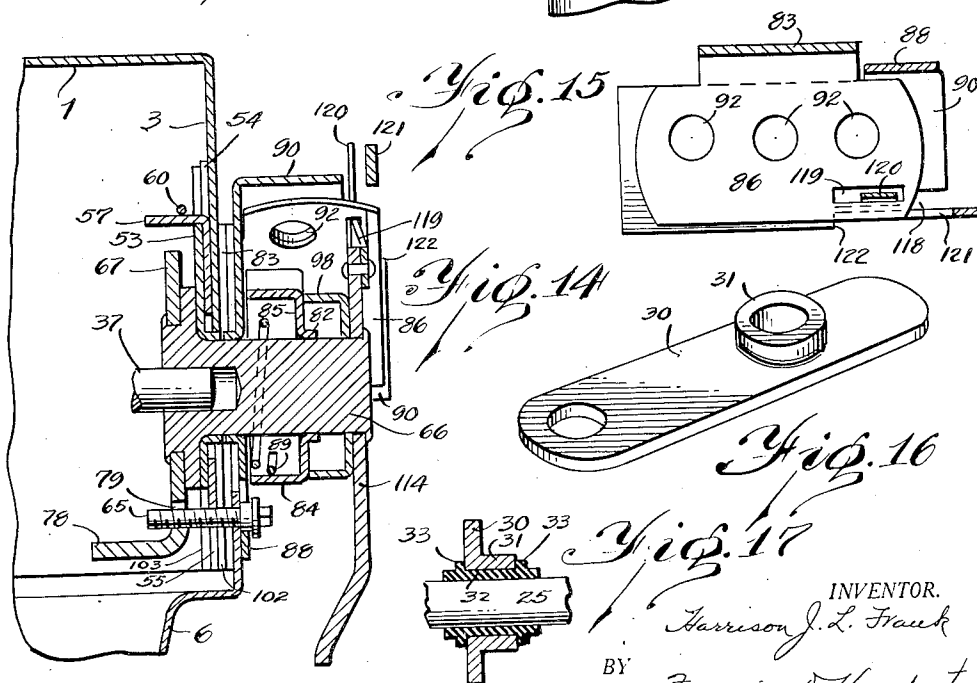
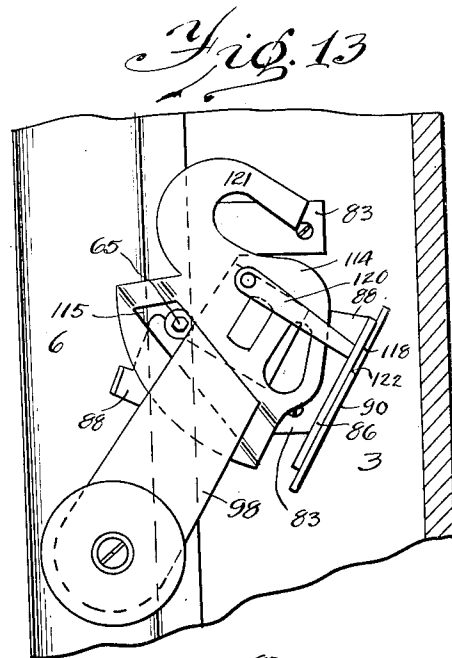
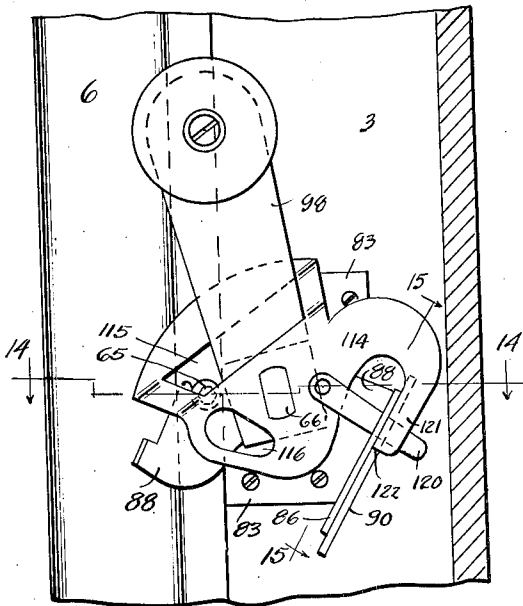
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4 Sheets-Sheet 3



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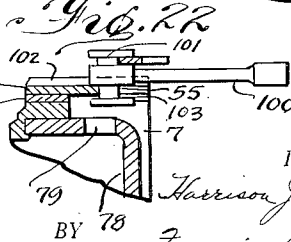
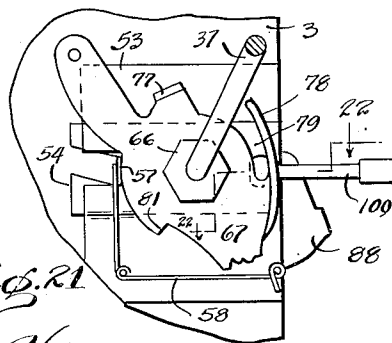
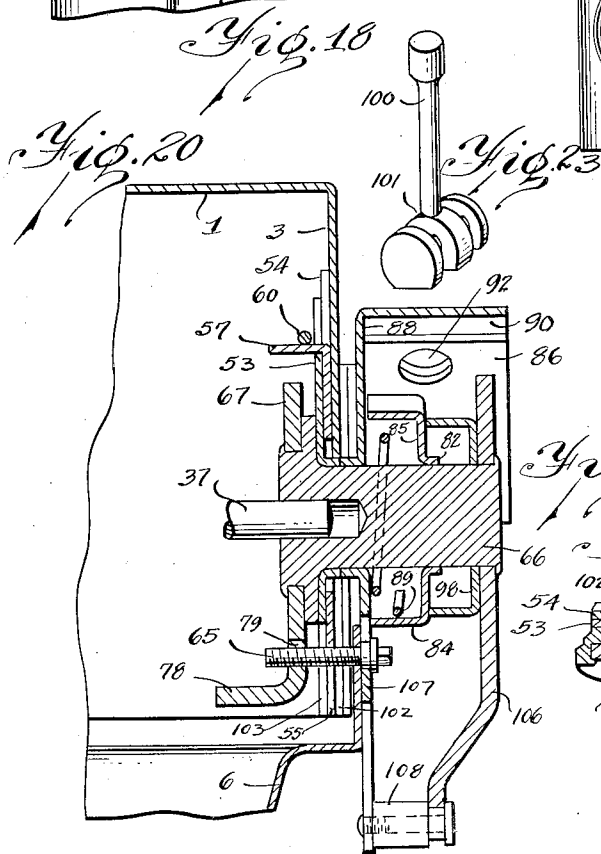
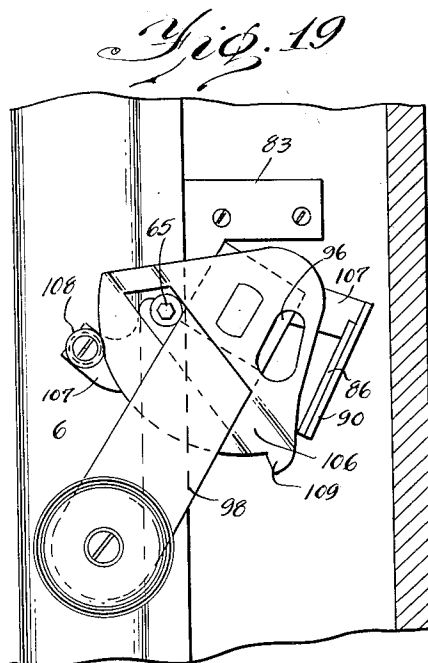
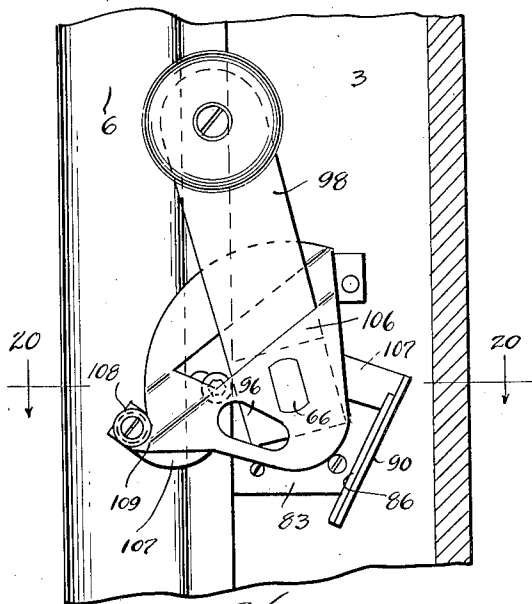
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SWITCH

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UNITED STATES PATENT OFFICE

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SWITCH

Original application filed September 15, 1922, Serial No. 538,303, now Patent No. 1,731,489, dated October 15, 1929. Divided and this application filed September 16, 1929. Serial No. 392,776.

This invention relates to electric switches of the so-called iron clad type, that is, switches enclosed in metal boxes and having operating handles on the outside of the boxes so that the switches therein can be opened and closed while the cover is closed, mechanism being provided to normally prevent the closing of the switch while the cover is open and to prevent the switch being opened while the switch is closed.

This invention consists in a bar extending through a plurality of knife blades of switches, the bar being encased in a tube of insulating material and short bushings within the knife blades and surrounding the bar and upset on each side of the knife blades to prevent lateral movement between them.

It also consists in a switch mounted within a switch box, a shaft, a cover for the box, a lock plate attached to the shaft and adapted to secure the cover in closed position, and operating member adapted to be engaged by the lock plate and a novel stop plate to prevent the lock plate from closing the switch while the cover is open, the stop plate being movable by the cover to inoperative position.

It also consists in a locking hook mounted on the operating shaft of the switch and adapted to hold the cover in closed position, and means to prevent the hook from moving.

It also consists in an actuating plate attached to the shaft, an operating handle loose on the shaft and adapted to engage the actuating plate to turn the shaft, said engagement embodying an amount of slack motion, and a spring operatively connected to the actuating plate to accelerate the final movements of the shaft.

It further consists of the details of construction illustrated in the accompanying drawings and particularly pointed out in the claims.

In the accompanying drawings, Fig. 1 is a front view of this switch and the box therefor with the cover removed.

Fig. 2 is a section on the line 2—2 of Fig. 1.

Fig. 3 is a side elevation from the right in

Fig. 1, of the operating handle for the switch.

Fig. 4 is a section on the line 4—4 of Fig. 2.

Fig. 5 is a section on the line 5—5 of Fig. 1.

Fig. 6 is a section on the line 6—6 of Fig. 4.

Fig. 7 is a view of a connecting bar and a section of the insulation thereon.

Fig. 8 is a side elevation of a switch blade.

Fig. 9 is a side elevation of one form of lock for the operating handle.

Fig. 10 is a detail of a lock plate.

Fig. 11 is a slightly modified form of insulation for a connector bar.

Figs. 12 and 13 are side elevations of a modified form of locking device for the operating handle showing the mechanism in two positions.

Figs. 14 and 15 are sections on the lines 14—14 and 15—15 of Fig. 12 respectively.

Fig. 16 is a perspective of another form of knife blade.

Fig. 17 is a section thereof on a connector bar.

Figs. 18 and 19 are elevations of another form of locking device for the operating handle showing the parts in two positions.

Fig. 20 is a section on the line 20—20 of Fig. 18.

Fig. 21 is an elevation of a door lock held inoperative.

Fig. 22 is a section on the line 22—22 of Fig. 21.

Fig. 23 is a perspective of a device to hold the door lock inoperative.

Similar reference characters refer to like parts throughout the several views.

The switch shown in Figs. 1 to 5 of the drawings is of the type known as "Bulldog" to the trade, that is, a switch mechanism is enclosed in a steel case or box and interlocking mechanism is provided for normally preventing the case being opened while the switch is closed and also normally preventing the switch being closed while the case is open. The present case has a bottom 1, sides 2 and 3, ends 4 and 5 and a cover 6. The ends may be provided with

the usual removable plates 7 provided with "knock-out" discs and held in position by the tongues 7a on the ends.

A base 8 (Fig. 1) of insulating material carried the clips 9 and 10 for the fuses 11, and the work or load wires 12 extending through openings in the end 5 connect to the screws 14.

The opposite ends of the fuses are held by the clips 10 which connect to the small bearing plates 17 between which the knife blade contacts 18 are mounted on the bolts 19. The feed wires 20 extend in through openings in the end 4 and connect to the contacts 21 which also have side plates 22 between which the knife blades 18 extend when the switch is closed.

The knife blade contacts may be of many different constructions and are connected and insulated as may be desired. I prefer to use one of the several novel constructions detailed in Figs. 7, 8, 11 and 16. The construction shown in Figs. 7 and 8 consists of a blade 18, preferably of copper, in which a hole is formed by first slitting the blade by means of a wedge which separates its sides and then placing it between dies which force the ends of the blade toward each other while limiting the outward expansion to the form shown. The hole is then properly finished to receive the connector bar 24. The loss of material is very small. The edges of the blade are the same as in the original ribbon thus saving the usual re-finishing. The original cross section remains substantially the same at the point of expansion so that the conducting capacity is not affected. This bar is surrounded by a tube 25 of insulating material and a short sleeve 26 of vulcanized fibre fitting around this tube extends through the blade 18. The ends of the sleeve 26 are inserted in substantially cylindrical and counterbored jaws which move toward each other while a mandrel on the inside prevents collapsing. This produces the circumferential ribs 27 on the sleeve at either side of the blade 18 and at the same time retains the proper internal diameter of the sleeve so that it fits the tube 25 to hold the blade in position and at the same time permits the blade to adjust itself on this tube.

In Fig. 11 I have shown the bar 24, tube 25 and knife blade 18, and in addition a short sleeve 28 placed on this tube within the blade, and this sleeve has its ends expanded and rolled back to engage the blade, this expansion reducing the internal diameter sufficiently to grip the tube 25.

In Figs. 16 and 17, a knife blade 30 is shown formed with a hub 31 which is produced by forcing out the metal of the blade without widening it. A small guide hole is first punched in the blade and a drawing punch is then forced down to extrude the

hub. Normally this would crack the hub along its outer edge but by using a resisting die of cup shape which is held against the hub as it is formed by considerable pressure, the cracking of the hub is prevented. A pressure pad should bear against the upper face of the blade to prevent distortion while the hub is extruded downward. A tube 25 on the connector rod again extends through the opening in this hub and a short sleeve 32 with circumferential ribs 33 again fills the space within the hub and around the tube. The blades thus constructed cannot become disconnected from the bar on which they are mounted.

The knife blades 18 are connected to an operating bail consisting of a central bar 34, arms 36 and 37 having outwardly turned aligned ends, the bail connecting to the knife blades by means of links 38, each having one end pivoted on the central bar 34 and the other end pierced, then split to pass over the end 40 of the connector bar 24, and then squeezed down to fit into the groove 41, as shown in Fig. 7. If desired, a washer 42 of insulating material may be placed between the ends of the insulating tube 25 and the links 38, as shown in Fig. 11.

A plate 43 (Figs. 1 and 5), is attached to the side 2 by means of bolts 44 having nuts 45 on their inner sides and by means of tongues 46 struck up from the plate and extending through holes in the side 2. A raised portion 47 of this plate is formed with a cylindrical flange 48 which constitutes a bearing for the end 36 of the bail, this end being upset at 49 to prevent withdrawal of the bail from its bearing. An extension 50 on this plate serves as a stop for the bail.

A plate 53 is attached to the inner side of the side 3 and the middle portion 52 is bent away from the side 3 to serve as a guide for the stop plate 54 shown in Fig. 10. The stop plate is formed with a notch 55 at its upper end, with a central hole 56 to receive the shaft 66 and with a tongue 57 at its lower end. A spring 58 is mounted on pins 59 struck up from the plate 52 and has a portion 60 extending under the tongue 57 to normally hold up the plate 54.

The box has a cover 6 provided with side flanges 62 and 63, the former formed with slots to receive the curved tongues 64 attached to the side 2 of the box which constitute hinges for the cover (see Fig. 4). The opposite side flange 63 carries a screw 65 adapted to be removed by a special key in the hands of the inspector who is trusted to open the box to examine the switch without opening the switch.

A stub shaft 66 is mounted in the side 3 and has a central bore to receive the end 37 of the switch operating bail. Secured to the inner end of this stub shaft is a locking plate 67 which has an arm 68 carry-

ing a pin 69 to which the bar 70 connects. This bar is slidable in a slot in the lug 72 on a plate 73 pivoted at 74 to the side 3, and this lug serves as an abutment for the
 5 spring 75 which also engages a plate 76 on the bar 70. This spring is compressed while the plate 67 is turned clockwise (in Fig. 2) until about the time the tongue 77 on this plate reaches the arm 37 of the oper-
 10 ating bail, after which this spring causes the plate 67 to continue its movement to swiftly swing the bail to a position approximately at right angles to the bottom of the box and in doing so, opens the switch at
 15 such speed that very little arcing occurs at the contacts 22. This spring also assists in the swift and complete closure of the switch through the engagement of the flange 78 on the plate 67 with the opposite side of the
 20 arm 37.

This arrangement of the switch blade actuating parts permits the operation of the switch by means of the operating handle 98 even though the spring 75 should become
 25 broken and therefore inoperative to produce the quick make or break.

Further, mounting the spring 75 on the bar or link 70 provides not only a guide for the spring but, in case of spring, break-
 30 age, prevents the parts from becoming displaced and possibly getting into the "live" portions of the switch and causing short circuiting.

The plate 67 is undercut at the flange 78
 35 to form a circular slot 79 in which the screw 65 extends. So long as the plate 67 is in the position shown in Fig. 2, at which position the switch is closed, the flange 78 extends over the screw 65 and prevents the
 40 door being opened. When the plate 67 has been swung to release the screw 65 and the door has been opened, the arm 60 of the spring 58 presses up the plate 54 and brings the tongue 57 thereon against the edge of
 45 the plate at about the point 80 where this tongue is in the path of the shoulder 81 on the locking plate 67 and prevents this plate of the bail 34 from turning. The switch is thus locked in open position while the door
 50 6 is open. The screw 65 enters the notch 55 in the plate 54 when the cover is closed and depresses the plate sufficiently to carry the tongue 57 out of the path of the shoulder 81 so long as the cover 6 is in closed posi-
 55 tion.

The side 3 of the body is formed with a notch 102 to permit this entrance of the pin 65. Attached to the outer side of the wall 3 of the box is a plate 83 having a central
 60 portion made up of two sides 84 and a top 85 which is apertured and formed with a flange 82 to serve as a bearing for the short shaft 66. This plate has a portion 86 bent up at right angles to constitute a lock plate
 65 shown in Figs. 4 and 6. On the shaft is ro-

tatably mounted a hook 88 adapted to en-
 70 gage the screw 65 carried by the cover 6, and a spring 89 normally holds this hook in the position shown in Fig. 6. A foot 90 on this hook is adapted to lie flat against the
 75 lock plate 86 and these two are formed with registering holes 92 adapted to receive the padlock 93 so that the box cover can be locked. I prefer a number of these holes 92 so that the box cannot be opened without
 80 the consent of several employees.

This plate 83 and the plate 53 are preferably secured to the side 3 of the box by means of the same screws so that the entire
 85 operating and interlocking mechanism may be taken out as a unit when these screws are removed.

The actuating plate 94 shown in Fig. 3 is attached to the shaft 66 and has a long slot 95 through which the operating handle 98
 90 extends. This slot is of such length that the spring 75 can accelerate the movements of the switch in either direction. The handle is loose on the shaft and its inner end may be flanged, as shown in Fig. 4, to engage the middle portion 85 of the supporting
 95 plate 83. The plate 94 has a slot 96 through which and through the holes 92, a padlock 97 can be passed to lock the switch in open position, as shown in Fig. 9. This permits a line man to lock the switch in open position while he is at work on the circuits connecting into the box.

If it is desired to inspect the switch when the switch is in the closed position, then the socket end 124 of the key or tool 100
 100 shown in Fig. 23, having a head 101, is fitted over the head of the screw 65 and the screw is backed out sufficiently to miss the projecting part 78 of the lock plate 67 when the hook 88 may be pulled back and the cover opened.

The cover may then be closed by reversing the process, and the screw 65 is then
 110 screwed into the cover again.

It may also be desirable to inspect and operate the switch when the cover is open. In this case the head 101 of the key or tool 100 is used to depress the plate 54 which
 115 permits the switch to be closed. The key or tool 100 is then removed. (See Figs. 21 and 22.)

If it is desired to close the cover, the screw 65 is backed out sufficiently to clear the hook 78 and the cover is then closed and the screw run back in until it rests in a position underneath the hook 78.
 120

In Figs. 18, 19 and 20 I have shown an actuating plate 106, somewhat similar to the plate 94 shown in Fig. 3. The hook plate 107 has a button or knob 108 adapted to be engaged by the ear 109 on this actuating
 125 plate 106 so that the hook plate cannot be swung back to release the screw 110 carried by the cover 6 of the box so long as the switch
 130

remains closed. The slot 112 in this plate 106 is shown in Fig. 19 made sufficiently large to permit the screw 65 to be backed by means of a proper tool when the switch is open so that the switch may be closed and the cover opened, if necessary. The remaining parts are the same as those shown in Figs. 3 and 4 and are similarly lettered.

In Figs. 12, 13 and 15 inclusive is shown another interlock between the locking hook for securing the cover and the actuating plate through which the handle 98 extends. The supporting plate 83 is again provided with an outward extension 86 which has holes 92 to receive a padlock. Mounted on the shaft 66 is a switch actuating plate 114, provided with a long slot 115, to permit the passage of the handle 98 as before described and this plate also has an eye 116 to receive a padlock which may also extend through a hole 92 again provided with holes to register with the holes 92 in the extension 86.

This lock plate 90 on the hook 88 is formed with a notch 118 and the rigid extension 86 on the supporting plate 83 is provided with a slot 119. The switch-actuating plate 114 has pivoted to it a tongue 120 adapted to extend through the slot 119, and has an arm 121 adapted to extend into the notch 118. When the switch is open, as shown in Fig. 13, the tongue 120 is up out of the path of the shoulder 122 on the plate 90 and the arm 121 is also swung out of this path. The switch-actuating plate must be swung to normal position before the switch is closed for otherwise the tongue 120 cannot be forced down but as the hook 88 and the arm 121 are mounted on the same shaft, the closing of the switch will swing the hook to operative position. Unless the cover 6 is already closed when this occurs, it cannot be swung to closing position as the screw 65 will engage the top or outer edge of the hook 88. The interlock composed of the sliding plate 54 and the lock plate 67 shown in Figs. 1 and 2 prevent the switch being closed until this plate 54 is pushed in, either by the screw 65 or by a device such as shown in Fig. 23.

The tongue 120 and the flange 78 on the plate 67 perform the same duties and either may be omitted when the other is employed but both may be used for the sake of greater safety.

It will be observed that the operating mechanism and the switch may all be removed without disturbing the conductors 12 and 20, so that any part may be replaced without the necessity of removing the wiring or conduits of the installation where this switch is employed.

Many other changes in the details of switches and their boxes embodying this invention may be made by those skilled in

the art without departing from the spirit of my invention as set forth in the following claims.

This application is a division of prior application Serial No. 588,306, filed September 15, 1922, now Patent No. 1,731,489 granted Oct. 15, 1929, on a switch.

I claim:

1. In a switch, the combination of an operating bar, a sleeve of insulating material thereon, a short sleeve of insulating material on the long sleeve, a switch bar having an opening through which the sleeves and operating bar extend, the short sleeve being formed with circumferential ribs at each side of the switch bar to prevent movement between them.

2. In a switch, the combination of an operating bar, a sleeve of insulating material thereon, and a switch bar having an opening through which said sleeve and operating bar extend, said switch bar having an integral hub on one side surrounding said opening, said sleeve having a circumferential rib at each side of the switch bar to prevent movement between them.

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