Nov. 7, 1933. E. G. K. ANDERSON 1,934,024

SWITCH BOX HAVING PLUG-IN MEANS

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Fig. 1

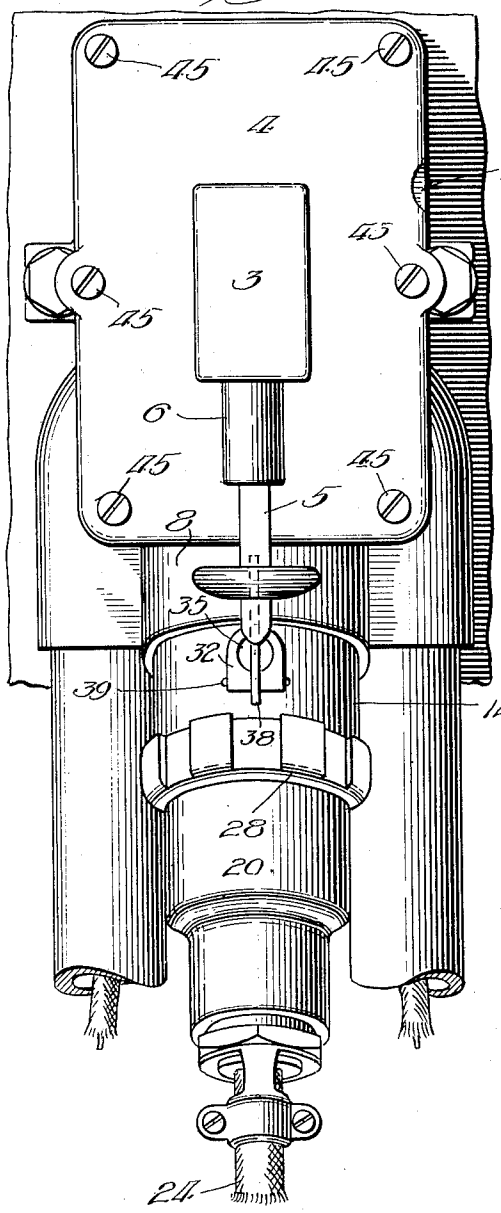

Fig. 2

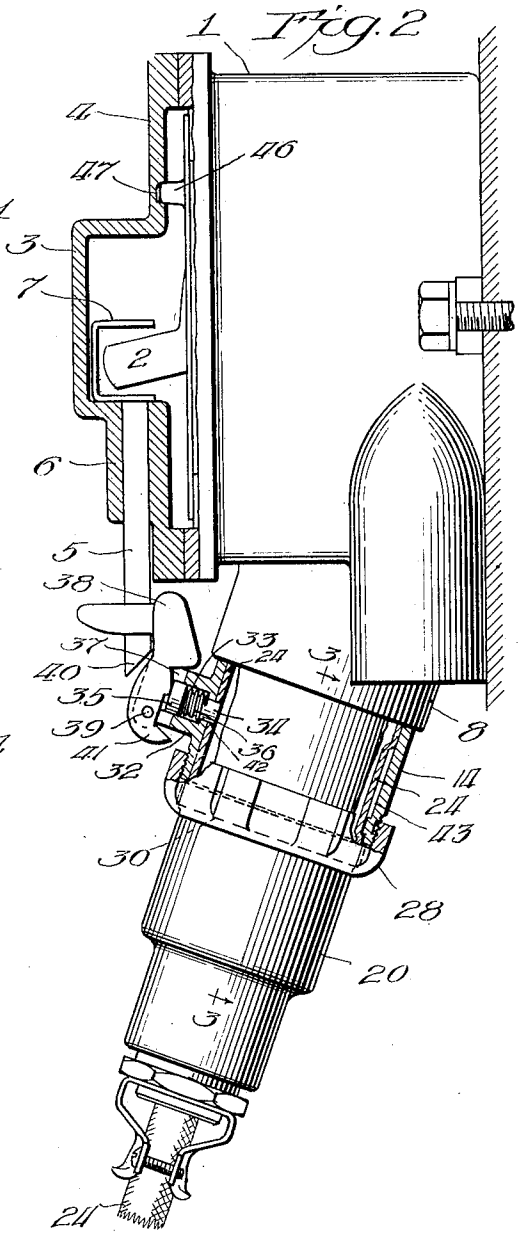

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Fig. 3

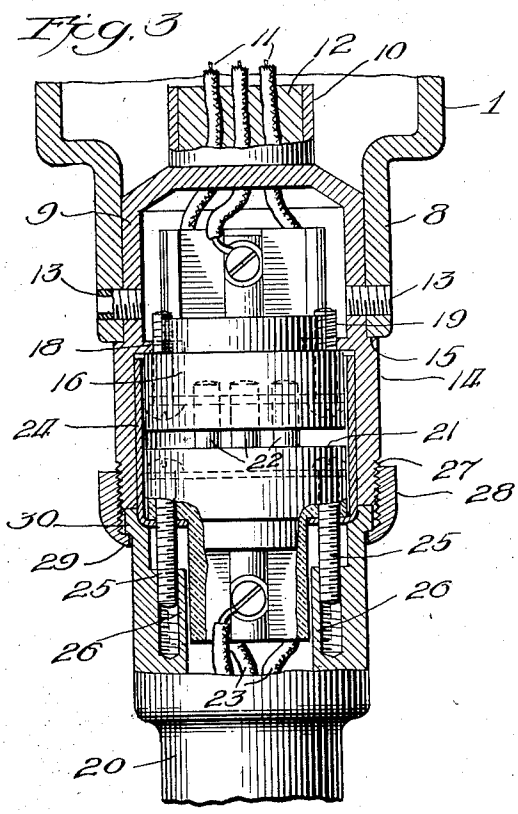


Fig. 4.

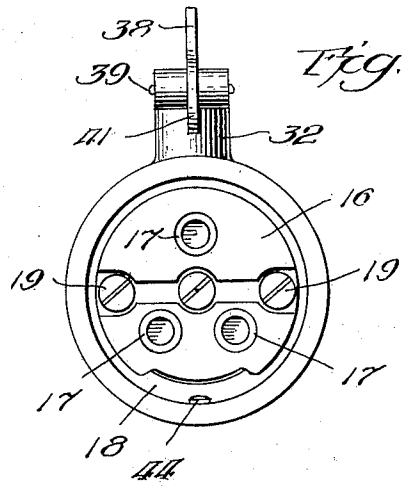


Fig. 5.

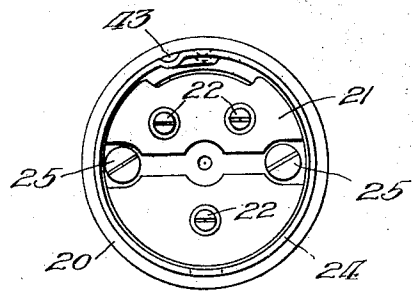


Fig. 7.

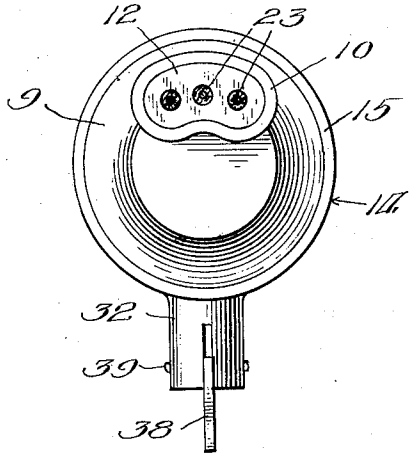
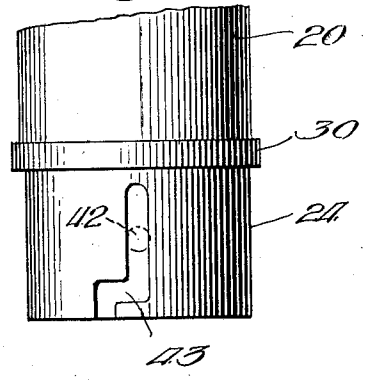


Fig. 6.



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SWITCH BOX HAVING PLUG-IN MEANS

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Application May 27, 1932. Serial No. 613,820

3 Claims. (Cl. 200—50)

The object of the present invention is to produce a simple and novel switch box provided with means for plugging in a cable, which will make it necessary that the switch be open before the plug can be disconnected after a coupling has once been made.

A further object of the present invention is to provide a plug and a cooperating socket whose contacts make a sliding engagement with each other in the direction of the length of the device with means to interlock the plug and socket so as to compel them to be rotated relatively to each other after the contacts have been separated in order to disconnect the plug and socket from each other; thereby insuring that arcing at the contacts will have ceased before the outside atmosphere can enter.

The various features of novelty whereby my invention is characterized will hereinafter be pointed out with particularity in the claims; but, for a full understanding of my invention and of its objects and advantages, reference may be had to the following detailed description taken in connection with the accompanying drawings, wherein:

Figure 1 is a front elevation of a device embodying the present invention; Fig. 2 is a side elevation of the device, parts being in section; Fig. 3 is a section on line 3—3 of Fig. 2, on a somewhat larger scale than Figs. 1 and 2; Fig. 4 is an end view of the socket member on the box, on the same scale as Fig. 3; Fig. 5 is an end view of the plug member adapted to be engaged with the socket; Fig. 6 is an elevation of a fragment of a plug member; and Fig. 7 is a view showing the opposite end of the socket member from that which appears in Fig. 4.

Referring to the drawings, 1 represents a switch box of any usual or suitable construction; that illustrated being one adapted to be secured to a vertical wall. The box may contain a switch of any usual or suitable construction, the only part of which to which attention need be called being the oscillatory handle 2 that projects from the box proper into a dome-like chamber 3 in the detachable cover 4 of the box. The switch is adapted to be operated by a rod or bar 5 slidably mounted in a boss 6 on the cover just below the part 3; the upper end of the rod or bar extending into the switch handle chamber and having thereon a U-shaped portion 7 between the arms of which the switch handle or lever lies. In other words, as the actuating bar or rod is moved up and down the switch is opened and closed; the upward movement causing the switch to open and the downward movement, of course, causing the switch to close.

At the lower end of the box is a tubular hub-like part 8 in which the socket member of the plug and socket connection is fixed. This socket member is formed, in part, of a hollow cylinder or plug 9 contracted at its inner or upper end into a neck portion 10. The wires 11 from the switch are led into the member 9 through this neck portion. In the arrangement shown, there are three wires. After the wires have been inserted, the interior of the neck element 10 is filled with sealing wax 12 or other suitable composition to provide a seal. The interior of the tubular part 8 and the exterior of the member 9 are machined so as to be a good fit and therefore, since the neck portion 10 is sealed, there can be no interchange of air or other gas between the surrounding atmosphere and the interior of the box through the tubular hub on the box. The member 9 is held to the box in any suitable way as, for example, screws 13 passing into the same through the surrounding wall of the member 9. The outer end 14 of the member 9 is enlarged somewhat in diameter to produce a shoulder 15 to abut against the lower end of the hub 8 and limit the distance to which the member 9 can be inserted in the hub.

Within the member 9 is fixed a body 16 of insulating material containing three tubular contact pieces 17 extending parallel with the axis of said member; each contact piece being connected to one of the wires 11. In the arrangement shown, the member 9 has internal ledges or ribs 18 to which the block or body of insulating material is secured by screws 19. The portion of the insulating body or block that lies outwardly from or below the ledges 18 is smaller in diameter than the internal diameter of the cylindrical part 14.

The plug element cooperating with the socket just described is composed of a comparatively heavy tubular part 20 having in one end a block or body 21 of insulating material carrying three projecting pins 22. These pins are terminals or contact pieces connected to the wires 23 of a cable 24 that is adapted to be electrically connected to the switch. A portion of the insulating block 21 lies outwardly beyond the end of the member 20 and fits within a cup-shaped sheet metal shell 24 having in the bottom a large central opening through which the inner part of the insulating block 21 may pass. Screws 25, extending down through the insulat-

ing block 21, the remaining portion of the bottom wall of the cup-shaped shell and into bosses 26 within the member 20, serve to secure the members 24, 21 and 20 together. The parts are so proportioned that, when the plug and the socket members are brought together, the cylindrical wall of the member 24 fits nicely within the enlarged part 14 of the socket member; the forward end of this cylindrical shell or wall lying between the outer part of the block 13 and the surrounding cylindrical part 14. The lower end of the member 14 may be externally screw-threaded, as indicated at 27, to be engaged by a cup-shaped nut 28 rotatable on the member 20, and interlocked therewith by having an annular in-turned lip 29 engaged under an annular enlargement or collar 30 around the upper end of the member 20. After the plug has been inserted in the socket the nut 28 may be screwed up on the part 14 so that a pull on the cable will not cause the plug to become separated from the socket.

When the plug and the socket have been assembled, as shown, arcing at the switch in opening the same to break the circuit cannot ignite combustible gases in the surrounding atmosphere because the passages through which the conductors of the cable are connected to the switch are effectively sealed. However, if the circuit is broken by the act of pulling out the plug, the arcs that may be formed between the contact pieces 17 and 22 could act directly upon combustible gases in the vicinity of the device and cause an explosion. I have therefore provided means to prevent the separation of the plug from the socket until the switch has been opened, so that there is no current flowing when the plug is withdrawn. In the arrangement shown, the part 14 has on the front side, directly behind the path of movement of the switch actuator 5, a boss 32 provided with a central bore 33 that extends entirely through the underlying wall of the part 14. In this bore is located a pin 34 having at the outer end a head 35. That part of the bore 33 that extends through the wall of the part 14 at the inner end of the boss is only as large in diameter as the pin, whereas the remainder of the bore is of the same diameter as the head of the pin. Consequently, there is at the inner end of the large portion of the bore a shoulder on which may rest a compression spring 36 that surrounds the pin and engages it at its outer end with the under side of the head on the pin. The spring is put in under an initial compression so that, when free to do so, it will push the pin out clear of the bore at the part 14. The outer end of the boss is slotted, as indicated at 37, in the plane of the actuator 5 and, in the slot in the boss, is arranged a lever 38 pivoted at its lower end, as indicated at 39. The upper end of the lever lies underneath and overlaps the lower end of the switch actuator 5 when the actuator is in its switch-closing position. The extreme lower end of the switch actuator is wedge-shaped so as to provide an inclined face 40. When the switch actuator is up, in the switch-open position, the lower end thereof is clear of the lever 38 and therefore the spring under the head of the pin 34 forces the pin outwardly and swings the free end of the lever outwardly. The outward movement of the lever is limited by a finger 41 on the lower end of the lever which engages with the under side of the boss. Then, when the switch actuator is moved down so as to close the switch, the inclined face 40 engages with the upper free end of the lever and gradually swings the lever in the clockwise direction, as viewed in Fig. 2; thereby causing the lever to push the pin inwardly, as shown in Fig. 2.

The cylindrical part of the metal shell 24 on the plug member has therein a hole 42 in position to register with the pin 34 and receive the inner end of the pin when the pin is pushed in upon the closing of the switch. Therefore, after the parts have been assembled, the plug cannot be withdrawn until the switch is opened and the locking pin retracted. Furthermore, if the switch should be closed while the plug is disconnected, the coupling cannot be completed until the switch is again opened, because the pin 34 will act as a stop to engage with the upper end of the member 24 and prevent this member from entering fully into the socket. I have also illustrated means to prevent arcing between the contacts in the plug and the socket in the event that the interlock with the switch is not being used or is not in condition for use. To this end, as best shown in Figs. 2, 5 and 6, I have deformed the cylindrical portion of the shell 24 to produce therein a trough-like recess 43 consisting of a short outer arm and a long inner arm paralleling the axis of the plug and separated from each other circumferentially of the latter; these two arms being connected by a cross arm extending circumferentially. Within the part 14 of the socket is a pin 44 in position to cooperate with the bayonet slot or groove. It will be seen that, when the plug is inserted in the socket, it can move in a short distance and must then be turned before it is pushed in the rest of the way. Similarly, upon withdrawing the plug, it can be pulled out for a distance equal to the length of the long arm or leg of the slot, which is sufficient to open the circuit at the contacts in the connector, and must then be turned before it can be completely withdrawn. In other words, the circuit is broken and the arcs are extinguished before the space around the contacts in the connector is opened to atmosphere. This interlock, consisting of the pin and the bayonet slot or groove, of course serves the further purpose of accurately positioning the plug angularly of its axis to bring the hole 42 directly opposite the locking pin or ledge 34.

It should be noted that, if the cover for the switch box were reversed, end for end, the switch could be opened and closed without causing the plug to be locked in the socket while the switch is closed. This may be prevented by so constructing the parts that the cover can be set on the box in only one way, namely, that which will enable the switch actuator to control the lock or catch for the connector. This can be accomplished by such a spacing of the holes for the screws that the screw holes in the box will not register with those in the cover except in one position of the cover and by an interlock between the cover and the switch. In the arrangement shown, the holes in the cover for the screws 45 are farther apart at one end of the cover than the other. Also, the switch is provided with a boss or lug 46 that will enter a recess 47 in the inner side of the cover when the cover is properly applied, and not interfere with the securing of the cover; but which will engage with the inner face of the cover if the latter be turned end for end, and hold the cover away from the box. Therefore, the switch must

be properly positioned in the box and the cover must be properly positioned with respect to the switch in making the assembly.

While I have illustrated and described with particularity only a single preferred form of my invention, I do not desire to be limited to the exact structural details thus illustrated and described; but intend to cover all forms and arrangements which come within the definitions of my invention constituting the appended claims.

I claim:

1. In combination, a box containing a switch and having at one side an external socket to receive a plug on a cable to be connected to the switch, a locking device on the socket adapted to engage with a plug in the socket to lock it against removal, a detachable cover for the box, and a switch actuator slidably mounted in the cover and having a part adapted to engage with the switch when the cover is applied to the box and having a second part lying outside of the box and adapted to move from a position overlying said locking device when the switch is closed to a position clear of the locking device when the switch is open.

2. In combination, a box containing a switch and having at one side a socket to receive a plug on a cable to be connected to the switch, a locking device on the socket adapted to engage with a plug in the socket to lock it against removal, a detachable cover for the box, a switch actuator slidably mounted in the cover to move from a position overlying said locking device when the switch is closed to a position clear of the locking device when the switch is open, and cooperating means on the box and the cover to prevent the cover from being applied in any position except that which brings the switch actuator in proper relation to the locking device.

3. In combination, a switch box having a socket to receive a plug on a cable to be connected to the switch in the box, a movable radial pin on the socket, a spring tending constantly to hold the pin with its inner end clear of the bore in the socket while permitting the pin to be pushed into said bore against the resistance of the spring, a lever mounted on the socket and overlying the pin and adapted to force the pin inwardly when pressure is applied to the lever, and a switch actuator slidably mounted on the box in such a position that it moves across the top of the lever in the direction of the length of the latter during its switch-actuating movements, said actuator having a part adapted to engage the lever and press it down when the actuator is moved in the direction to close the switch.

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