

May 6, 1952

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2,595,949

SWITCH

Filed May 26, 1948

2 SHEETS--SHEET 1

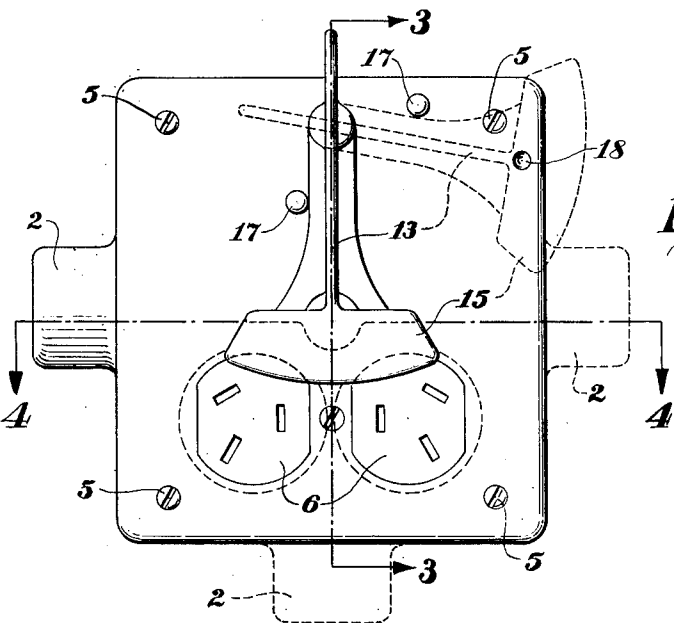


Fig. 1.

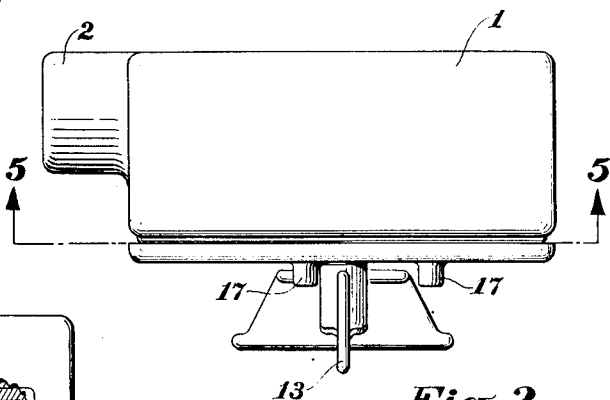


Fig. 2.

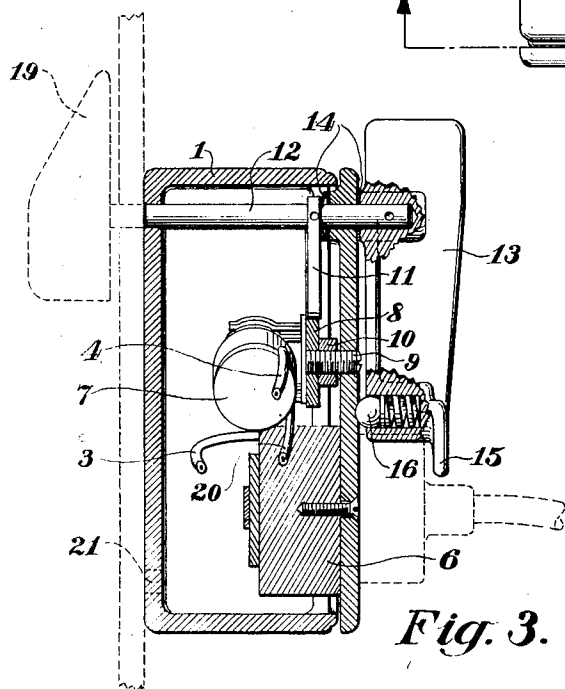


Fig. 3.

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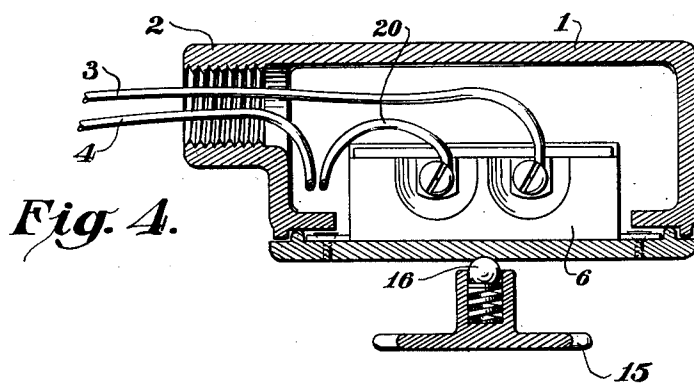
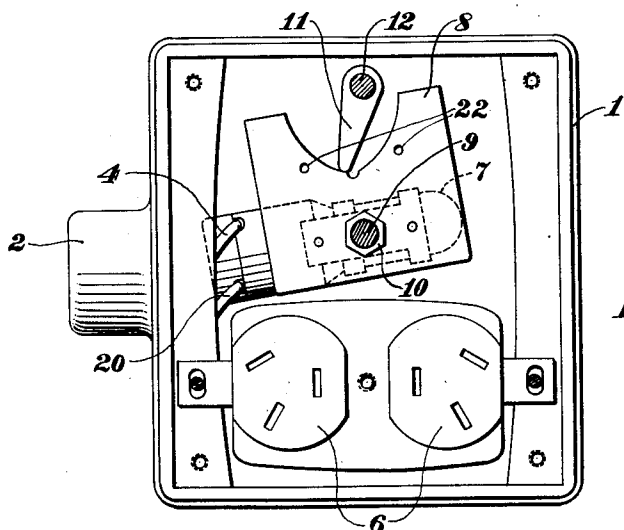
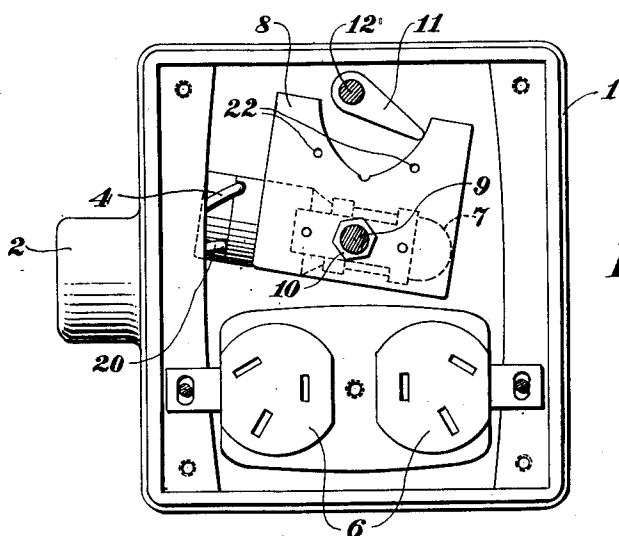
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SWITCH

Filed May 26, 1948

2 SHEETS—SHEET 2



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2,595,949

SWITCH

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Application May 26, 1948, Serial No. 29,342

4 Claims. (Cl. 200—50)

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This invention relates to electric switches and particularly those switches which are used in locations where the atmosphere contains inflammable or explosive vapors which may be ignited by chance electrical sparks.

It has heretofore been the practice to provide completely enclosed switch boxes in such service, the connection to using equipment being made by outlet plugs that recess through relatively long metal passages which dissipate heat from the vapor-air mixture in the immediate vicinity of the contact points to such an extent that a flame will not be propagated outwardly even if a spark is struck at the contact points. Such devices have the disadvantage that they are bulky and expensive in construction. Furthermore, the connecting outlet plugs are relatively heavy and large in size, requiring that operating personnel use both hands to make or break the electrical connection.

A primary object of this invention is an improved electric switch suitable for locations where inflammable or explosive vapors are present.

Another object is an electric switch that is compact in construction and economical to manufacture.

A further object is an electric switch wherein circuit connections can be easily and conveniently established and broken.

Other objects will become apparent upon consideration of the description of certain embodiments of this invention as illustrated by the accompanying drawings in which:

Figure 1 is a front elevation view of one embodiment provided with a double outlet receptacle for 120 volt alternating current service, the off position of the switch knob and the positions of engaged outlet plugs being indicated by broken line representation.

Figure 2 is a top plan view of the device shown in Figure 1.

Figure 3 is a sectional view taken on line 3—3 of Figure 1, indicating by broken line representation the position of an outlet plug in engagement with a receptacle, and also a second switch knob.

Figure 4 is a sectional view taken on line 4—4 of Figure 1.

Figure 5 is a sectional view taken on line 5—5 of Figure 2 showing the switch in closed circuit position.

Figure 6 is a view similar to Figure 5 except with the switch in open circuit position.

The general objects of this invention are attained by providing a completely enclosed switch

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unit having an actuating member that prevents either circuit connection or disconnection when the switch is in closed circuit position. When the actuating member is moved to open circuit position provision is made for the ready removal or connection of the output leads, it being understood that, with the circuit interrupted, the connection points will be a substantially zero potential level, whereupon no sparking can occur upon their contact or separation.

Referring to Figures 1, 2, 3, and 4, the switch mechanism here illustrated is housed within a conventional metal switch box 1 which is provided with an integral threaded conduit receiving opening 2 through which the two insulated power supply lead wires 3 and 4 are introduced. The cover plate of switch box 1 is retained in place by screws 5 which engage with mating tapped holes in the main body portion and is shown cut away to expose the connection faces of the conventional double receptacle element 6.

The receptacle and enclosed switch elements are preferably mounted upon the inside surface of the cover plate to facilitate assembly and the connection of the power supply wires in the manner hereinafter described.

The enclosed switch element 7 is a conventional mercury type tilt switch of a design similar to those shown in U. S. Patents 2,033,372 and 2,132,921. The switch comprises an outer casing electrically insulated from an interior chamber provided with two electrical inleads 3, 4, the circuit between which is opened or closed by the movement of a globule of mercury metal when the switch is tilted so that the inlead end is above the horizontal level or below the horizontal level, respectively.

Switch element 7 is mounted upon pivot plate 8 to which it may be secured by a clamp and screws as shown or in any other convenient manner. Pivot plate 8 is tapped to receive set screw 9 to which it is locked by lock nut 10 that is tightened against the plate's forward face. The opposite end of set screw 9 is threadedly engaged with a tapped hole in the switch box cover plate so that the pivot plate and screw are freely rotatable about the line defined by the axis of the set screw.

As shown in Figures 3, 5, and 6, pivot plate 8 is generally rectangular in shape except along the top edge where it is arcuately recessed to provide a cam track 8a for engagement with cam finger 11. The cam track may have various shapes as long as the cam finger is made to contact the track at all points during the switching

cycle; however, the composite of two circular arcs separated by a small semi-circular portion 8b as illustrated is entirely satisfactory for the purpose contemplated.

Cam finger 11 is pinned to shaft 12 which is journaled in holes drilled in the cover plate and the switch box. Switch knob 13 is pinned to the outer end of shaft 12 and spring washers 14 are interposed between both the knob and the cover plate, and the cam finger and the cover plate to maintain the cam finger in the plane of pivot plate 8 and at the same time provide a moderately tight assembly.

Switch knob 13 is elongated in shape with its longest radius arm disposed across the switch plate cover. The lower portion is provided with a flange 15 which is raised sufficiently to clear an electrical outlet plug in conducting engagement with receptacle 6 and is of sufficient width to prevent the disengagement of a plug from either of the receptacle faces when the knob is turned to closed circuit position. Knob 13 is provided at its lower end with a spring loaded ball plunger 16 which bears against the cover plate and exerts a counter force against the knob body so that a positive force is required to turn the knob and actuate the switch. Lugs 17 integral with the cover plate define the limits of travel of the switch knob, and the cover plate may also be provided with countersunk depressions such as indicated at 18 along the arc of travel of ball plunger 16 at these points to provide an engaging seat preventing accidental movement of the switch out of either closed or open position.

Switch shaft 12 may be made of sufficient length to accommodate a second switch knob 19 (see Figure 3) permitting operation of the switch from either side of switch box 1. This feature is particularly advantageous in installations where the switch may be mounted in an inaccessible place, such as within a laboratory hood or in a like location.

The two power lead wires 3 and 4 are connected in circuit with enclosed switch 7, one of the wires being joined to a terminal of receptacle 6 while the other wire is connected to one of the inleads of the switch. A third wire 20 connects the other terminal of the receptacle with the other inlead of the switch, so that when switch 7 is closed the contact elements of receptacle 6 will be at the potential level of the line voltage while, when switch 7 is in open circuit position, the contact elements will be at zero potential.

Switch box 1 is symmetrical in shape, making it possible to orient the box so that the conduit receiving opening 2 is disposed along either of the side or bottom edges so that the existing arrangement of outside electrical wiring may be utilized to the best advantage. With opening 2 oriented in either of the positions shown in broken line representation in Figure 1 it will be understood that other shaft holes, such as indicated at 21 in Figure 3, must be provided for the reception of the switch shaft.

In operation, switch knob 13 must be turned to such a position that flange 15 clears the faces of receptacle 6 in order to either connect or disconnect an electrical outlet plug. In this position, however, cam finger 11 is turned by shaft 12 so that pivot plate 8 and switch element 7 are rotated to open circuit position as shown in Figure 6. Under these conditions the connection points of receptacle 6 are at zero potential level and the prongs of the outlet plug will not draw a spark when moved into or out of contact therewith.

When the outlet plug has been seated in connecting relation to the receptacle, or withdrawn from the vicinity of the receptacle face, if the operation is one of disconnection, switch knob 13 may be turned in a clockwise direction, and the circuit is then closed as cam finger 11 rotates pivot plate 8 and switch element 7 to the position shown in Figure 5 where the inlead end of the switch is then disposed below the horizontal level. It will be understood that the flange 15 of the switch knob 13 will abut against an outlet plug which is either not properly seated or not completely removed from the receptacle 6 and will thereby prevent closure of the circuit until the situation is remedied. Under these conditions there can be no sparking at the connection points and no danger of initiating explosions from this source.

With the cam track shape hereinbefore described the actual switching action occurs when the end of the cam finger 11 is in contact with the small semi-circular path 8b at the point of joiner of the two arcs 8a. A relatively small angular rotation of only about 6 to 10 degrees is all that is required to effect circuit opening or closure. The balance of the switch knob 13 rotation necessary to clear the receptacle faces to such an extent that electrical connection can be established or broken provides a large margin of safety between switching action and clearing action, and it will be understood that precise horizontal placement of the switch box is unnecessary to successful operation.

While the foregoing description has been directed to the details of a switch suitable for 120 volt service, it will be understood that this invention is equally applicable to 230 volt service. In the latter case the four power lead wires are connected in pairs across each of two enclosed switch units 7 identical to the switch hereinabove described. Both switch units are mounted on a common pivot plate, the second unit being attached with screws fitted to the upper tapped holes 22 (see Figs. 5 and 6). A cover plate provided with an opening for a single four prong receptacle suitable for 230 volt service is substituted for the cover plate shown in Figure 1. With the exception of a substitution of receptacle elements and the addition of a second switch unit, all switch elements are utilized in 230 volt service in exactly the same form as has been described.

The switch of this invention utilizes conventional electrical switch boxes, receptacles and outlet plugs with the result that construction costs are lowered and all the advantages of ease in circuit connection and disconnection are retained. At the same time the dangers inherent in electric sparking during connection and disconnection operations are entirely eliminated, making it possible to employ the switch safely in hazardous locations where inflammable vapors or like materials are present.

While a precise construction in detail of a device made in accordance with this invention has been described and illustrated in the foregoing, I do not intend to be limited thereto except by the broadest interpretation of the following patent claims.

What is claimed is:

1. In an electric switch having a switch box with actuating means for preventing either circuit connection or disconnection when the switch is in closed-circuit position, a switching element positioned within said box, a receptacle element also positioned within said box in electrical cir-

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cuit with said switching element, a pivot member in said box, in spaced relation to the receptacle element, for operating said switching element, an actuating shaft rotatably mounted in spaced relation to the pivot member and carrying a switch knob positioned on said shaft outside the box, a cam means on said shaft within said box in cooperative relation with the pivot member, an elongated arm on the switch actuating shaft, and a flange on the elongated arm positioned to prevent the circuit connection or disconnection when the switch is in closed-circuit position.

2. The electric switch of claim 1 including means for maintaining the movement of the cam means in the plane of the pivot plate.

3. In an electric switch having a switch box with actuating means for preventing either circuit connection or disconnection when the switch is in closed-circuit position, a mercury switching element positioned within said box, a receptacle element also positioned within said box in electrical circuit with said switching element, a pivot plate mounted in said box, in spaced relation to the receptacle element, and supporting said mercury switching element, a cam track on the pivot plate, a shaft rotatably mounted in spaced relation to the pivot plate, a cam finger mounted on said shaft in cooperative relation with said track, an elongated arm on said actuating means, and a flange on the elongated arm operating to prevent connection or disconnection when the switching element is in closed-circuit position.

4. In an electric switch having a switch box with actuating means outside the box for preventing either circuit connection or disconnection when the switch is in closed-circuit, a mercury switching element positioned within said box,

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a receptacle element also positioned within said box in electrical circuit with said switching element, a pivotally mounted plate positioned within said box and having an arcuately recessed cam track comprising two circular arcs separated by a small semi-circular portion, a switch operating shaft journaled in the walls of the switch box and in spaced relation to the pivot plate, a cam finger mounted on said shaft within the box in cooperative relation with said cam track for making and breaking electric contact, an actuating member mounted on said shaft outside the box and having an elongated arm disposed across the switch-box cover, and a flange carried by the elongated arm and extending partially across the receptacle face to prevent either engagement with or disengagement from the receptacle face when the actuating member is turned to closed-circuit position.

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