

Sept. 8, 1942.

E. FRANCK

2,295,499

SWITCH RECEPTACLE

Filed March 10, 1941

2 Sheets-Sheet 1

Fig. 1

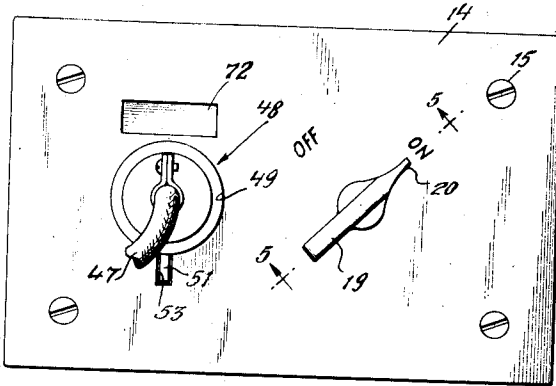


Fig. 2

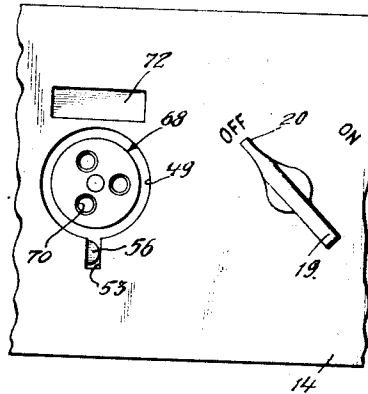


Fig. 3

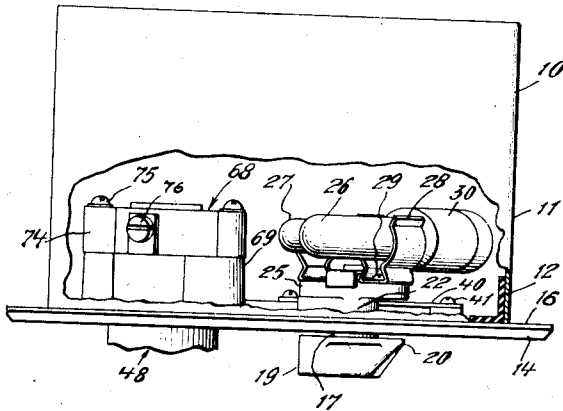


Fig. 6

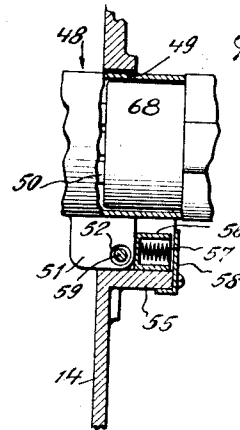


Fig. 5

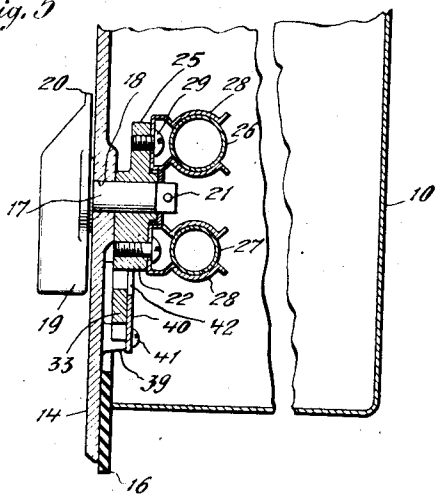
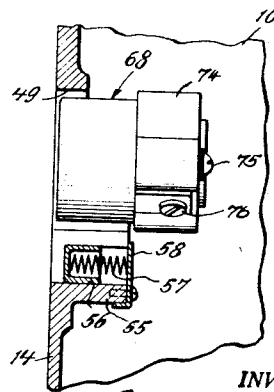


Fig. 7



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Fig. 4

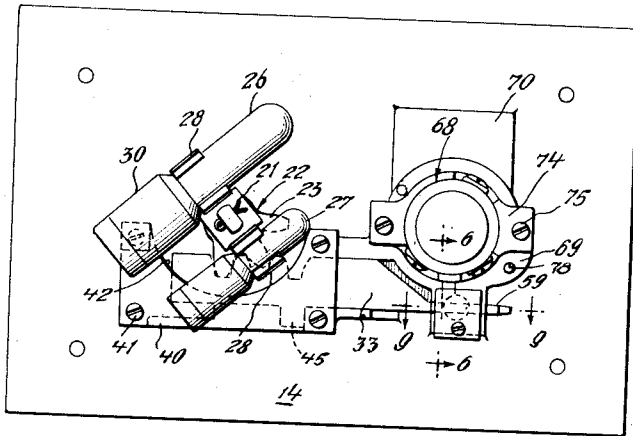


Fig. 9

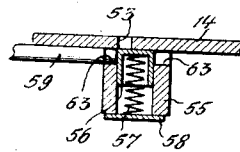


Fig. 8

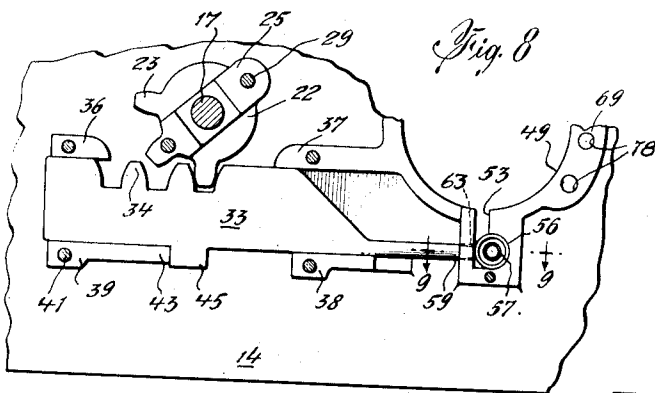


Fig. 10

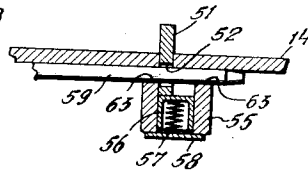


Fig. 13

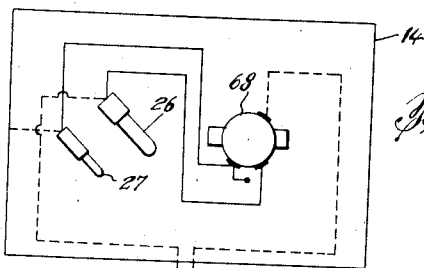


Fig. 11

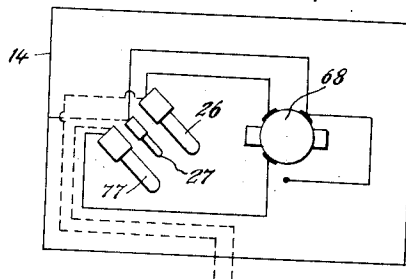
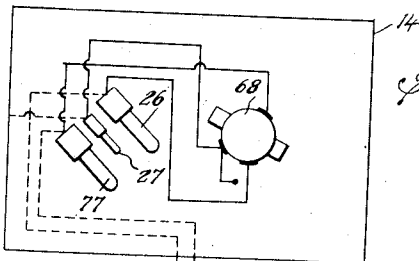


Fig. 12



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UNITED STATES PATENT OFFICE

2,295,499

SWITCH RECEPTACLE

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Application March 10, 1941, Serial No. 382,614

12 Claims. (Cl. 171-37)

This invention relates to new and useful improvements in switch receptacles for removable terminal plugs, and relates more particularly to a combined switch and receptacle having means for preventing arcs due to opening of the circuit by manipulation of the switch having exposed breaking points or removing the terminal plug.

It is known that the opening of a circuit by the operation of the usual switch produces an arc and the arc so formed will ignite any inflammable gases that may be present. In mines, hospital operating rooms, anesthesia rooms, chemical laboratories engaged in certain types of research, certain industries such as powder factories, and the like, it is necessary to provide means for either preventing the arc when the circuit is opened, or confining the resulting explosion in such a manner as to prevent damage. Most devices for this purpose are designed to accomplish the latter result, and usually include a housing for the operative parts of sufficient strength to confine the explosion to the area enclosed by the housing.

It is one of the principal objects of the present invention to provide a device of this general character which will positively prevent the occurrence of an arc under any conditions whatsoever, and will further prevent the formation of a spark due to the discharge of static electricity from the human body when the operator turns the switch from "off" to "on" position. To this end the device includes a circuit which is separate from, and independent of, the main circuit and which connects the metallic switch handle with the ground when the main circuit is closed, said auxiliary circuit having a separate switch which is open when the main circuit is open. Thus, if a charge of static electricity is present in the body of the operator when he grasps the switch handle, no spark occurs since the handle is not grounded. As he turns the handle, however, the ground circuit becomes closed, thus safely discharging the static charge.

A further object of the invention is the provision of an improved switch receptacle of the type described wherein no switch having breaking points exposed to the air is provided, thus preventing the possibility of an arc under any conditions whatsoever.

Another object of the present invention is to provide novel and effective interlocking means associated with the switch lever for preventing the withdrawal of the removable terminal plug while the switch is in "on" position, such means likewise preventing actuation of the switch from

"off" to "on" position unless the terminal plug is positioned in the receptacle.

Still another object of the invention is to provide a novel arrangement for mounting one or a plurality of mercury switches in a device of the character described and improved means for actuating such switches.

In the drawings:

Fig. 1 is a front elevation of the preferred embodiment of the present invention, the view showing the manually actuated switch in "on" position, and showing the removable terminal plug in inserted position.

Fig. 2 is a broken front elevation similar to Fig. 1, but shows the plug removed and switch in "off" position.

Fig. 3 is a top plan view of the structure shown in Fig. 1, a portion of the housing being broken away to show certain internal parts.

Fig. 4 is a rear elevation of the preferred embodiment of the invention with the housing removed, such view showing the rear of the face plate and the several operative portions of the device mounted thereon.

Fig. 5 is a broken transverse vertical section taken on line 5-5 of Fig. 1.

Fig. 6 is a broken vertical section taken on line 6-6 of Fig. 4, the view showing the plug in position within the casing.

Fig. 7 is similar to Fig. 6, but shows the position of the parts when the plug is removed.

Fig. 8 is an enlarged detail view of certain of the operative parts of the device.

Fig. 9 is a broken horizontal section taken on line 9-9 of Fig. 4, the view showing the longitudinally movable bolt in retracted position.

Fig. 10 is similar to Fig. 9, but shows the bolt in extended position.

Fig. 11 shows the preferred electrical circuit employed in connection with the device.

Figs. 12 and 13 show alternate circuits.

The operative parts of the device, with the exception of the switch handle, are positioned within a substantially rectangular housing 10 formed preferably of sheet metal. This housing is adapted to be inserted within a suitable recess in a wall or the like, and to be secured therein with the front or open portion of the housing substantially flush with such wall. Each end wall of the housing is provided with an angle bracket 12 formed of suitable insulating material, as shown in Fig. 3, and the open front of the housing is closed by means of a removable face plate 14, such face plate being larger than the open front of the housing. The face plate is secured to the

housing by means of screws 15 which pass through suitable apertures (not shown) in the insulating angle brackets 12. A strip of insulating material 16 is further positioned between the housing and the face plate to effectively insulate the face plate from the housing, for a reason to be hereinafter set forth.

The face plate 14 is desirably cast from metal and supports the several operative elements of the device. One of these elements is the switch mechanism comprising a rotatable shaft 17, which is suitably journaled within an aperture 18 formed in a thickened portion of the face plate 14, the shaft carrying externally of the plate an elongated, manually actuated switch lever or handle 19 having a pointer portion 20 at its upper end. Rotation of the switch is limited to an arc of approximately 90°, and when turned to its maximum clockwise position, as shown in Fig. 1, the pointer portion 20 is positioned adjacent to the word "on," printed or otherwise inscribed on the exterior of the face plate. When the switch is turned to its maximum counter-clockwise position, as shown in Fig. 2, the pointer is adjacent to the word "off."

A segmental gear structure 22, having a plurality of gear teeth 23, is carried at the inner end of shaft 17 and is keyed thereto. A switch supporting block 25 is preferably formed integrally with the gear 22, the gear and the block being secured to the shaft by means of a pin 21 or otherwise. One or more elongated mercury switches 26 and 27 are secured to switch block 25 by means of spring clips 28, the clips being secured to the block by means of screws 29. No details of the construction of the mercury switches are shown herein, since such switches are well known in the art and usually are formed with an enlarged portion 30 at one end thereof which houses appropriate spaced contact members. Thus, when this enlarged end portion occupies a position substantially lower than the opposite end of the tube, the mercury (not shown) contained therein moves into this enlarged end portion, thus closing the circuit. When, however, the tubular switch is turned on its central pivotal support and such larger end is positioned upwardly, the mercury flows away from the contacts to the now lower end of the elongated tube.

Switch block 25 is so positioned relative to shaft 17 that when switch handle 19 is in "on" position, the enlarged end portions of tubes 26 and 27 are downwardly, as shown in Fig. 4. An elongated rack member 33 is formed with a plurality of teeth 34 which are engaged by teeth 23 of segmental gear 22. This rack is supported for longitudinal movement by means of a plurality of guide members 36, 37, 38 and 39 which are formed integrally with the rear surface of face plate 14. The rack is held in substantial meeting engagement with the rear surface of plate 14 by means of a removable plate 40 secured to the guide members 36 to 39 by means of screws 41. The upper edge of plate 40 is formed with a semi-circular cut-away portion 42 to form a clearance for teeth 23 of gear 22.

Substantially midway between the terminals of the main body portion of rack member 33, a projection 45 is formed on its lower surface, and when lever 19 is moved to "off" position, as shown in Fig. 8, such projection engages an extension 43 of guide portion 39, thus limiting the movement to the left of rack member 33 when viewed as in Figs. 4 and 8. When, however,

switch lever 19 is moved to "on" position, as shown in Fig. 4, projection 45 engages guide portion 38, thus limiting its movement to the right. Guide members 37 and 33 are elongated, thus supporting rack member 33 in either right or left position, as shown in Figs. 4 and 8, respectively.

A removable terminal plug 43 carrying conductor 47 is received within a suitable aperture 49 in face plate 14. This plug carries two or more contact pins 50, and the sleeve or cylindrical housing enclosing such plug is provided on its lower edge with a radically disposed lug or key 51 having an aperture 52 therein, such key being received within a substantially rectangular aperture 53 connecting with circular aperture 49. Immediately to the rear of aperture 53 a substantially square housing 55 is formed integrally with the rear surface of face plate 14. Within such housing a substantially cylindrical stop member 56, having an outer end wall, is positioned and is movable perpendicularly to the plate. Stop member 56 is urged outwardly by means of a coil compression spring 57 which engages the closed end wall at one end of the member, the opposite end of the spring being engaged by a removable plate 58.

As long as terminal plug 43 carrying key or lug 51 is out of engagement with the receptacle, stop member 56 is in engagement with the rear surface of plate 14, as shown in Figs. 7 and 9. Aligned apertures 63 are formed in opposed vertical side walls of housing 55, and an elongated extension 59 of rack member 33 forms a locking bar, such locking bar being positioned within one of apertures 63 at all times. When stop member 56 is in engagement with rear surface of face plate 14, the forward end of locking bar 59 engages such stop member, which latter prevents its entrance into the housing, and as a result, prevents any movement whatsoever of rack member 33 or of switch operating shaft 17. When, however, removable terminal plug 43 is moved into the position shown in Fig. 6, key 51 moving through aperture 53 in face plate 14 causes stop member 56 to move rearwardly until it is in engagement with plate 58.

In this position, aperture 52 in key 51 is in alignment with apertures 63, and accordingly locking bar 59 may be moved to the position shown in Fig. 10, it occupying this position when switch handle 19 has been moved to "on" position. It will thus be apparent that so long as the switch handle is in "on" position, terminal plug 43 and its key 51 cannot be removed from the receptacle. A fixed receptacle 68 is mounted on a plurality of spaced posts 69 which are formed integrally with face plate 14. Receptacle 68 is formed with three female terminals 70 in the embodiment shown, which receive contact pins 50 in terminal plug 43. Receptacle 68 includes a block 74 formed of insulating material which is positioned concentrically of aperture 49, such block being secured to posts 69 by means of screws 75. This receptacle also includes appropriate connections (not shown) between female terminals 70 and terminals 76 carried on block 74, conductors (not shown) being secured to such terminals 76. If desired, a suitable recess 72 may be formed in the front of face plate 14 to receive a card indicating the voltage of the switch, or other data. Posts 69 have a plurality of threaded apertures 78 into which screws 75 pass. Thus, in many instances, a plurality of the switch receptacles may be mounted in side-by-side relation-

ship, and it is desirable that the particular terminal plug be received in the proper receptacle. This is particularly important in case both A. C. and D. C. are employed. Accordingly, the receptacle may be rotated to use any desired set of apertures 78 for screws 75, and thus it can be arranged so that a terminal plug may be received only in the proper receptacle.

The circuit shown in Fig. 11 is preferred, although either the one shown in Fig. 12 or in Fig. 13 may be employed, both of the latter circuits including two mercury switches in the main circuit.

In the circuit shown in Fig. 11, the metallic face plate 14 which carries the manual switch lever (not shown), which, of course, is formed of metallic material, is connected with switch 27. The portions of the circuit shown in full lines indicate the wiring circuit formed in the instrument at the time of manufacture thereof, whereas the portions shown in dotted lines represent the additional wiring when the device is installed. Switches 26 and 27 in Fig. 11 are shown in open position, and, in this instance, the circuit-connecting plate 14 and the metallic switch lever with ground is open. Likewise, the main circuit including switch 26 is open. When the switches are simultaneously reversed, the auxiliary ground circuit is closed, and the main circuit is closed at the same time. The circuit shown in Fig. 12 is similar to that shown in Fig. 11, except that one leg of the main circuit includes switch 25, and another leg includes switch 77. In the event that two receptacles, one for A. C. and one for D. C. are placed side by side, one receptacle may be wired, as shown in Fig. 12, and the other as shown in Fig. 13, which is identical with Fig. 12 except that member 74 has been rotated from the position shown in Fig. 4 to the position it would occupy if screw 75 were placed in aperture 78. Accordingly, a D. C. plug would not fit in the A. C. receptacle, and vice versa.

It will be apparent that many changes and modifications may be made in the foregoing embodiment without departing from the spirit of the invention. The housing 10 illustrated herein is adapted for mounting within a recess in the wall, although a housing suitable for surface mounting may also be employed. If this housing is made of insulating material the bracket 12 may be made of metal, and in any case it may be made of metal with insulation interposed between housing and bracket. The number of switches is a matter of choice, it being preferred to provide at least one or more in the main circuit, and one in the auxiliary or ground circuit.

What I claim is:

1. In a switch receptacle, the combination of a rotatable shaft, a switch block and a switch handle keyed thereto, a plurality of tubular switches formed with enclosed contacts and carried by the block, a terminal plug, a receptacle therefor, interlocking means associated with the switch block for preventing withdrawal of the plug from the receptacle while the switch is in "on" position and preventing movement of the switch to "on" position when the plug is withdrawn, and an auxiliary circuit for connecting the switch handle with ground when the switch is moved to "on" position and comprising a ground connection, one of the switches, and the switch handle.

2. In a switch receptacle, the combination of a switch handle and a mercury switch, a terminal plug, a receptacle therefor, interlocking means

associated with the switch for preventing withdrawal of the plug from the receptacle while the switch is in "on" position and preventing movement of the switch to "on" position when the plug is withdrawn, and an auxiliary circuit for connecting the switch with ground when the switch is moved to "on" position.

3. In a switch receptacle, the combination of a rotatable shaft, a switch block and a switch handle keyed thereto, a plurality of tubular switches formed with enclosed contacts and carried by the block, a terminal plug, a receptacle therefor, interlocking means associated with the switch block for preventing withdrawal of the plug from the receptacle while the switch is in "on" position and preventing movement of the switch to "on" position when the plug is withdrawn, said means comprising a key carried by the plug and having an aperture therein, the receptacle having a complementary recess for receiving said key, a locking bar movable by actuation of the switch handle, stop means for preventing movement of the bar and of the switch handle when the plug is withdrawn, the key retracting said stop means to permit the bar to enter the aperture in the key and thus lock the plug against movement, and an auxiliary circuit for connecting the switch handle with ground when the switch is moved to "on" position and comprising a ground connection, one of the switches, and the switch handle.

4. In a switch receptacle, the combination of a rotatable shaft, a switch block and a switch handle keyed thereto, a plurality of mercury switches carried by the block, a terminal plug, a receptacle therefor, interlocking means associated with the switch block for preventing withdrawal of the plug from the receptacle while the switch is in "on" position and preventing movement of the switch to "on" position when the plug is withdrawn, said means comprising an element movable by actuation of the switch handle to engage a portion of the plug when the switch is moved to "on" position, and means for preventing movement of the element when the plug is withdrawn, and an auxiliary circuit comprising a ground connection, one of the switches, and the switch handle, adapted to connect the latter with ground when the switch is moved to "on" position.

5. In a switch receptacle, the combination of a housing, a face plate mounted thereon and insulated therefrom, a rotatable shaft journaled in the face plate, a switch support and a switch handle secured thereto, a plurality of mercury switches carried by the support, a removable terminal plug, a receptacle therefor, interlocking means associated with the switch support for preventing withdrawal of the plug from the receptacle while the switch is in "on" position and preventing movement of the switch to "on" position when the plug is withdrawn, and an auxiliary circuit for connecting the switch handle and the face plate with ground when the switch is moved to "on" position.

6. A combined switch and plug terminal receptacle comprising a housing, a shaft journaled in one of the walls of the housing, a switch handle carried at one end of the shaft and a switch block carried at the other end thereof, a plurality of enclosed, tubular mercury switches carried by the block, a receptacle having a plurality of female terminals for receiving the contact pins of a removable terminal plug, a gear carried by the switch block, a rack bar engaged

by said gear, a locking bar adapted to engage a portion of the removable plug when the switch is in "on" position, and prevent removal of the plug when the switch is in such position, and means for restraining movement of the switch when the plug is removed, comprising a stop member preventing movement of the locking bar, such member being retracted when the plug is inserted within the receptacle, a main circuit including one of the switches, and an auxiliary circuit including a second switch, the switch handle and a ground connection.

7. A combined switch and plug terminal receptacle comprising a rotatable switch block, a plurality of mercury switches carried thereby, an operating handle for the switch block, a terminal plug, a receptacle for receiving the plug, an apertured key associated with the plug, a locking bar operatively connected with the switch block and adapted to move into the apertured lug when the switch is in "on" position to prevent removal of the plug, means for preventing movement of the bar and of the switch to "on" position when the plug is withdrawn from the terminal, comprising a spring pressed member which is retractable when engaged by the key, a main circuit including one of the mercury switches, an auxiliary circuit including a second mercury switch, the switch handle and a ground connection.

8. A switch receptacle comprising a plurality of switches provided with enclosed contact members, a switch handle for simultaneously actuating said switches, a terminal plug, a receptacle therefor, an apertured key associated with the terminal plug, a yieldable stop member adapted to be moved when the plug is in the receptacle, a locking bar movable by actuation of the switch, such stop member restraining movement of the locking bar when the plug is withdrawn, the locking bar passing into the aperture in the key

when the switch is actuated, thus preventing withdrawal of the plug.

9. In a switch receptacle, the combination of a plurality of circuit making and breaking elements formed with enclosed contacts, a rotatable support for said elements, handle means for manually actuating said switches, a main circuit including one of said elements, and an auxiliary circuit including the other of said elements, the handle means, and a ground connection, whereby the auxiliary circuit is open when the elements are in circuit breaking position, said circuit becoming closed when the handle means are actuated, thus grounding the operator who manually actuates the switch.

10. In a switch receptacle, the combination of a housing, manually actuated means disposed externally of the housing, comprising a handle element for opening and closing a circuit, and means for grounding the handle element as said circuit is closed, said means comprising an auxiliary circuit including the handle element, a switch actuated by the handle element, and a ground connection.

11. In a switch receptacle having a housing, a main circuit including a switch, and manual means disposed externally of the housing for actuating the switch, and an auxiliary circuit for connecting the manual means with ground and including an auxiliary switch also actuated by the manual means for closing such circuit when the main circuit is closed.

12. A switch receptacle comprising a plurality of mercury switches, a support therefor, manual means for actuating the switch for closing a main circuit including one of the switches, and an auxiliary circuit including another of said switches for connecting the manual means with ground when the main circuit is closed.

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