May 17, 1949. L. JACOBS 2,470,701

SAFETY SWITCH

Filed Aug. 29, 1947

2 Sheets-Sheet 1

Fig. 1

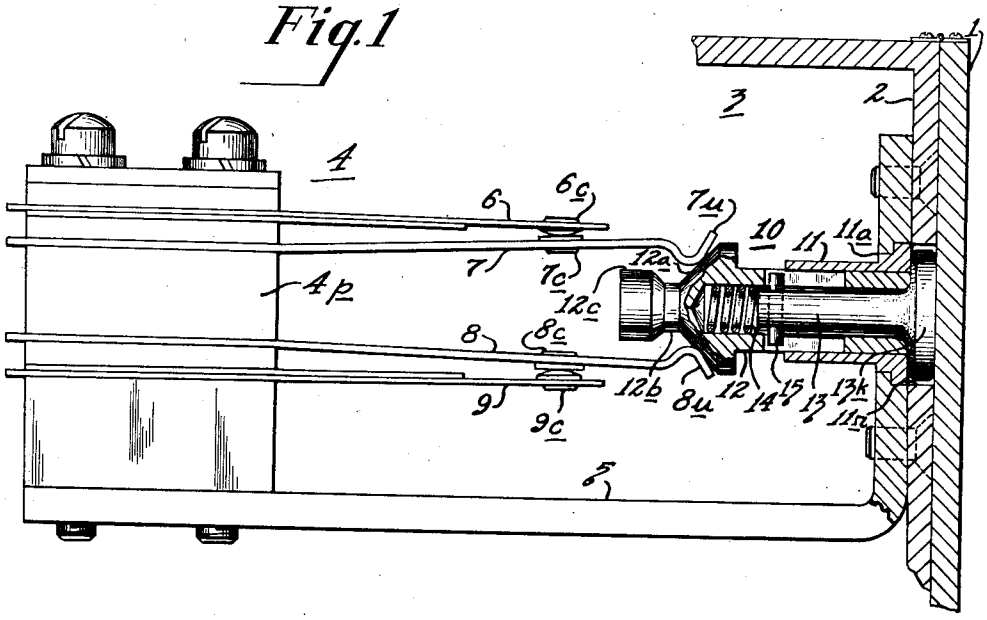
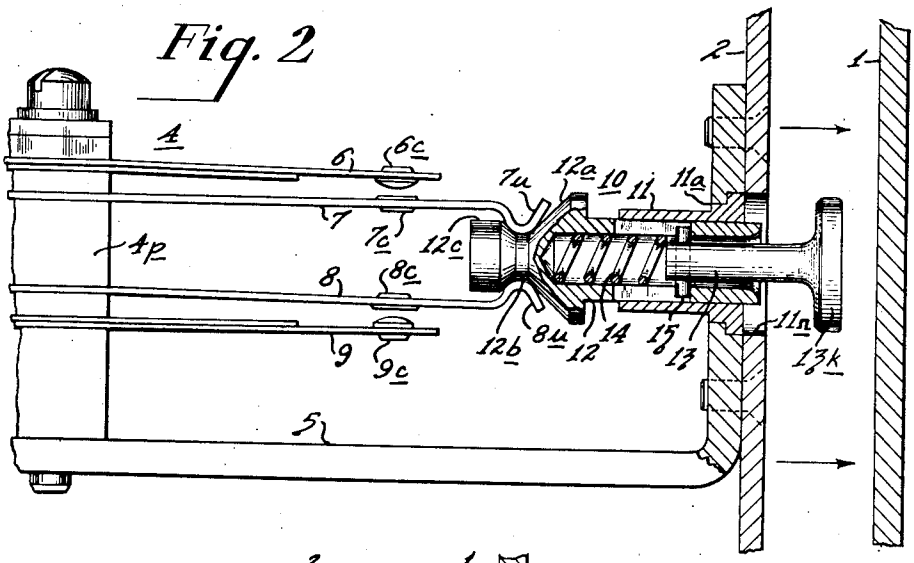


Fig. 2



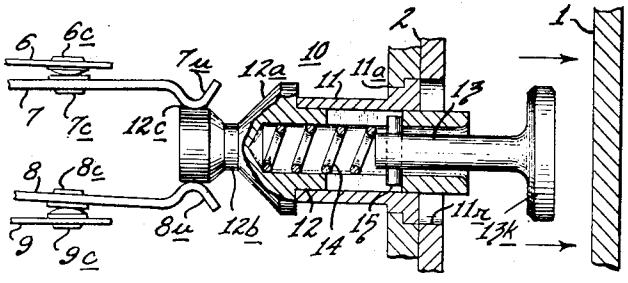


Fig. 3

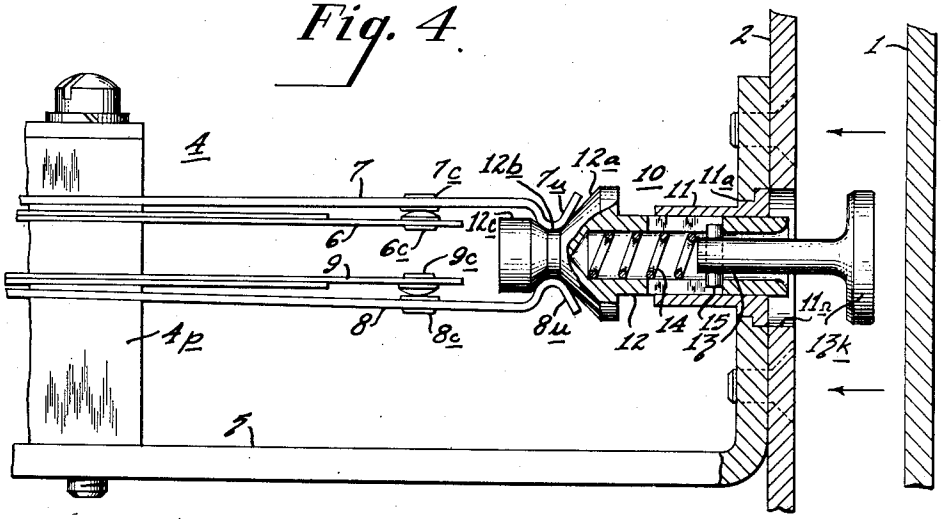
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Fig. 4.



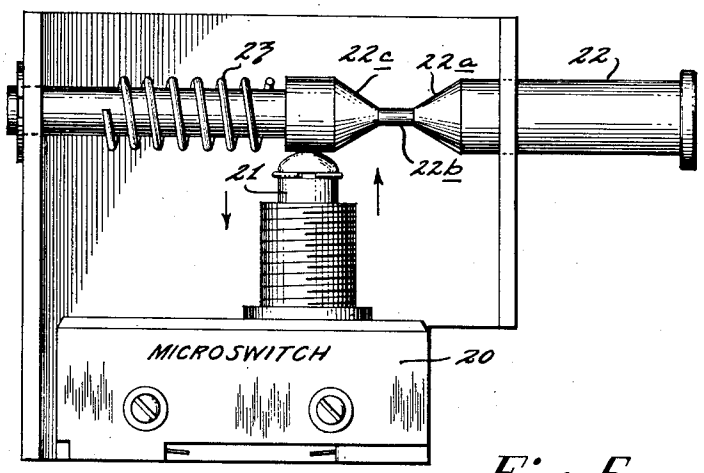


Fig. 5

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SAFETY SWITCH

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2 Claims. (Cl. 200—54)

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This invention relates to safety systems and devices for electrical apparatus.

In radio-transmitters and other high voltage installations it is standard practice to employ a door-actuated switch for preventing access to the interior of the high-voltage compartment so long as the power is on. In certain installations, wherein servicing must be accomplished with the utmost dispatch, it is often desirable to operate the equipment, e. g. for test purposes, while the door of the high voltage compartment is open. In the usual installation the door switch must be "jambed" in one way or another before the power can be turned on. One trouble with this procedure is that the service man may forget to remove the "jamb" and the switch will fail to operate in its intended manner.

Accordingly, the principal object of the present invention is to obviate the foregoing objections to conventional safety systems and to provide an improved switch installation which may be "set" while the door is open and automatically "re-set," from either its closed or its open position, upon closing the door.

Another and important object of the invention is to provide an inexpensive and trouble-free, door-switch and one capable of being re-set from either of two positions to its third position by a simple linear movement.

The invention will be described in connection with the accompanying drawings, wherein:

Fig. 1 is a side elevational view, partly in section of a safety system including a three-position door switch constructed in accordance with the invention, the door and the switch being closed.

Fig. 2 is a similar view, with the door open and the switch contacts open.

Fig. 3 is a view similar to Fig. 2, with the door open, but with the switch moved to a third position whereat its contacts are closed.

Fig. 4 is a side elevational view, partly in section for installation similar to the one shown in Figs. 1–3 but wherein the switch contacts are biased to open when the door is opened and,

Fig. 5 is a side elevational view, partly in section, showing the invention as applied to an installation employing a conventional micro-switch.

In the embodiment of the invention shown in Figs. 1, 2 and 3, 1 designates the door, or hinged lid and 2 the front panel of a compartment 3 which may contain, in addition to a switch 4, the high voltage apparatus (not shown) which the switch is designed to control. The switch 4 is shown mounted within the compartment upon a

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chassis or shelf 5 which extends rearwardly from the front panel 2. In the instant case the switch comprises two sets of parallelly arranged switch arms 6—7, 8—9, which are constituted of spring metal and are supported adjacent to their inner ends upon an insulating pedestal 4p. Each arm is provided with a switch contact 6c, 7c, 8c, 9c respectively, in register with the contact with which it is paired. Since all of the switch arms 6—9 are constituted of spring material and each arm is mounted in spaced relation with respect to the particular arm with which it is paired, it will be apparent that all of the contacts 6c—9c are normally biased to their open position (shown in Fig. 2) by the spring action of their said supporting arms. One arm of each pair (in this case the "inner" arms 7 and 8) extends beyond the free end of the other arm and the free ends of these longer arms terminate in a preferably outwardly inclined U-shaped section 7u, 8u, to which a force may be applied in a direction calculated to close the contacts 6c—7c, 8c—9c against the biasing force of the resilient material of which the switch arms 6—9 are formed.

The force required to close the switch contacts 6c—7c etc. against the bias of the switch arms 6, 7 etc., is supplied by closing the door and is applied to the U-shape terminals 7u and 8u of the arms 7 and 8 through a plunger mechanism, indicated generally at 10, which extends through a bushing 11 surrounding an aperture 11a in the shelf 5 and panel 2. The plunger mechanism itself comprises a hollow insulating sleeve 12 which has a sliding fit in the bearing 11 and an inner rod-like member 13 which has a similar fit in the bore of the sleeve 12. The outer end of the rod 13 terminates in knob 13k which is biased outwardly to bear against the door 2, when the door is closed, by a coil spring 14 which is seated within the sleeve 12. A pin 15 limits the extent of the outward movement of the rod 13 within the sleeve 12. When the door 1 is closed the knob 13k is received in a counter-bore 11r in the front panel so that the outer plane surface of the knob 13k lies flush with the inner surface of the door. The sleeve 12 of the plunger mechanism is provided adjacent to its inner end with an outwardly inclined surface 12a against which the bent ends 7u, 8u, of the spring arms 7 and 8 of the switch are adapted to bear, when the door is closed. The said arms 7 and 8 thus exert an outwardly directed axial force on the sleeve 12 in a direction opposite to the holding force exerted thereon by the door when it is closed. Thus, when the door is opened the energy stored

in the resilient arms 7 and 8 is translated by the inclined surface 12*a* of the sleeve into an outwardly directed axial force which causes the sleeve 12 to move to the right a limited distance sufficient to break the engagement between the contacts 6*c*—7*c* and 8*c*—9*c*. With the door opened the energy of the coil spring 14 within the sleeve 12 is also released and serves to move the knob 13*k* out of its recess 11*r* to a position (shown in Fig. 2) whereat it may be grasped for the purpose of re-setting the contacts while the door is open.

The novel form of the inner end of the sleeve 12 of the plunger permits the switch contacts 6*c*—7*c* etc. to be closed and maintained in the closed position while the door is open. This terminal section of the sleeve comprises, in addition to the inclined surface 12*a*, a riser 12*c* on the end of the sleeve and a "dwell" or cut-away portion 12*b* intermediate the riser 12*c* and the inclined surface 12*a*. As shown in Fig. 2 the diameter of the dwell 12*b* is sufficiently small to permit the contacts 6*c*, 7*c* etc. to stay open so long as the bent-ends 7*u*, 8*u* of the switch arms 7 and 8 remain therein, whereas the diameter of the end portion 12*c* adjacent to the dwell is sufficiently large to close the said contacts when the sleeve is pulled out of the position, shown in Fig. 3, whereat the bent ends 7*u*, 8*u* of the switch arms rest thereon.

The switch is automatically re-set from either of its above described "open" or "closed" positions since in moving the door to its closed position, the knob 13*k* is urged inwardly against the force of the coil spring 14 until the said knob abuts the sleeve 12 which is then moved inwardly until, when the door is tightly closed, the ends of the switch arms 7*u* and 8*u* come to rest upon the inclined surface 12*a* of the sleeve.

In certain installations (e. g. in dark enclosures wherein the door switch operates to turn on a light when the door is opened, and wherein it may be desired to turn-off the light while the door is open) the switch arms may be arranged to open when the plunger is "in" and to close when the plunger is partway out. One way of achieving this in a switch of the general character shown in Figs. 1 to 3 is to reverse the position of the shorter arms 6 and 9 so that, as shown in Fig. 4, the contacts 6*c*, 7*c* etc. are normally biased to their closed position.

In the door-actuated switch installation shown in Fig. 5, the switch, which is here designated 20, comprises a conventional micro-switch wherein the actuating arm 21 is normally biased to its extended position. Here the door actuated plunger of the invention comprises simply a solid metal rod 22 mounted for slideable movement along an axis normal to the axis of movement of the arm 21 and having an intermediate portion or dwell 22*b* of reduced diameter in which the said arm is adapted to be accommodated when the door is opened. In the instant case, the energy required to move the plunger to a position whereat the dwell 12*b* is in register with the switch arm 21 is provided by a coil spring 23 about the inner end of the plunger. This spring 23 is under compression when the door is closed but is not rigidly affixed to the plunger and hence does not prevent the plunger from being pulled out, when the door is open, to a position whereat the switch arm is in its illustrated closed position.

It will now be apparent that the present invention provides an improved door-actuated safety system and switch and one wherein the switch may be "set" while the door is open and automatically "re-set" from either its closed or its open position upon closing the door.

What is claimed is:

1. In apparatus of the character described, a switch having an actuating arm, a plunger mounted for axial movement along a line which intersects the line of movement of said arm, said plunger having an intermediate dwell-portion of reduced diameter, equal diameter end portions, and switch positions corresponding to said portions, said arm being biased into contact with said plunger, and a coil spring associated with said plunger biasing said plunger from one of said end positions to said intermediate position, said spring being inoperative when said plunger is in its other end position.

2. In apparatus of the character described, a plunger mounted for axial movement, said plunger having an intermediate dwell portion of a diameter less than either of its end portions and having three switch positions corresponding to said portions, a switch having an actuating arm mounted in register with said dwell portion when said plunger is in its intermediate position, said arm being biased into continual contact with said plunger, and resilient means associated with said plunger biasing said plunger to its intermediate position when said plunger is moved in one direction from its intermediate position, said biasing means being inoperative when said plunger is moved in the opposite direction from its intermediate position.

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