

May 20, 1947.

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2,420,768

ELECTRIC SWITCH

Filed Jan. 12, 1945

3 Sheets-Sheet 1

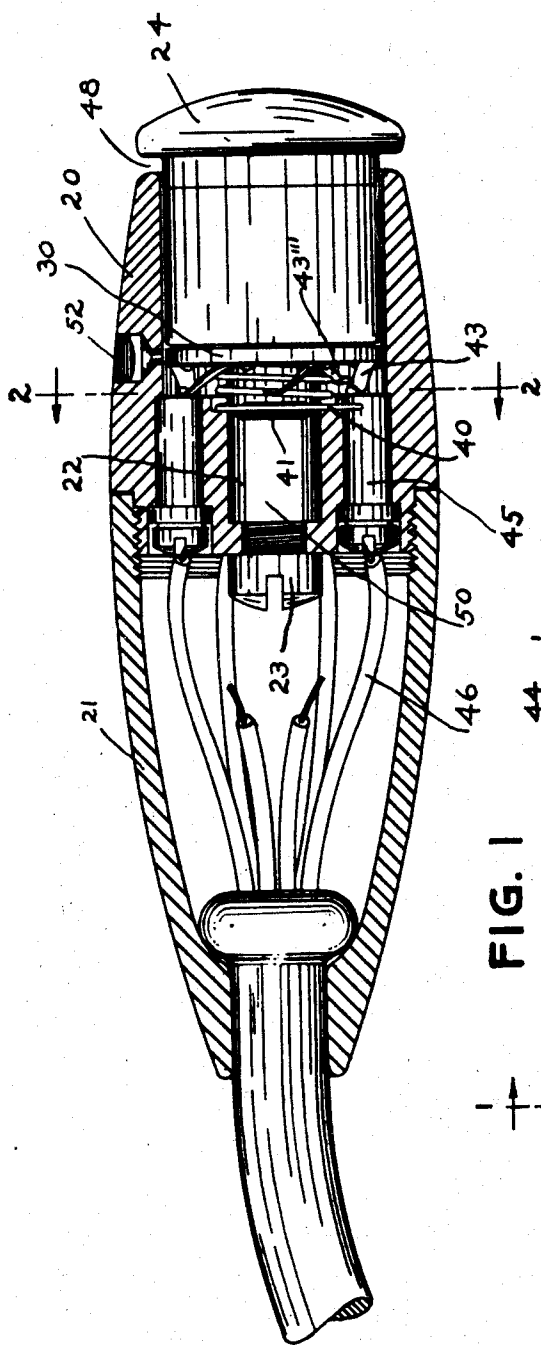


FIG. 1

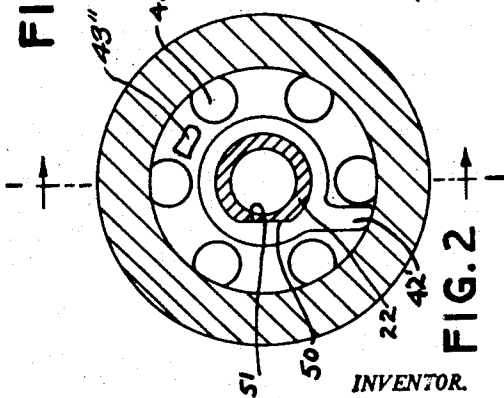


FIG. 2

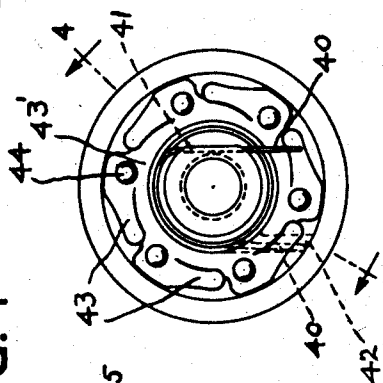


FIG. 3

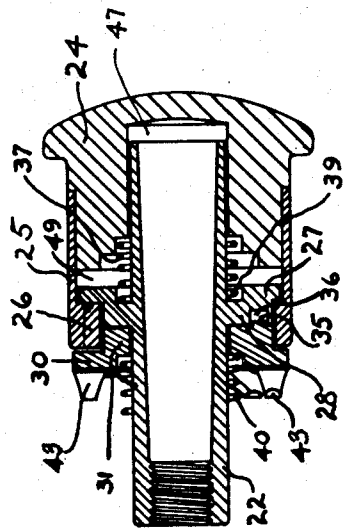


FIG. 4

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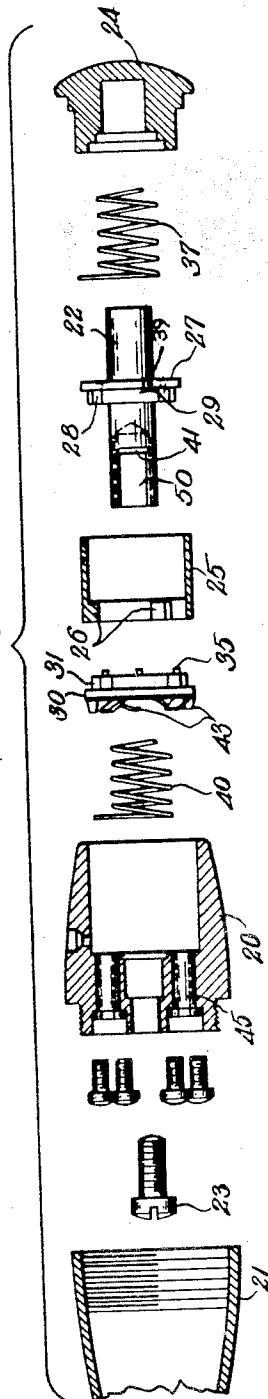
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3 Sheets-Sheet 3

Fig. 19



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UNITED STATES PATENT OFFICE

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ELECTRIC SWITCH

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6 Claims. (Cl. 200—4)

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The primary object of the present invention is the production of an especially simple and very compact, shock-resistant switch which may be manufactured economically and operated efficiently, notwithstanding any hard usage to which it may be subjected.

Other objects of the invention will appear from the detailed description of the particular embodiment thereof selected to illustrate the principle underlying the same.

The invention consists of the various parts and combinations of parts hereinafter more fully described and defined by the appended claims.

In the accompanying drawings:

Figure 1 is a central longitudinal section taken on the line 1—1 of Fig. 2 of a switch embodying my invention, certain parts being shown in elevation.

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

Fig. 3 is an elevation of the left-hand end of the switch mechanism shown in Fig. 4.

Fig. 4 is a longitudinal section taken on the irregular line 4—4 of Fig. 3.

Fig. 5 is an elevation of the left-hand end of the push button hereinafter described.

Fig. 6 is an elevation of the left-hand end of the sleeve enclosing a portion of said push button and forming a part of the plunger means hereinafter described.

Fig. 7 is a perspective view of the inertia wheel engaging the lock shaft or spindle means.

Figs. 8, 9, and 10, are, respectively, an elevation of the left-hand end of the spindle means, a side view of said spindle means, and an elevation of the right-hand end of said spindle means.

Figs. 11, 12, and 13, are, respectively, an elevation of the left-hand end of the inertia wheel, a side elevation of the same, and an elevation of the right-hand end of said wheel.

Fig. 14 is a side view of my improved switch partly cut away to show the incorporation therein of telephonic apparatus.

Fig. 15 is a similar view showing the incorporation in said switch of an electric light bulb.

Figs. 5-15 are drawn on a smaller scale than Figs. 1-4. Figs. 16, 17, and 18 are explanatory diagrams.

Fig. 19 is an exploded view showing the relation of the several parts making up the switch illustrated in Fig. 1.

In the particular drawings selected for more fully illustrating my invention and the principle underlying the same, such drawings being illustrative, merely, and not restrictive, 20 is a hous-

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ing of insulating material for enclosing the switch mechanism, and 21 is a closure for the same suitably attached thereto and housing the various wires that are connected to the stationary switch contact members.

Enclosed within the housing is a stationary spindle 22 rigidly secured in the bottom portion of the housing in any suitable manner, as by the screw 23. Mounted on said spindle for rotational and axial movement, is a plunger means comprising, in the present instance, a push button 24, the forward portion of which is enclosed within a sleeve 25, the forward end of said sleeve being provided with a plurality of internally projecting and uniformly spaced stop members 26, herein shown as three in number (Fig. 6). The spindle is provided intermediate its ends with two discs 27, 28, one or both of which may be integral with the spindle or separate therefrom and suitably secured thereto. The rearward face of the stop members 26 of the sleeve about the forward face of the disc 27 and thereby limit the outward movement of the plunger means. The disc 28 is provided with one or more stop members 29 extending outwardly, and herein shown as three in number (Fig. 8). The spindle 22, with the discs 27, 28, rigidly secured thereto or else integral therewith, is hereinafter called the spindle means.

Also mounted for rotational and axial movement on the spindle means rearwardly of the disc 28, is an inertia wheel comprising two discs 30, 31, of unequal diameter. The forward face of the disc 30 is disposed for co-operation with the stop members 26 of the plunger means and when the switch is in circuit opening position, there is a small gap between said disc and said stop member. The disc 31 is provided with outwardly projecting teeth 32 (Fig. 13) having substantially the same shape as the stop members 29 of the spindle means.

In normal or circuit opening position, the stop members 29 and the teeth 32 are in alignment, as are also the arcuate grooves or spaces 33, 34, between the stop members 29 and the teeth 32, respectively (Fig. 7). In circuit opening position, the stop members 26 of the plunger means are in engagement with the respective stop members 29 carried by the spindle means and, as indicated in Fig. 8, the plunger means may be rotated axially through an arc equal to approximately one-half the arc lying between each pair of stop members 29, i. e., the arc 33'-34'.

In circuit opening position, the teeth 32 are in engagement with the stop members 26 of the

plunger means and, as indicated in Fig. 13, the plunger means is free to rotate in a clockwise direction (from the aspect of one viewing the outer end of the push button) through about one-half the arc between each pair of teeth 32 without rotating the inertia wheel. When the stop member 26 has moved in a clockwise direction to the face 33' of the stop member 29, it will be abutting said face 33' and also the face 34' of the teeth 32, and as the spindle means is stationary, further clockwise motion of the plunger means will be arrested.

Means are provided for releasably coupling the inertia wheel to the spindle means, and, in the present instance, this is accomplished by the laterally extending pins 35, herein shown as three in number, projecting forwardly from the disc 31 for co-operation with the holes 36 disposed in the rearward face of the disc 28. In circuit opening position, the inertia wheel is clutched to the spindle means (Fig. 4 and Fig. 16), and in circuit closing position, said pins abut the face of the disc 28 (Figs. 17 and 18). When the inertia wheel is uncoupled from the spindle means, the switch, being in circuit closing position, the clockwise rotation of the plunger means will move the inertia wheel in a clockwise direction and certain resilient means, hereinafter described, will move the wheel outwardly (rearwardly) and effect the reclutching of the wheel and spindle means.

To effect axial outward movement of the plunger means after the button has been depressed, and counterclockwise rotational movement thereof after it has been turned clockwise for a purpose hereinafter described, a torsion-compression spring 37 is disposed between the plunger means and the spindle means, one end of said spring resting in the groove 38 in the rearward end of the button (Fig. 5), and the other, in the groove 39, in the outer face of the disc 27. The spring 37 opposes the inward axial movement of the plunger means and at all times urges the rotary movement of said plunger means about the spindle means in a counterclockwise direction. When the plunger means is turned clockwise to reset the switch to circuit opening position, as hereinafter described, and then released, said spring will restore the plunger means to its original position with the stop 26 resting against the face 33' of the stop members 29 of the spindle means, and against the face 34' of the teeth 32 of the inertia wheel. A compound torsion-compression spring 40 is employed to resist the inward axial movement of the inertia wheel and to cause a rotary movement of the latter about the spindle means in a counterclockwise direction upon the uncoupling of the inertia wheel from the disc 28 of the spindle means.

The rearward torsion end of the spring 40 rests in the groove 41 of the spindle means, and the other end thereof is disposed in the groove 42 in the inner or rearward face of the disc 30. When further assembled in housing 20, the rearward torsion end of spring 40 will be guided by groove 41 of the spindle to be disposed into groove 42' of housing 20.

The inward (forward) face of the inertia wheel is provided with resilient contact fingers 43, of any suitable construction and material, said fingers, in the present instance, being shown as stamped out of an annulus 43', suitably secured to the inward face of the inertia wheel by the pins 44 taking into correspondingly spaced holes

in said annulus and headed thereover. Disposed for co-operation with said contact fingers are a corresponding number of studs 45, shown, in the present instance, as molded into the bottom of said housing, to which studs are electrically connected in any suitable manner the wires 46 of the circuits to be controlled. In the present instance, six such wires are shown, one being a ground wire, and the others each forming one side of one of the five circuits which are opened and closed by the switch. While the number and nature of the circuits are quite immaterial, in the present instance, the six circuits shown for illustrative purposes, merely, may control any suitable electro-responsive devices, audible or visual. The usual hospital set-up at the present time is as follows:

A buzzer is located in the nurses' rest room and four signal lights are located, respectively, at the nurses's duty station, the nurses' diet kitchen, one in the hall outside the ward room door, and one in the ward room beside the ward patients' bed.

In circuit opening position, five of the contact fingers rest under slight tension on the bottom of the housing, as indicated at 43'' in Fig. 2. The sixth finger 43''', which controls the circuit of an audible signal, such as a buzzer, is arranged for co-operation with one of the studs 45 and is slightly spaced away therefrom. When the plunger means is pressed inwardly, the sixth finger will make contact with its co-operating stud and close the circuit of the buzzer, or other audible signal device. By pressing the plunger means inwardly, the inertia wheel is unclutched from the spindle means, as aforesaid, and is rotated through a small arc in a counterclockwise direction, as hereinafter more fully described. Five of the spring fingers are brought into co-operation with the respective studs and placed under increased tension by virtue of the change in the axial position of the rotary wheel caused by the pins 35 which, in circuit closing position, abut the inward face of the disc 28 of the spindle means, and are locked in such position by the spring 40 which at all times exerts a counterclockwise and axial outward force on the inertia wheel.

The sixth and shorter spring finger, however, breaks contact with its co-operating stud upon the release of the plunger means due to the compression effect of said spring 40 which opposes the inward axial movement of the inertia wheel.

When the switch is in circuit closing position, the plunger means may be depressed repeatedly to open and close the audible signal circuit, the sixth finger making contact with its stud only when the plunger means is depressed, and moving away from said stud when the plunger means is released, the spring 40 normally resisting the inward axial movement of the inertia wheel to which all the spring fingers are secured.

The spacing of the plunger means from the spindle means is such that, with the exception of said sixth spring finger, no direct action on any spring finger by the plunger means is possible when the switch is in circuit closing position. Such spacing is shown at 47 between the inward end of the head of the push button 24 and the outer end of the spindle; at 48, between the inward surface of the push button flange of the plunger means and the outer end of the housing; and at 49, between the inward end of said push button and the outer face of the disc 27. To secure the proper relative position of the

spindle means and the elements co-operating therewith, a portion of the inner end 50 of the spindle is flattened to conform with the configuration of the inner end 51 of the bore in the bottom of the housing (Fig. 2).

A window 52, provided with a lens, may be placed in the housing, as indicated, to view a marking (not shown) on the flange 30 of the inertia wheel, said marking being so arranged that it will be under said window when the switch is in circuit closing position.

As indicated in Fig. 15, a lamp 53 may be inserted in the closure 21 and connected to the contact members in such manner that it will be lighted when the switch is in circuit closing position.

If desired, telephone apparatus 54 may be inserted in the closure 21 and the button perforated, as shown at 55, to enable the user of the switch to communicate with a person at a distance, for example, a person located in the room in which the audible signal device is placed. (Fig. 14).

The switch may conveniently be assembled as follows:

The spring 37 is placed in the cylindrical cavity in the rearward face of the button 24 (Figs. 4 and 5), one torsion end thereof resting in the groove 38 tangential to said cavity. The sleeve 25 is then placed over the spindle discs 27, 28, with the stop members 26 of said sleeve disposed in the recesses 33, cut in the disc 28, between the stop members 29 thereof. The right-hand end of the spindle 22 is then inserted in the central longitudinal bore of the button; the other torsion end of the spring 27 let into the groove 39 in the spindle disc 27 and the sleeve moved farther to the right (Fig. 4) until the forward face of the stop members 26 abut the rearward face of the disc 27. The button is then turned in a clockwise direction to preload said spring and then the sleeve is secured rigidly to the button in any suitable manner, as by deformation or crimping.

The contact finger ring 43'' is then secured to the disc 30 of the inertia wheel, which comprises the discs 30 and 31, by the pins 44, the ends of which project through holes in said ring spaced correspondingly with said pins and the ends of the latter are then peened over the ring, or, in any other suitable manner, said ring may be secured to said disc 30.

The spring 40 is then placed over the left-hand end of the spindle, one torsion end of said spring being let into the groove 42 of the inertia wheel disc 30. The spring is then turned counterclockwise from the aspect of one viewing the switch from a point to the right of the button 24 until the other torsion arm is parallel with the flat 50 of the spindle, whereupon the spring is compressed by forcing it forwardly until the other torsion arm thereof takes into the groove 41 cut into the spindle at the rearward end of said flat (Figs. 1, 3, and 9).

This completes the assembly of the preassembled switch mechanism (Fig. 4). This assembly is then inserted into the right-hand end of the housing 20, in such manner that the flattened end portion 50 of the spindle mates with the corresponding flattened portion 51 of the interior wall of said housing. When this has been done, groove 41 of said spindle will hold the rearward torsion end of spring 40 in position to be disposed in the space afforded by groove 42' of housing 20. Said groove 42' of housing 20 co-operating with

groove 42 of disc 30, prevents spring 40 from unwinding from its preloaded torsion position.

The screw 23 is then inserted through the left-hand end of housing 20 and screwed into the left-hand end of the spindle to hold the preassembled switch mechanism and housing together. The several wires are then connected to their respective binding posts 45 and the closure 21 is screwed to the casing 20.

The operation of the switch, referring to Figs. 16, 17, and 18 which are fragmentary developments of the discs 27, 28, 30 and 31, with certain co-operative adjuncts indicated diagrammatically, is as follows:

When the switch is in circuit opening position (Fig. 16), a stop member 26 (assuming for simplicity of explanation, only one of the co-operating members shown in triplicate in Figs. 6, 8, and 13) on the plunger means rests on the surfaces 33' of the spindle means and 34' of the inertia wheel, thereby permitting the rotation of stop member 26 in a clockwise direction against the torsional force of the spring 37 through the arc 33', 33'', and the arc 34', 34'', in the annular grooves 33 and 34, which, as aforesaid, are in alignment, as are the stop member 29 of the spindle means and the tooth 32 of the inertia wheel (Fig. 7).

The pin 35 on the inertia wheel is disposed in the hole 36 of the spindle means. The spring 40 is urging the inertia wheel outwardly and maintaining the parts in the position shown in Fig. 16. The spring 37 is urging the plunger means outwardly and maintaining the parts in the position shown in Fig. 4.

By pressing the plunger means inwardly, the stop member 26, acting against the flange 30 of the inertia wheel, forces the latter inwardly (Fig. 17), and the inertia wheel is moved axially to such an extent that the pin 35 is forced out of its hole 36, whereupon the torsion spring 40, which at all times urges the inertia wheel in a counterclockwise direction, gives to said wheel a rotary movement in a counterclockwise direction, with the result that the tooth member 32 is forced against the stop member 26, which is restrained by a stop member 29 of the spindle means from moving in a counterclockwise direction. In other words, the counterclockwise face 34'' of a tooth member 32 rests against the clockwise face of the stop member 26. The spring fingers are thus brought to rest on their respective studs 45, and are maintained in such position by the compression action of the spring 40, the pins 35 remaining against the inward face of the disc 28 of the spindle means.

Immediately upon placing the switch in circuit closing position, the compression action of the spring 37 will restore the plunger means to its normal axial position, thereby opening the circuit of the audible signal device, and such circuit may be closed repeatedly by pressing and releasing the push button.

The switch may be reset to normal or circuit opening position by rotating the push button in a clockwise direction. If the switch is used in a hospital signalling system, a nurse or attendant responding to a call made by a patient, will reset the switch to normal position by rotating the plunger means in a clockwise direction through the arc 33'—33'' (34'—34''), whereupon the plunger means is immediately returned counterclockwise by spring 37 to its normal position, shown in Figs. 8, 13, and 16.

Fig. 18 shows the position of the parts when

the resetting operation has almost, but not quite, been completed. The co-operating faces of the stop members 29 and the teeth 32 are still separated by the length of the pin 35, although the push button is maintained in its outermost position by the compression spring 37, and therefore the stop member 26 thereof is no longer in contact with the disc 30 of the inertia wheel. Further clockwise rotation of the plunger means from the position shown in Fig. 18, will bring the counterclockwise boundaries 33', 34', of the annular grooves 33, 34, into alignment, that is to say, the annular grooves 33, 34, will be in alignment and the pin 35 will be forced by the spring 40 into the hole 36, whereupon the inertia wheel will resume its normal position shown in Fig. 16 and all circuits will be quickly broken, except that of the audible signal device which, as above stated, was broken when the inward pressure on the push button was released. As soon as pin 35 enters its hole, the operator releases the button 24 which immediately is snapped back to its normal position, shown in Figs. 1 and 4, and the other rotary parts will resume their normal positions, as shown in Figs. 8, 13 and 16.

Having thus described illustrative embodiments of my invention without, however, limiting the same thereto, what I claim and desire to secure by Letters Patent is:

1. An electric switch comprising in combination, a housing, stationary spindle means disposed within said housing, rotatably and axially movable plunger means mounted for rotational and axial movement on said spindle means, an inertia wheel mounted for rotational and axial movement on said spindle means, a stop member carried by said plunger means, a co-operating stop member carried by said spindle means, means carried by said inertia wheel for engaging the stop member carried by said plunger means for rotative movement of said wheel by said plunger means, means for releasably coupling said inertia wheel to said spindle means, resilient means opposing the inward axial movement of said plunger means and urging a rotary movement of said plunger means about said spindle means in a given sense, other resilient means opposing the inward axial movement of said inertia wheel and causing a rotary movement of said inertia wheel about said spindle means in the same sense as the aforesaid rotary movement of the plunger means upon the uncoupling of said inertia wheel from said spindle means, a contact member carried by said inertia wheel, and a co-operating stationary contact member carried by said housing.

2. An electric switch comprising in combination, a housing, stationary spindle means disposed within said housing, rotatably and axially movable plunger means mounted for rotational and axial movement on said spindle means, an inertia wheel rotatably mounted on said spindle means, co-operating clutch means carried by said spindle means and said inertia wheel, resilient means opposing the inward axial movement of said plunger means and urging a rotary movement of said plunger means about said spindle means in a given sense, other resilient means opposing the inward axial movement of the inertia wheel and causing a rotary movement of said inertia wheel about said spindle in the same sense as the

aforesaid rotary movement of said plunger means upon the disengagement of said inertia wheel from said spindle means, means limiting the rotational arc of said plunger means, and co-operating contacts constructed and arranged to be opened and closed by the rotational movement of said inertia wheel.

3. An electric switch comprising in combination, a spring actuated rotary contact member, a co-operating stationary contact member, rotatably and axially movable plunger means, locking means for maintaining said rotary contact member in circuit opening position, and means actuated by the axial movement of said plunger means for releasing said locking means.

4. An electric switch comprising in combination, a spring actuated rotary contact member, a co-operating stationary contact member, rotatably and axially movable plunger means, locking means for maintaining said rotary contact member in circuit opening position, means actuated by the axial movement of said plunger means for releasing said locking means, and means actuated by the rotary movement of said plunger means for resetting the rotary contact member in circuit opening position.

5. An electric switch comprising in combination, a rotary contact member, a torsion-compression spring associated with said rotary contact member for moving the same rotatably or axially, rotatably and axially movable plunger means, a torsion-compression spring associated with said plunger means for opposing the inward axial movement thereof and urging a rotary movement of the same, locking means to maintain said rotary contact member in circuit opening position, means actuated by the axial movement of said plunger means for releasing said locking means, and means actuated by the rotary movement of said plunger means against the force of the torsion-compression spring associated therewith to restore said rotary contact member to circuit opening position.

6. An electric switch comprising in combination, a housing, stationary spindle means disposed within said housing, a rotary contact member mounted on said spindle means, spring contact fingers carried by said contact member, rotatably and axially movable plunger means mounted on said spindle means, locking means for maintaining said rotary contact member in circuit opening position, and means actuated by the axial movement of said plunger means for releasing said locking means, one inward surface of said plunger means when in circuit opening position being spaced from said spindle means sufficiently to prevent direct action on said spring fingers by said plunger means when the latter is in circuit closing position.

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Disclaimer

2,420,768.—*David D. Beveridge, Jr.*, Boston, Mass. ELECTRIC SWITCH. Patent dated May 20, 1947. Disclaimer filed June 15, 1951, by the assignee, *National Pneumatic Co., Inc.*

Hereby enters this disclaimer to claims 3 and 4 of said patent.
[*Official Gazette August 7, 1951.*]

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