

Feb. 27, 1973

D. FILA

3,718,786

ROTARY SWITCH ASSEMBLY

Filed Aug. 5, 1971

3 Sheets-Sheet 1

Fig. 1

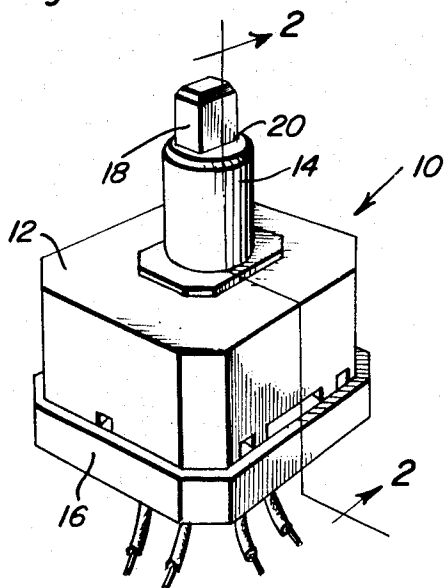


Fig. 2

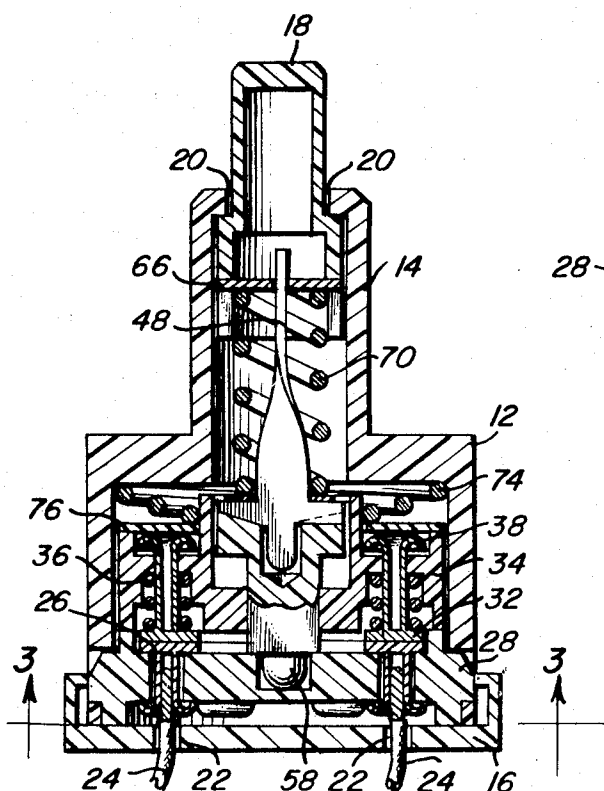


Fig. 5

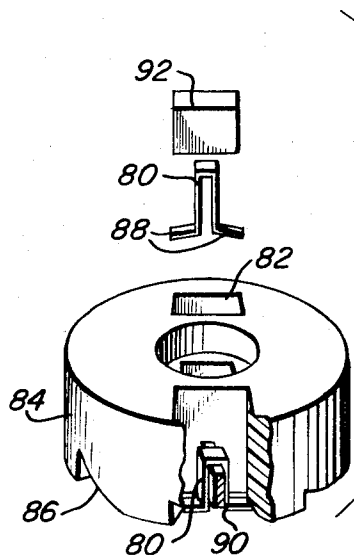
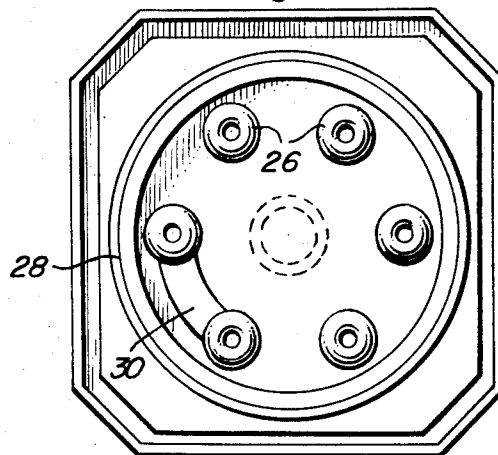


Fig. 3



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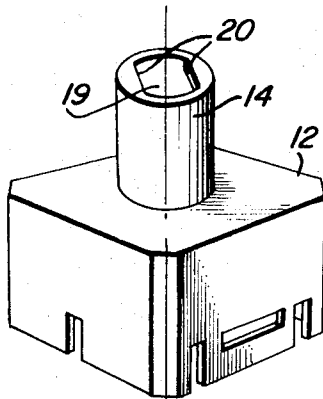
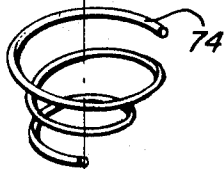
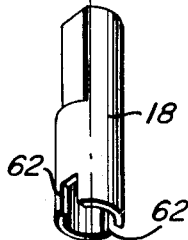
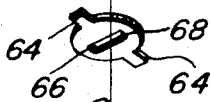
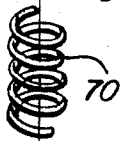
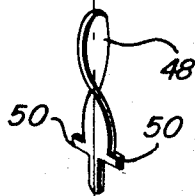
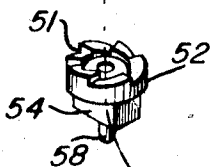
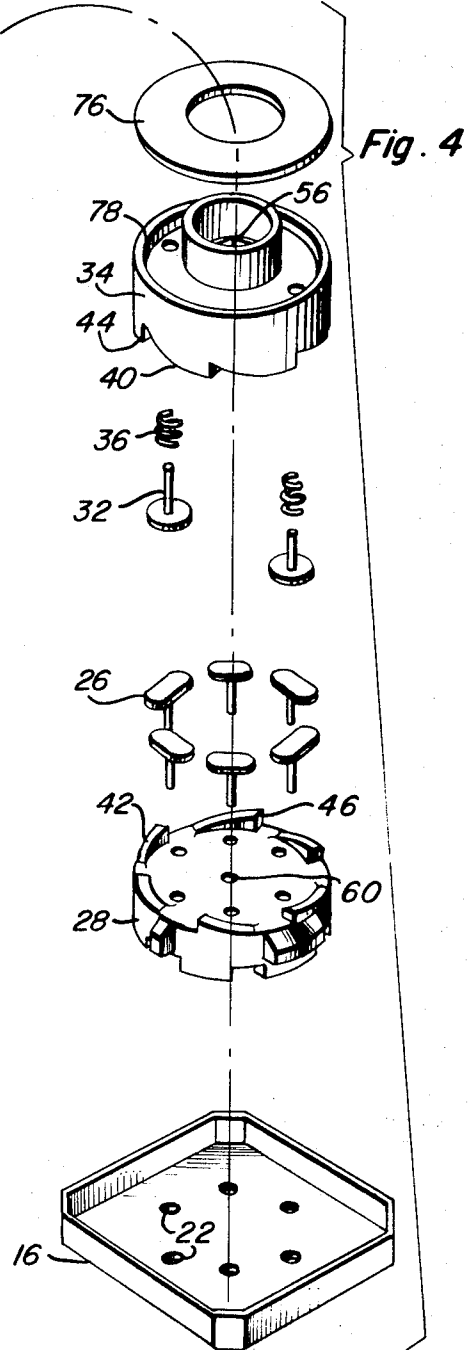
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ROTARY SWITCH ASSEMBLY

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Fig. 7

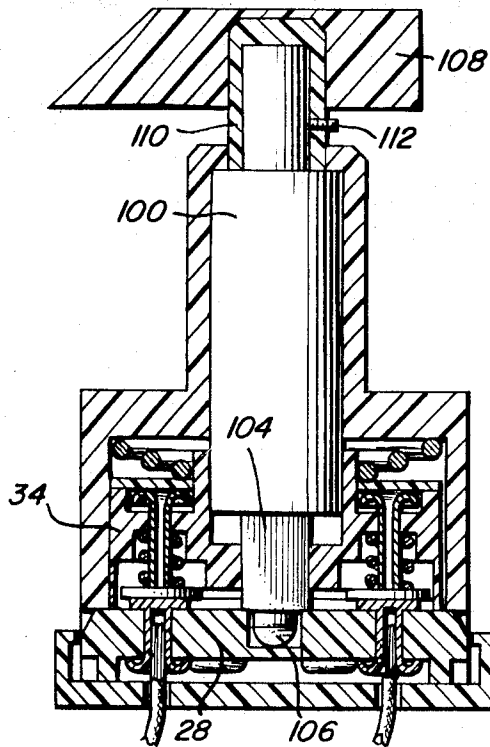
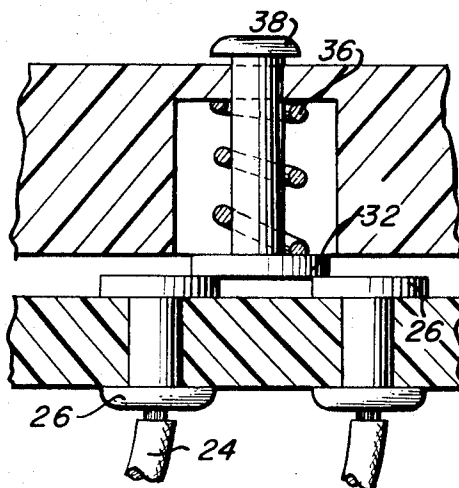
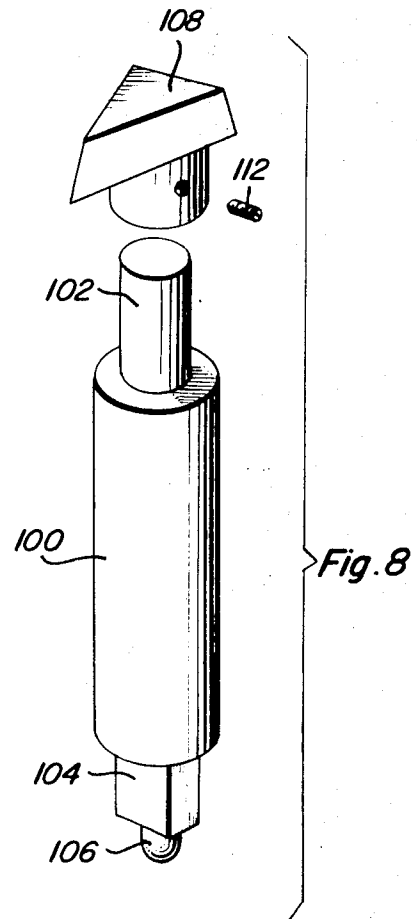


Fig. 6



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3,718,786

ROTARY SWITCH ASSEMBLY
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U.S. Cl. 200—63

10 Claims

ABSTRACT OF THE DISCLOSURE

A multi-purpose switch assembly comprising a plurality of stationary contacts mounted in a base having a first set of circumferentially spaced ratchet-like surfaces thereon, a movable rotor carrying a pair of movable contacts adapted to engage the stationary contacts and including a second set of ratchet-like surfaces operatively associated with the first set of ratchet-like surfaces such that rotation effects axial movement of the rotor sufficient to separate the contacts with wiping and lifting action. The movable contacts biasingly engage the stationary contacts, and rotor rotation is effected by a spiral drive or rotating knob member operatively connected to the rotor. When the spiral drive is used, rotation is initiated through depression of a push button reciprocally mounted in a housing of the switch assembly.

The present invention is generally related to rotary and push button switches and, more particularly, to switches of the ratchet drive type. In the past, a variety of ratchet drive switches have been proposed. However, such switch constructions were limited, for the most part, to switching achieved by contact wiping action. This resulted in excessive or rapid contact wear, especially when applied to handle heavy electrical loads. This necessitated frequent contact maintenance or in some cases replacement of the entire switch.

It is an object of the present invention to provide a novel switch assembly wherein the movable contacts are axially separated from the stationary contacts with a mild wiping action sufficient to provide cleaning yet prevent excessive wear especially when handling heavy electrical loads.

Another object of the present invention is to provide a versatile switch assembly comprised of stationary and movable contact carrying members having oppositely disposed ratchet-like surfaces which interact with each other to axially displace the movable contacts during switching.

It is a further object of the present invention to provide a unique switching assembly wherein the movable contacts are biasingly mounted to insure positive engagement with the stationary contacts, yet permit proper disengagement after slight axial movement of the rotor in which they are mounted.

Still another object of the present invention is to provide a versatile push button switch assembly comprising a ratchet clutch actuated by a spiral drive element, and movable and stationary contact carrying members having ratchet-like surfaces thereon which provide axial displacement of the movable contacts as well as indexing the spiral drive element after each push button depression.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIG. 1 is a perspective view of the push button switch assembly of the present invention.

FIG. 2 is a sectional view of the push button switch assembly taken along section 2—2 of FIG. 1.

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FIG. 3 is a sectional view taken along section 3—3 of FIG. 2.

FIG. 4 is an exploded perspective view of the push button switch assembly of the present invention.

FIG. 5 is an exploded perspective view of a second embodiment of the movable contact carrying rotor associated with the present invention.

FIG. 6 is an enlarged partial sectional view of the movable and stationary contacts associated with the present invention.

FIG. 7 is a sectional view of a second embodiment of the switch assembly of the present invention.

FIG. 8 is an exploded perspective view of the actuating mechanism associated with the second embodiment of the present invention.

Referring now to FIGS. 1 and 2, the push button switch assembly of the present invention is generally indicated by the numeral 10 and includes a housing 12 with a centrally located push button guide 14 and a bottom cover or cap 16. The push button guide is hollow and is adapted to receive a push button 18 through an opening 19 having a pair of flat edges 20 which define a guide channel permitting reciprocal movement of the push button, yet preventing rotation of the push button relative to the housing during depression. Cover 16 is provided with several circumferentially spaced openings 22 adapted to accommodate the passage of wires 24 for connection to the switch. Wires 24 are connected to a plurality of stationary contacts 26 carried by a contact base 28. Preferably, the base is made of a molded thermal plastic with the stationary contacts rigidly affixed thereto and circumferentially spaced therein. When desired, a shunt or jumper 30 may be provided between the stationary contacts to achieve a variety of switching functions.

A pair of movable contacts 32 are spring mounted in lost-motion connections in a movable rotor member 34 which is rotated through depression of push button 18, as hereinafter explained. Each movable contact 32 is provided with a spring 36 which biases the contact in the downward direction to assure positive engagement with a corresponding pair of stationary contacts. However, axial travel of the movable contacts under the influence of spring 36 is limited through engagement of the widened or flared portion 38 at the top end of each contact.

Referring to FIG. 4, the internal operation of the switch assembly will be more fully appreciated. Movable contact rotor 34 and stationary contact base 28 are provided with oppositely disposed ratchet-like surfaces 40 and 42, respectively. These ratchet-like surfaces are defined by circumferentially spaced, axially extending teeth which are rigidly affixed to or integral with each of the contact carrying members. The teeth correspond in number and position to the stationary contacts 26, such that when the vertical surfaces 44 and 46 of each tooth are aligned with each other the movable contacts are aligned between the stationary contacts, thus bridging the same. Thus, as rotor 34 is rotated in the clockwise direction, as seen in FIG. 4, ratchet surfaces 40 and 42 engage each other effecting axial movement of rotor 34 relative to stationary contact base 28.

During the the initial increment of axial movement, springs 36 bias the contacts in the downward direction until the flared head portions 38 of each movable contact engages the corresponding mounting surfaces of rotor 34. During this small incremental movement, rotation of the rotor produces a wiping action between the stationary and movable contacts. As rotation continues, the flared portions 38 of each movable contact engages the rotor mounting surfaces to transmit axial movement of the rotor to the movable contacts. The movable contacts are lifted relative to the stationary contacts until the vertical surfaces of the ratchet teeth align with each other, at

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which time movable contacts 32 make rapid contact with stationary contacts 26.

Rotary motion is imparted to rotor 34 by way of a spiral drive mechanism including a rigid spiral or twisted metal strip 48 having a pair of oppositely extending drive fingers 50 which engage the vertical tooth surfaces 51 of ratchet clutch member 52. As shown in FIG. 4, clockwise rotation of spiral 48 will impart corresponding rotary movement to ratchet clutch 52, but counterclockwise rotation of spiral 48 will be ineffective in imparting rotary movement. The bottom of ratchet clutch 52 is provided with a rectangular mounting portion 54 which is adapted to be received in a corresponding rectangular opening 56 formed in the center of rotor 34. A centering pin 58 extending from the bottom of the ratchet clutch is received by a center hole 60 of corresponding dimension in stationary contact base 28 to assure proper alignment between the components.

The bottom of push button 18 is provided with a hollowed opening having a pair of diametrically opposite keyways 62 which receive a corresponding pair of mounting tabs 64 on slotted drive member 66. A rectangular slot 68 in drive member 66 slidably receives spiral 48 such that reciprocation of push button 18 will impart rotary movement to the spiral. After depression, push button 18 is returned to its initial position by return spring 70, one end of which engages the bottom surfaces of drive member 66 and the opposite end of which engages slotted spring seat 72, also slidably positioned on spiral 48.

A rotor biasing spring 74 extends between housing 12 and insulated disc 76 to bias rotor 34 in the downward direction. Disc 76 rests on annular rim portion 78 of the rotor and is spaced from the flared tops 38 of each movable contact such that it does not interfere with the contact movement and provides adequate clearance for wiring connections between each movable contact, should such be desired.

Referring to FIG. 5, it will be appreciated that a second embodiment of the movable contact rotor is provided. This embodiment includes a pair of bifurcated bridging contacts 80 mounted in a pair of rectangular holes 82 in rotor member 84 such that they provide a bridging between adjacent stationary contact 26. Rotor 84 is provided with a plurality of ratchet-like surfaces, similar to those of rotor member 34. Each bifurcated contact 80 includes a pair of contact feet 88 which are angled slightly in the downward direction to provide a spring action and bias-type engagement with the stationary contacts. Each bifurcated contact is made of a resilient metal material and, preferably, includes a silver alloy on its contact surfaces. Each of the contacts is held in position by way of a radially extending mounting wall 90, upon which the contact seats. After each contact is inserted within the rotor, a retaining block or plug 92 is inserted in each opening 82 and is held rigidly in place by cement, or other fastening means. Thus, it will be appreciated that the second embodiment of the movable contact rotor provides a bridging contact arrangement which functions in a manner similar to the first embodiment, but does not require the use of coil contact springs such as springs 36. The operation of rotor 88 is identical to the operation of rotor 34, as explained above.

Referring to FIG. 6, the engagement between the movable and stationary contacts can be seen in more detail. Due to the corresponding positions of the ratchet surfaces, the movable contacts 32 bridge a corresponding pair of stationary contacts 26 by engaging a substantial portion thereof. It should be noted that the size and shape of the contacts may be modified in order to accommodate heavier electrical loads, such that the engagement areas between the movable and stationary contacts is increased.

Referring now to FIGS. 7 and 8, a second embodiment of the present invention may be seen. The second embodiment is provided with a rotary selector mechanism for actuation of the switch, rather than the spiral drive mechanism

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as utilized with the first embodiment. However, the remainder of the switch structure, including the movable contact rotor with ratchet surfaces, is the same as that of the first embodiment of the present invention. The rotary selector mechanism includes an actuation member 100 which is generally cylindrical in shape and includes an uppermost mounting portion 102 of reduced diameter and a lower rectangular base portion 104 adapted to engage rotor member 34. A pin portion 106 extends from the bottom of rectangular base 104 and is adapted to be received by center hole 60 of corresponding dimension in stationary contact base 28 to assure proper alignment between these components. Thus, it will be appreciated that the cylindrical actuation member of the second embodiment replaces the spiral drive mechanism including the ratchet clutch utilized in the first embodiment. A manual selector knob 108 is located on the exterior of the switch housing and includes a mounting sleeve 110 which is journaled around mounting portion 102 of the actuating member and which may be held in place by way of a setscrew 112, or similar fastening means. Movement of rotor 34 is identical to that achieved by way of the spiral drive push button embodiment of the invention, as explained above. Actuation of the rotor, however, is achieved by rotary manipulation of selector knob 108, which in turn imparts movement to rotor 34 by way of rectangular base 104. As such, the second embodiment of the present invention provides a means for rotary actuation of the switch assembly, and does such by the use of a relatively small number of moving parts. Thus, the second embodiment of the present invention may be utilized in situations requiring frequent switching or where a multi-position selector knob is required.

From the foregoing it will be appreciated that the switch assembly of the present invention provides a versatile means of effecting rotary switching between a plurality of electrical circuits. Disengagement between the movable and stationary contacts is such that a mild wiping action is obtained in addition to axial disengagement of the contacts. This provides proper cleaning of the contacts, yet increases contact life compared to conventional rotary switches of the push button type. In the preferred embodiment, the housing, end cap, stationary and movable contact carrying members are made of synthetic materials such as thermoplastics, nylon, or polyethylene. The spiral drive element is made of a hardened steel to assure long life and to prevent any deformation due to push button actuation. Of course, minor changes in the materials in the components or in the location or number of the stationary or movable contacts are deemed to fall within the scope of the present invention.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A switch assembly comprising a switch housing, a relatively rigid rotor of insulation material carried by said switch housing for rotation about a vertical axis, said rotor carrying at least one movable contact extending in a downward direction, a stationary contact base of insulation material carried by said switch housing underlying said rotor and carrying at least one stationary contact which is engaged by said movable contact when said rotor is in a contact-making position, and means for producing axial movement of said rotor relative to said stationary contact base in response to selective rotation of said rotor about said axis, said means for producing axial movement including a first set of axially extending ratchet-like teeth around the bottom of said rotor, and a second set of ratchet-like teeth on said stationary

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contact base and underlying said first set of teeth and normally in meshing engagement therewith, said contacts being disposed radially inward of said first and second sets of teeth, whereby said contacts are substantially enclosed and insulated by said teeth when meshed with each other.

2. The structure set forth in claim 1 together with rotor spring means mounted in said switch housing and biasing said rotor toward said stationary contact base to encourage engagement between said first and second sets of ratchet-like teeth.

3. The structure set forth in claim 2 wherein one of said contacts is mounted in an axial lost-motion connection including spring means biasing it axially towards the other of the contacts, said lost-motion connection being effective during only a portion of the axial movement produced by said first and second sets of ratchet-like teeth during rotation of said rotor.

4. The structure set forth in claim 1 together with a generally cylindrical actuation member rotatably mounted in said housing and operatively engaging said rotor for rotation thereof.

5. The structure set forth in claim 4 wherein said cylindrical actuation member is connected to a manual selector knob located outside of said housing to permit selective rotation of said rotor.

6. A push button switch assembly comprising a switch housing, a push button reciprocally mounted to said housing, a rotary contact-carrying member mounted to said housing for rotation about an axis, at least one movable contact carried by said rotary member and extending axially therefrom, a stationary contact-carrying member axially disposed of said rotary member and carrying at least one stationary contact operatively associated with said one movable contact and engaging said movable contact when said rotor is in a contact-making angular position, actuation means operatively associated with said push button for selectively rotating said rotary member in one direction in response to reciprocation of said push button in said housing, and means operatively connected to said actuation means for producing axial movement of said rotary member in response to rotation in said one direction by said actuation means and preventing rotation of said rotary member in the opposite direction,

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said axial movement producing means including first and second sets of ratchet-like teeth carried by said rotary and stationary members, respectively, the teeth of each set being circumferentially spaced about said axis, said contacts being disposed radially inward of said teeth whereby said contacts are substantially enclosed by said sets of teeth when meshed with each other.

7. The structure set forth in claim 6 wherein said actuation means includes an elongated spiral drive element operatively connected to said push button and engaging a ratchet clutch member for rotation thereof in said one direction, said ratchet clutch member being connected to said rotary member for rotation thereof in response to reciprocation of said push button in one direction only.

8. The structure set forth in claim 7 wherein said first and second sets of ratchet-like teeth when meshed with each other prevent rotation of said ratchet clutch member in a direction opposite said one direction.

9. The structure set forth in claim 8 wherein each set of ratchet-like teeth is defined by an inclined surface terminating at a surface which extends in a direction substantially parallel to the axis of rotor rotation, rotation of said ratchet clutch member producing both axial and angular movement of said rotor.

10. The structure set forth in claim 9 wherein axial movement of said rotor beyond a predetermined distance produces disengagement of said movable contact from said stationary contact.

References Cited

UNITED STATES PATENTS

2,762,876	9/1956	Glogau et al.	200—11 EA
2,798,907	7/1957	Schneider	200—64 X
3,596,013	7/1971	Pihl	200—11 EA
2,908,777	10/1959	Brown	200—65

FOREIGN PATENTS

684,881	11/1939	Germany	200—156
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U.S. Cl. X.R.

200—11 EA