March 25, 1952 P. SILVIUS 2,590,658

ROTARY ELECTRIC SWITCH

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Fig.1.

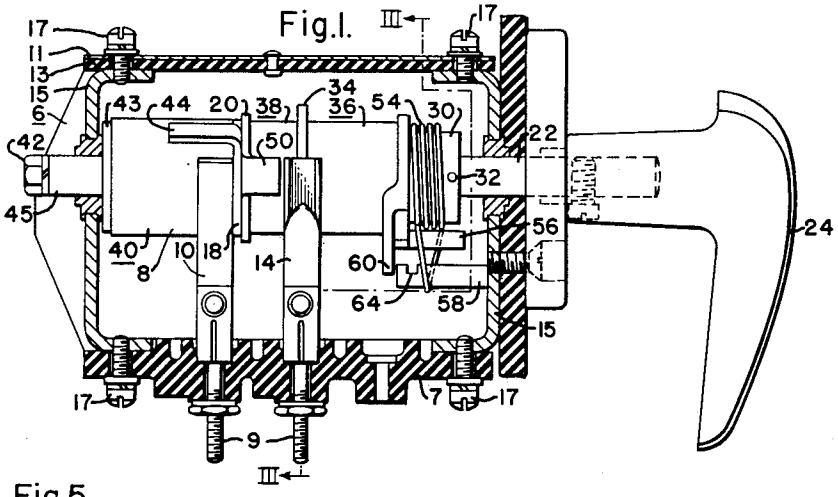


Fig.5.

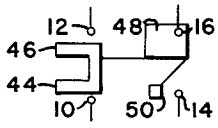


Fig.3.

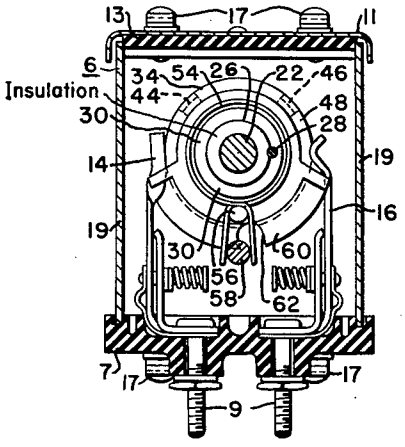


Fig.2.

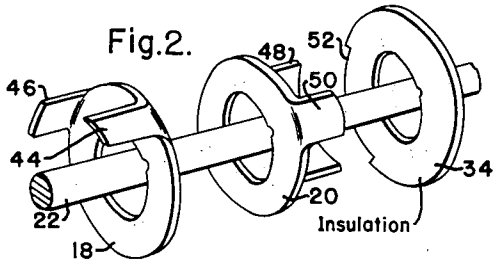
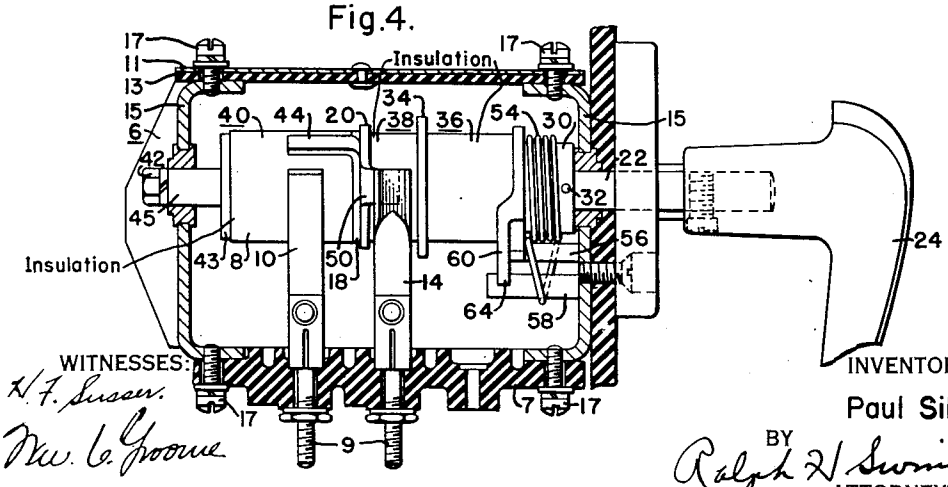


Fig.4.



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ROTARY ELECTRIC SWITCH

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12 Claims. (Cl. 200—4)

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This invention relates to electric switches and more particularly to switches of the rotary type which are rotatable in opposite directions from a neutral position for the control of a plurality of electrical circuits.

One of the objects of the present invention is to provide a rotary switch construction which combines rotary and push-pull movements in a novel manner in order to efficiently control various electrical circuits.

Another object of the invention is to provide a unitary switch construction of the above type capable of push-pull operation between two neutral positions and capable of rotary movement in opposite directions from either neutral position to selectively complete one or the other of the same pair of electrical circuits.

Still another object is to provide in a switch construction of the above character, a novel arrangement for resiliently biasing the switch to a normal position when the switch occupies either neutral position, together with means for preventing accidental movement of the switch from one neutral position to the other.

A still further object is to provide a switch of the above character which includes a novel arrangement of contact members to secure a selective control of a pair of electrical circuits when the switch is adjusted to either neutral position, the construction affording a highly efficient and positive operation without the necessity of employing a large number of intricate elements.

The above and other objects and novel features of the invention will appear more fully hereinafter from the following detailed description when taken in connection with the accompanying drawing. It is to be expressly understood, however, that the drawing is utilized for purposes of illustration only and is not to be taken as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawing, wherein similar reference characters refer to similar parts throughout the several views:

Figure 1 is an axial sectional view of a rotary push-pull switch embodying the principles of the present invention;

Fig. 2 is a perspective view of certain of the rotary contact members;

Fig. 3 is a transverse sectional view taken substantially along line III—III of Fig. 1;

Fig. 4 is a sectional view similar to Fig. 1 except that the switch is illustrated in a different position of longitudinal adjustment, and

Fig. 5 is a diagrammatic view of the switch contacts and circuit terminals controlled thereby.

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The system and circuit described in the copending application of John R. Dunbar, Serial No. 745,620, filed May 2, 1947, now Patent No. 2,484,210 dated October 11, 1949, on Control Systems, and assigned to the assignee of this invention, is illustrative of one arrangement where it is desirable to provide a unitary switch structure having two "neutral" positions from which the switch can be manually operated to other positions, but will automatically return to the neutral position from which it was moved to such other positions. While the particular application disclosed in the aforesaid copending application is in connection with a regulator which may normally be either "automatically" or "manually" controlled, thus defining the two desired "neutral" positions of a control switch therefor, and arranged so that similar test circuits may be established under either normal condition, it will be apparent that the switch hereinafter disclosed may be useful for the control of other apparatus as well.

Referring now to the drawing, a switch embodying the principles of the present invention is illustrated therein as embodying a casing 6 in which a switching member or rotor 8 is mounted for rotary movement in opposite directions and for longitudinal adjustment to two neutral positions, the latter adjustment being effected by a push-pull operation. Two pairs of contact fingers 10, 12 and 14, 16 are secured to the base 7, which is of insulating material such as a phenolic material, by terminal bolts 9, and these may be connected externally to the electrical circuits it is desired to control. Casing 6 is completed by a cover 11, preferably lined with a sheet of insulating material 13, such as fiber, and secured to base 7 by end brackets 15 having inturned flanges for receiving screws 17 which secure the base and cover thereto. Side plates 19 are received in grooves in the base, and held at their upper ends by flanges on cover 11. In a manner which will appear more fully hereinafter, the contact fingers 10, 12 and 14, 16 cooperate with contact members 18 and 20, carried by a shaft 22, the latter being provided with a handle 24 in order to impart the desired switching movements to the member 8.

As shown, the switching member 8 includes an insulating sleeve 26 which is provided with

a suitable longitudinal groove for receiving an insulating rod 28 which serves to lock together, the various members constituting the rotor. In assembling the latter, the sleeve 26 is slipped on the shaft 22 following which a spring support 30 is fitted over the sleeve and these parts are secured to the shaft 22 as by a pin 32. Contact members 18 and 20 are assembled in contacting relation and an insulating disk 34 is positioned intermediate the said contact members and the spring support 30 as clearly illustrated in Figs. 1 and 4. Suitable insulating spacers, 36, 38 and 40 are provided for spacing the elements 18, 20 and 34 along the shaft 22, and all of the aforementioned parts are secured together to form a unitary construction as by means of a screw 42 which has a sleeve 45 thereon to secure a washer 43 against adjacent spacer 40.

In order to control the circuits with which the control fingers 10, 12 and 14, 16 are connected, the contact member 18 is provided with a pair of spaced-apart contacts 44 and 46 which are adapted to engage with the contact fingers 10 and 12, respectively, upon rotatable movement of the rotor 8 in either direction from the normal positions shown in Figs. 1 and 4. Contact member 20 on the other hand includes a contact 48 which is of sufficient axial extent as to be in constant engagement with the contact finger 16 irrespective of the position of the rotor 8, and also includes a contact 50 which only engages the contact finger 14 when the rotor 8 occupies the normal neutral position illustrated in Fig. 4. Thus with the arrangement of contacts just described, rotary movement of the switching member 8 counter-clockwise from the neutral positions shown in Figs. 1 and 4, will selectively complete a circuit through contact finger 15, contacts 48 and 44 and contact finger 10. Rotary movement in the opposite direction from said neutral positions of Figs. 1 and 4 will complete a circuit through contact finger 16, contacts 48 and 46 and contact finger 12. Hence, regardless of the longitudinal position of the switching member 8, one or the other of the same pair of circuits may be controlled by rotation of the rotor 8 in opposite directions from either neutral position. On the other hand, all circuits are open when the switch is in the normal neutral position of Fig. 1. When the rotor is adjusted to the neutral position of Fig. 4, a circuit is automatically completed between the contact fingers 14 and 16 through contacts 50 and 48. This last named circuit however, is broken upon rotation of the rotor 8 a sufficient distance in either direction from the neutral position shown in Fig. 4.

From the foregoing, it will be readily understood that as the switching member 8 is adjusted longitudinally from the neutral position shown in Fig. 4 to that illustrated in Fig. 1, engagement between contact 50 and contact finger 14 is broken, while engagement between contact 48 and contact finger 16 is maintained. This action is assured by a proper proportioning of the axial lengths of the contacts 48 and 50 and by the provision of the insulating disk 34 which cams the contact finger 14 out of engagement with the contact 50 during the longitudinal movement from the neutral position of Fig. 4 to that of Fig. 1. When, however, the switch is moved longitudinally to the position shown in Fig. 4, the disk 34 becomes disengaged from the contact finger 14 and the latter drops into engagement with the contact 50, due to its spring action. As shown, the insulating disk 34 is provided with a cutout portion 52 for receiving the contact 48 when the parts are assembled and contact finger 14 is V-shaped in section to facilitate its cam action on disk 34.

In addition to the above features, the present invention provides a novel arrangement for resiliently biasing the rotor 8 to a central neutral position when the switch occupies the positions illustrated in Figs. 1 and 4. As shown in Fig. 3, such means includes a double-acting spring 54 having its ends crossed over and positioned on opposite sides of pins 56 and 58, the former being carried by the spring support 30 and the latter being mounted in the front bracket 15 of the casing 6. With such a construction, the rotor 8 is resiliently maintained at all times in the normal centralized position shown in Fig. 3, and automatically returns the rotor to such position whenever the operator releases the handle 24.

One of the features of the invention resides in the provision of means for preventing accidental displacement of the switching member 8 from either of its positions of longitudinal adjustment, while said switching member occupies the normal centralized position. As shown, such means includes a flange 60 on the spring support 30 which is provided with a notch 62, slightly displaced with respect to the pin 58, see Fig. 3, when the rotor 8 is spring-centered to neutral. With such an arrangement, longitudinal adjustment of the rotor 8 from the position shown in Fig. 1 to that illustrated in Fig. 4 is prevented unless the rotor is turned a slight amount in a clockwise direction as viewed in Fig. 3, in order to align the notch 62 with the pin 58. When the parts reach the position shown in Fig. 4 and the handle 24 is released, the flange 60 is received in a slot 64 formed in the pin 58 through the action of the spring 54. In this position of the switch, it will be understood that while rotatable movement of the rotor 8 in opposite directions is permitted, still inward movement of the rotor 8 is prevented unless the latter is slightly rotated in a clockwise direction, as viewed in Fig. 3 to again align the notch 62 with the pin 58. Thus while the rotor 8 may be rotated in opposite directions in either position of longitudinal adjustment, push or pull operation of the rotor is prevented unless the rotor is rotated a slight distance from its normal centralized position. Hence, any accidental shifting of the rotor 8 from either position of longitudinal adjustment to the other is prevented. It is desired to point out that the construction of the parts is such that no circuits are completed or broken by the slight amount of rotation of the rotor 8 required for aligning the notch 62 with the pin 58.

In operation, and assuming that the switch occupies the position shown in Figs. 1, 3 and 5, it will be readily understood that all circuits are broken and that the switch is in the "off" position. Rotation of the handle 24 in a counter-clockwise direction as viewed in Fig. 3, will connect contact 44 to th contact finger 10 to complete a circuit from the latter to the contact finger 16 by way of contacts 44 and 48. This position of the switch may be termed the "raise" position. In the event the handle 24 is rotated in the opposite direction, a circuit is completed from the contact finger 12 to the finger 16 by way of contacts 46 and 48. In this position, the switch occupies what may be denoted the "lower" position. Thus it is seen that from the normal "off" position of Fig. 1, the rotor 8 may be rotated in opposite directions

to a "raise" or a "lower" position in order to selectively complete either one of a pair of circuits. During the above-described operations, and upon release of handle **24**, the rotor will automatically be returned to its "off" position. It will be understood that the upper end of the contact finger **14** rides on the insulating disk **34** and is maintained out of engagement with respect to the contact **50** at all of the foregoing positions.

Rotor **8** may be moved outwardly to the position shown in Fig. 4 in order to establish another control circuit. In order to do this, the rotor is rotated a slight amount clockwise, to align the notch **62** with the pin **58** and is then pulled. During movement of the rotor to the position shown in Fig. 4, which may be termed the "automatic" position, a circuit is automatically established from contact finger **14** to contact finger **16** through contacts **50** and **48**, it being understood that the insulating disk **34** moves out of engagement with the finger **14** in order to permit engagement of the latter with the contact **50**. Upon release of the rotor **8**, and centering thereof through the action of spring **54**, the aforesaid circuit will be maintained.

With the parts in the position shown in Fig. 4, it will be readily understood that upon rotatable movement of the rotor in opposite directions, the circuit from the finger **14** to the finger **16** through contacts **50** and **48** will be broken and circuits corresponding to the above-mentioned "raise" and "lower" positions will be selectively completed.

From the foregoing, it will be readily understood that the invention provides a novel switch construction wherein the rotor may be longitudinally shifted to one or the other of a pair of neutral positions and may be rotated from either neutral position to selectively complete one or the other of the same pair of electrical circuits. Thus the switch may be turned from one position to another without the necessity of passing through a third position. The arrangement proposed enables the rotor to be spring-centered in either neutral position while the use of the notch **62**, the pin **58** and the slot **64** in the latter provides a construction for preventing accidental longitudinal displacement of the rotor when at all positions except one which is slightly displaced from the "neutral" positions, while allowing rotatable movement thereof when the rotor is either pushed in or pulled out. The invention thus provides a unitary switch construction which is not only highly efficient in its operation but which embodies relatively few parts.

While one embodiment of the invention has been shown and described herein with considerable particularity, it will be readily understood by those skilled in the art that various modifications may be resorted to without departing from the spirit of the invention. Reference will, therefore, be had to the appended claims for a definition of the limits of the invention.

I claim as my invention:

1. A unitary switch construction comprising a support having two pairs of spaced-apart contact elements mounted thereon, a switching member mounted on said support for longitudinal adjustment between a first and a second position and for rotatable movement in opposite directions from at least the neutral position at said first position of longitudinal adjustment, contact means having a plurality of contact portions carried by said switching member, two of said contact portions being angularly spaced on said switching member at positions to engage the elements of one pair of contact elements upon rotation of said switching member in opposite directions, respectively, from the neutral position at said first position of longitudinal adjustment, two others of said contact portions being located on said switching member at positions to engage the elements of the other pair of contact elements when said switching member is longitudinally adjusted to the neutral position at said second position of longitudinal adjustment, and one of said other contact portions being larger in angular and axial extent to engage its contact element at all four positions of said switching member, for selectively connecting either element of said one pair of contact elements with one element of the other pair of contact elements as the switching member is rotated in opposite directions from the neutral position in said first position of longitudinal adjustment, and for completing another circuit between the elements of said other pair of contact elements when the switching member is longitudinally adjusted to the neutral position in said second position of adjustment.

2. A unitary switch construction comprising a support having two pairs of spaced-apart contact elements mounted thereon, a switching member mounted on said support for longitudinal adjustment between a first and a second position and for rotatable movement in opposite directions from a neutral position in each position of longitudinal adjustment, contact means having a plurality of contact portions carried by said switching member, two of said contact portions being angularly spaced on said switching member at positions to engage the elements of one pair of contact elements upon rotation of said switching member in opposite directions respectively, and said two contact portions being of sufficient axial length to engage said elements upon rotation from neutral position in either the first or second position of longitudinal adjustment, two others of said contact portions being located on said switching member at positions to engage the elements of the other pair of contact elements when said switching member is longitudinally adjusted to the neutral position at said second position of longitudinal adjustment, and one of said other contact portions being larger in angular and axial extent to engage its contact element at all six positions of said switching member, for selectively connecting either element of said one pair of contact elements with one element of the other pair of contact elements as the switching member is rotated in opposite directions from neutral in either the first or second position of longitudinal adjustment, and for completing another circuit between the elements of said other pair of contact elements when the switching member is moved to the neutral position in said second position of adjustment.

3. A unitary switch construction comprising a support having two pairs of spaced-apart contact elements mounted thereon, a switching member mounted on said support for adjustment in one plane between a first and a second position and for movement in spaced-apart planes in each of said positions, respectively, in opposite directions from a neutral position in each of said spaced planes, and contact means having contact portions carried by said switching member, two of said contact portions being spaced in the directions of said spaced planes on said

switching member at positions to engage the elements of one pair of contact elements upon movement of said switching member in opposite directions, respectively, and said two contact portions extending in the direction of said first plane an amount sufficient to engage said elements upon movement from the neutral positions in either of said spaced planes, two others of said contact portions being located on said switching member at positions to engage the elements of the other pair of contact elements when said switching member is adjusted to the neutral position at said second position of adjustment, and one of said other contact portions being greater in extent in the direction of all of said planes to engage its contact element at all six positions of said switching member, and cooperating with the contact elements to provide selectively closeable circuits between either contact element of one pair of elements and one element of the other pair of elements as the switching member is moved in opposite directions in either the first or second positions of adjustment, and to complete a circuit between the elements of the other pair of contact elements when the switching member is moved to the neutral position in the second position.

4. A unitary switch construction comprising a support having a plurality of contact elements mounted thereon, a switching member mounted on said support for adjustment in one plane between a first and a second position and for movement in spaced-apart planes in each of said positions, respectively, in opposite directions from a neutral position, resilient means movable longitudinally with the switching member and engaging the switching member when it is in each of said spaced planes and biasing it to the neutral position in each plane, contact means carried by the switching member and cooperable with the contact elements during movements of the switching member, and means for positively preventing adjustment of said switching member between said first and second positions except when said member is moved a relatively small amount from the neutral positions in one of said spaced-apart planes.

5. A unitary switch construction comprising a support having contact elements mounted thereon, a switching member mounted on said support for longitudinal adjustment between a first and a second position and for rotatable movement in opposite directions from a neutral position in each position of adjustment, resilient means movable longitudinally with the switching member engaging the switching member at both of its longitudinally adjusted positions and biasing it to the neutral position corresponding to the longitudinal adjustment, contact means carried by the switching member and cooperable with said contact elements during movements of the switching member, and means for positively preventing longitudinal adjustment of said switching member between said first and second positions except when said member is rotated a relatively small amount from the neutral positions.

6. A unitary switch construction comprising a support having two pairs of spaced-apart contact elements mounted thereon, a switching member mounted on said support for longitudinal adjustment between a first and a second position and for rotatable movement in opposite directions from a neutral position in each position of adjustment, a plurality of contacts carried by said switching member for selectively connecting either element of one pair of contact elements with one element of the other pair of contact elements as the switching member is rotated in opposite directions from neutral in either the first or second position of adjustment, and for completing another circuit between the elements of said other pair of contact elements when the switching member is moved to the neutral position in said second position of adjustment, resilient means movable longitudinally with the switching member and engaging the switching member at both of its longitudinally adjusted positions and biasing it to the neutral position corresponding to the longitudinal adjustment, and means for positively preventing longitudinal adjustment of said switching member between said first and second positions except when said member is rotated a relatively small amount from the neutral positions.

7. A unitary switch construction comprising a support having a plurality of contact elements mounted thereon, a switching member mounted on said support for adjustment in one plane between a first and a second position and for movement in spaced-apart planes in each of said positions in opposite directions from a neutral position in each of said spaced planes, resilient means for normally maintaining the switching member in the neutral positions, means carried by the switching member and cooperable with the contact elements during movements of the switching member, a pin carried by the support, a locking member carried by the switching member, the locking member having a flanged part to abut the end of the pin when the switching member occupies the neutral position in the first position of adjustment, the said flanged part having an opening offset from said pin and adapted to receive the pin to allow adjustment of the switching member from the first to the second position upon movement of said member a slight amount in one of said spaced-apart planes from the neutral position, and said pin being provided with a slot for receiving the flanged part when the switching member occupies the second position of adjustment.

8. A unitary switch construction comprising a support having two pairs of spaced-apart contact elements mounted thereon, a switching member mounted on said support for longitudinal adjustment between a first and a second position and for rotatable movement in opposite directions from a neutral position in each position of adjustment, and a plurality of contacts carried by said switching member for selectively connecting either element of one pair of contact elements with one element of the other pair of contact elements as the switching member is rotated in opposite directions from neutral in either the first or second position of adjustment, and for completing another circuit between the elements of said other pair of contact elements when the switching member is moved to the neutral position in said second position of adjustment, resilient means for normally maintaining the switching member in the neutral positions, a pin carried by the support, a locking member carried by the switching member, the locking member having a part to abut the end of the pin when the switching member occupies the neutral position in the first position of adjustment, the said part having an opening angularly offset from said pin and adapted to receive the pin to allow adjustment of the switching member from the first to the second

position upon rotation of said member a slight amount from the neutral position, and said pin being provided with a slot for receiving said part when the switching member occupies the second position of adjustment.

9. A unitary switch construction comprising a support having contact elements mounted thereon, a switching member mounted on said support for longitudinal adjustment between a first and a second position and for rotatable movement in opposite directions from a neutral position in each position of adjustment, resilient means for normally maintaining the switching member in the neutral positions, means carried by the switching member and cooperable with said contact elements during movements of the switching member, a pin carried by the support, a locking member carried by the switching member, the locking member having a part to abut the end of the pin when the switching member occupies the neutral position in the first position of adjustment, the said part having an opening offset from said pin and adapted to receive the pin to allow adjustment of the switching member from the first to the second position upon rotation of said member a slight amount from the neutral position, and said pin being provided with a slot for receiving said part when the switching member occupies the second position of adjustment.

10. A switch comprising a support, a contact-carrying rotor mounted on said support for push-pull axial movement to one or the other of a pair of neutral positions, and mounted for rotatable movement in opposite directions in either neutral position, a single spring movable axially with the rotor and engaging said rotor at both axial positions thereof for centering said rotor in either neutral position, contact elements carried by the casing for cooperation with the rotor during rotatable and push-pull movements of the latter, a first member carried by the casing, a second member carried by the rotor and cooperating with the first member to prevent axial movement of the rotor in either axial direction when the rotor occupies its spring-centered position, and means formed on one of said members to allow axial movement of the rotor in opposite directions when the latter is rotated a relatively small distance from its spring-centered position.

11. A unitary switch construction comprising, a support having a plurality of contact elements mounted thereon, a switching member mounted on said support for adjustment in one plane between a first and a second position and for movement in spaced-apart planes in each of said positions, respectively, in opposite directions from a neutral position, resilient means movable axially with the switching member and engaging the switching member when it is in each of said spaced planes and biasing it to the neutral position in each plane, and contact means carried by the switching member and cooperable with the contact elements during movements of the switching member.

12. A switch comprising, a support, contact actuating means mounted for axial movement and for rotation at two different axial positions on said support, contact means mounted on said support, said contact actuating means having means to complete a circuit through at least some of said contacts in response to axial movement and to rotative movements thereof from both of said axial positions, spring means movable axially with the contact actuating means and engaging said contact actuating means at both of its axial positions to bias it to a neutral rotative position at each of said axial positions, and means angularly offset a relatively small amount from each neutral position for positively preventing axial movement of said contact actuating means unless the latter is rotated such small amount from either neutral position.

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