July 19, 1960 H. F. MASON 2,945,927

ROTARY SWITCH WITH COMMON ADVANCING AND PRESSURE SPRINGS

Filed March 20, 1959

FIG. 1.

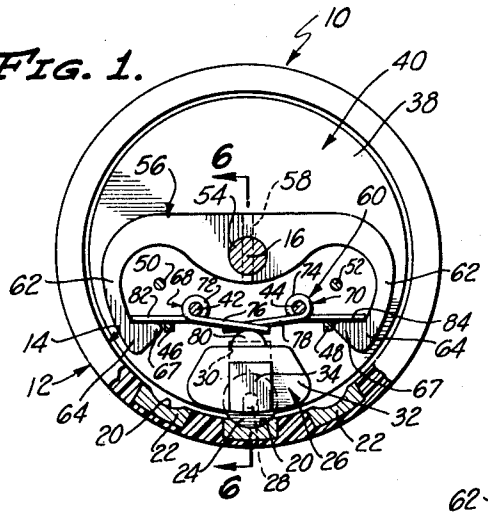


FIG. 6.

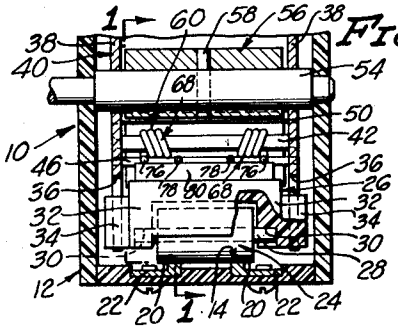


FIG. 2.

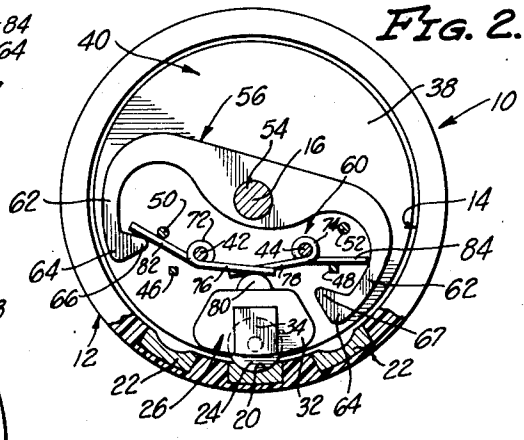


FIG. 3.

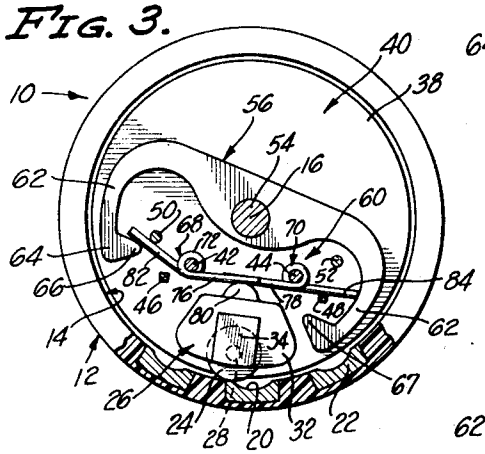


FIG. 4.

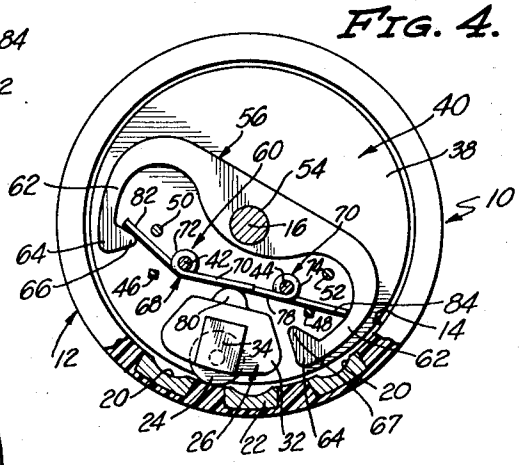
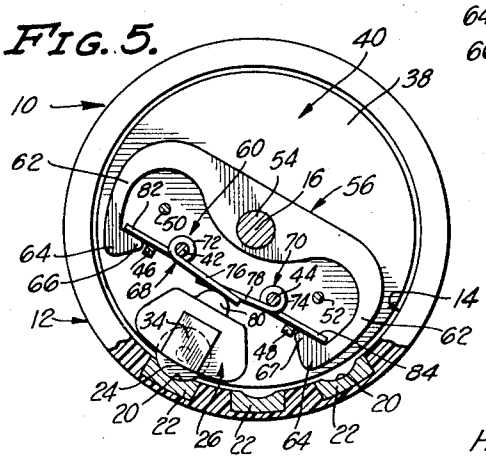


FIG. 5.



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2,945,927

ROTARY SWITCH WITH COMMON ADVANCING AND PRESSURE SPRINGS

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8 Claims. (Cl. 200—66)

The present invention relates in general to electric switches and, more particularly, to a rotary switch which operates with a snap action, produced by energy stored in a spring or system of springs, to make and break contact quickly so as to minimize arcing, which operates in a positive manner in the sense that the movable contact snaps from one operative position to another without any possibility of hesitating between such positions, which operates in this manner irrespective of how the switch may be manipulated by its operator and irrespective of vibration, which provides a positive "feel" so that, when the switch is operated manually, the operator can readily determine that the switch has advanced from one operative position to another, and the like.

Still more particularly, the invention relates to a switch which is similar to and achieves the results attainable with those disclosed in my Patents Nos. 2,831,073, 2,831,081 and 2,831,082, all granted April 15, 1958, a general object of the invention being to provide a switch which is an improvement on those disclosed in said patents.

Even more particularly, the present invention relates to a switch which in certain respects is an improvement on those disclosed in my copending patent application Serial No. 710,796, filed January 23, 1958, of which this application is a continuation in part.

Considering the switch of the present invention in a general way, it includes: an arcuate contact path having a center of curvature and having circumferentially spaced recesses therein and having thereon at least one stationary contact in which one of said recesses is formed, there normally, but not necessarily, being a stationary contact at each recess position; a contact carrier movable adjacent and parallel to the contact path; a movable contact, preferably a roller contact, carried by the contact carrier and engaging and movable along the contact path and receivable in each of the recesses therein; actuating means movable about the center of curvature of the contact path for moving the contact carrier adjacent and parallel to the contact path, the actuating means including a rotor and a rotor actuator rotatable relative to the rotor about an axis through the center of curvature of the contact path, the contact carrier being carried by the rotor and being movable relative thereto toward and away from the contact path along a carrier path extending radially from the center of curvature; and spring means mounted on the rotor at a location spaced from the center of curvature of the contact path and interconnecting the rotor, the rotary actuator and the contact carrier, and providing a resilient lost-motion connection between the rotor and the rotary actuator, for transmitting rotation of the rotary actuator to the rotor after limited rotation of the rotary actuator relative to the rotor, and for biasing the contact carrier toward the contact path so as to bias the roller contact into engagement with the contact path, such spring means including arms mounted on the rotor at the location mentioned and engaging the rotor, the rotary actuator and the contact carrier.

An important object of the present invention is to provide a switch of the foregoing character wherein the spring means engages the rotary actuator at a point remote from the center of curvature of the contact path, i.e., at a point spaced from the center of curvature a distance approaching the distance that the contact path itself is spaced therefrom, to provide maximum leverage for the rotary actuator.

Another important object is to provide a rotary switch of the foregoing nature wherein the spring means includes one or more springs, each of which engages the rotary actuator and the rotor to perform the function of transmitting rotation of the rotary actuator to the rotor after limited rotation of the rotary actuator relative to the rotor, and each of which also engages the contact carrier to perform the function of biasing the contact carrier toward the contact path so as to bias the roller contact into engagement with the contact path. Thus, the spring of the spring means, or each spring thereof, performs the dual function of advancing the roller contact from one recess to the next and of maintaining contact pressure, which is an important feature.

Another object is to provide a switch wherein the spring of the spring means, or each spring thereof, includes two arms one engaging the contact carrier to maintain contact pressure and the other engaging the rotary actuator and the rotor to advance the roller contact.

An important object is to provide a construction wherein the "advancing" arm engages the rotary actuator at a point remote from the center of curvature of the contact path, i.e., at a point spaced from the center of curvature a distance approaching the distance that the contact path itself is spaced from the center of curvature, to provide maximum leverage for the rotary actuator.

Another object is to provide a construction wherein each advancing arm is generally perpendicular to the radial carrier path and is engageable with the rotary actuator adjacent its outer or free end to locate the point of engagement with the rotary actuator a maximum distance from the center of curvature of the contact path to obtain maximum leverage

Another object is to provide a switch wherein each "pressure" arm is also generally perpendicular to the radial carrier path and is engageable with the contact carrier, each spring being mounted on the rotor at the junction of the advancing and pressure arms thereof and intermediate the point of engagement of the advancing arm with the rotary actuator and the point of engagement of the pressure arm with the contact carrier so that the advancing and pressure arms extend generally in opposite directions.

A further object is to provide a construction wherein each advancing and pressure spring is a torsion spring having a coil mounted on the rotor and having advancing and pressure arms which extend generally in opposite directions and which are transverse to the radial carrier path.

Still another object is to provide a switch wherein each advancing arm is movable, by rotation of the rotary actuator relative to the rotor, into engagement with an element on the rotor to "kick" the roller contact out of the particular recess in which it is disposed after limited rotation of the rotary actuator relative to the rotor. This results in displacement of the roller contact out of its recess in a positive manner and the energy stored in the advancing and pressure spring, or springs, then causes the roller contact to "jump" to the next recess.

The foregoing objects, advantages, features and results of the present invention, together with various other objects, advantages, features and results thereof which will be evident to those skilled in the switch art in the light of this disclosure, may be attained with the exemplary embodiment of the invention described in detail

hereinafter and illustrated in the accompanying drawing, in which:

Figs. 1 to 5 are semidiagrammatic, transverse sectional views illustrating a rotary switch which embodies the invention and illustrating successive events in one operating cycle thereof, Figs. 1 to 5 being taken along the arrowed line 1—1 of Fig. 6; and

Fig. 6 is a longitudinal sectional view taken as indicated by the arrowed line 6—6 of Fig. 1.

As previously indicated, the drawing illustrates a rotary switch embodying the invention semidiagrammatically. This has been done for purposes of simplification and to better illustrate the principles involved, attention being directed to the aforementioned patents and the aforementioned copending application for structural details which may be incorporated in the embodiment semidiagrammatically disclosed herein.

The embodiment of the rotary switch of the invention which is illustrated in the drawing is designated generally by the numeral 10 and includes a housing 12 of any suitable construction. The housing 12 provides an arcuate contact path 14 similar to that of my aforementioned copending patent application Serial No. 710,796 and having a center of curvature 16 on the axis 18 of the switch 10. The contact path 14 is provided therein with circumferentially spaced, concave recesses 20 facing the center of curvature 16. While only three recesses 20 are shown, it will be understood that there may be any number of such recesses and that they may be spaced entirely around the contact path 14.

In the construction illustrated, each recess 20 is formed in a pair of axially spaced contacts 22 adapted, as best shown in Fig. 6, to be bridged by a roller contact 24 receivable in the recess 20 formed in each pair of contacts 22. The pairs of contacts 22 are shown as separated and electrically insulated from each other by an electrical insulating material which forms the circumferential wall of the housing 12, and the contacts 22 of the particular pair shown in Fig. 6 are similarly shown as separated and electrically insulated from each other by such circumferential wall. It will be understood that all of the contacts 22 may be separated and electrically insulated from each other in this fashion, or that they may be interconnected in various ways, depending upon the circuitry to be controlled by the switch 10. For example, the contacts 22 at one end of the switch 10 may be separated and electrically insulated from each other and from the contacts 22 at the other end of the switch, and the contacts at such other end may be electrically interconnected. Various other stationary contact patterns may be employed also, depending upon the use to which the switch 10 is to be put.

The roller contact 24 is disposed in a shell-like contact carrier 26 similar to that disclosed in my aforementioned copending application, the roller contact projecting from one side of the contact carrier into engagement with the contact path 14. The roller contact 24 is mounted on an axle 28 the ends of which are disposed in notches 30 in end walls 32 of the contact carrier 26, whereby the roller contact rolls freely along th contact path 14.

The contact carrier 26 is provided on its end walls 32 with radial keys 34 respectively disposed in radial notches or keyways 36 in axially spaced, circular end plates 38 which constitute a rotor 40 of the switch 10. As will be apparent, the keys 34 are radially movable in the keyways 36 to permit radial movement of the contact carrier 26 relative to the rotor 40 along a carrier path which intersects the center of curvature 16. The contact carrier 26 moves radially inwardly along the carrier path as the roller contact 24 moves out of each recess 20, and moves radially outwardly along such path as the roller contact moves into the next recess on the contact path 14.

The end plates 38 of the rotor 40 are interconnected

and held in axially spaced relation by spring-carrying pins 42 and 44 and by stop pins 46 and 48 and "kicker" pins 50 and 52. The terminology just utilized to describe the various pins 42, 44, 46, 48, 50 and 52 is suggestive of the functions performed by these pins, which functions will be considered hereinafter.

The end plates 38 of the rotor 40 are rotatably mounted on a shaft 54 which, in turn, is rotatably mounted on the housing 12 of the switch 10, all as shown in Fig. 6 of the drawing. The shaft 54 is adapted to be rotated in any suitable manner, e.g., manually by means of a knob, not shown, fixed thereon externally of the housing 12, and carries a rotary actuator 56. The actuator 56 may be fixed on the shaft 54 in any suitable manner, as by means of a pin 58, or it may be formed integrally therewith.

The rotor 40 and the rotary actuator 56 together form an actuating means movable about the center of curvature 16 of the contact path 14 for moving the contact carrier 26 along a path adjacent and parallel to the contact path so as to move the roller contact 24 from one of the recesses 20 to the next. Spring means 60 mounted on the rotor 40 interconnects the rotor, the rotary actuator 56 and the contact carrier 26 and provides a resilient lost-motion connection between the rotor and the rotary actuator, this spring means, as hereinafter described, serving to transmit rotation of the rotary actuator to the rotor after limited rotation of the rotary actuator relative to the rotor, and serving also to bias the contact carrier toward the contact path 14 so as to bias the roller contact into engagement with the contact path.

Considering the rotary actuator 56 in more detail, it is generally U-shaped and includes two arms 62 which receive the various pins 42, 44, 46, 48, 50 and 52 of the rotary 40 therebetween. The ends 64 of the arms 62 are turned inwardly toward each other and provide "kickers" 66 and 67, the functions of which will be described hereinafter.

The spring means 60 includes springs 68 and 70 respectively mounted on the spring-carrying pins 42 and 44 of the rotor 40. There may be one of the springs 68 located at the midpoint of the pin 42 and one of the springs 70 located at the midpoint of the pin 44, although there may be pluralities of these springs spaced along the respective pins. In the particular construction illustrated, there are two of the springs 68 adjacent the respective ends of the pin 42 and there are two of the springs 70 adjacent the respective ends of the pin 44. However, the number of springs 68 and 70 on the respective pins 42 and 44 may be varied.

The springs 68 and 70 are shown as torsion springs respectively having coils 72 and 74 respectively encircling the pins 42 and 44. The coils 72 and 74 respectively terminate in "pressure" arms 76 and 78 which engage a convex spring seat 80 on the contact carrier 26, this spring seat being located on the radial path of contact-carrier movement. The coils 72 and 74 respectively terminate at their other ends in "advancing" arms 82 and 84 which extend in directions generally opposite to the respective directions in which the pressure arms 76 and 78 extend. The advancing arms 82 and 84 normally engage the kickers 66 and 67, respectively, and the stop pins 46 and 48, respectively, and are engageable with the kicker pins 50 and 52, respectively, upon rotation of the rotary actuator 56 relative to the rotor 40 in the clockwise and counterclockwise directions, respectively.

The springs 68 and 70 are so stressed that the pressure arms 76 and 78 are biased into engagement with the spring seat 80 on the contact carrier 26 to bias the contact carrier toward the contact path 14, and thus to bias the roller contact 24 into positive engagement with the contact path. This stressing of the springs 68 and 70 is also such that the advancing arms 82 and 84 are

biased into engagement with the kickers 66 and 67, respectively. Normally, i.e., when the rotary actuator 56 is in a centered or neutral position relative to the rotor 40, the advancing arms 82 and 84 are biased into engagement with the stop pins 46 and 48, respectively.

Operation

The operation of the switch 10 is the same for both directions of rotation of the actuating means formed by the rotary actuator 56 and the rotor 40. Consequently, only clockwise rotation, as viewed in the drawing, will be considered hereinafter. As a matter of convenience, the switch 10 will be regarded as including only one of the springs 68 and one of the springs 70, although, as hereinbefore discussed, there may be more than one of each.

Initial rotation of the shaft 54 results in rotation of the rotary actuator 56 relative to the rotor 40, as will readily be apparent from a comparison of Figs. 1 and 2 of the drawings. As the actuator 56 rotates relative to the rotor 40, the kicker 66 moves the advancing arm 82 away from stop pin 46 and toward the kicker pin 50, thereby increasing the stress in the spring 68 so that the pressure arm 76 increases the contact pressure, i.e., increases the force biasing the roller contact 24 into engagement with the contact path 14, thereby more firmly holding the roller contact in the particular recess 20 in which it is disposed. The foregoing results in no change in the stress in the spring 70 since, although the advancing arm 84 thereof is disengaged by the kicker 67, the stop pin 48 maintains the original stress therein.

Referring to Fig. 2, the kicker 66 ultimately displaces the advancing arm 82 into engagement with the kicker pin 50, such engagement marking the limit of the lost-motion connection between the actuator 56 and the rotor 40. Continued rotation of the actuator 56 now results in rotation of the rotor 40 through the kicker 66, the advancing arm 82 and the kicker pin 50, as will be apparent from a comparison of Figs. 2 and 3 of the drawing. Consequently, the roller contact 24 is forced out of the recess 20 in which it is disposed, the contact carrier 26 moving radially inwardly to permit this, thereby increasing the stresses in the springs 68 and 70. At this point, the roller contact 24 is in engagement with a portion of the contact path 14 between two of the recesses 20, which portion may be termed a "raceway." This raceway is formed of electrical insulating material and is located out of circumferential alignment with the contacts 22 of each pair so that the roller contact 24 does not track metal from the contacts 22 onto the raceway and so that the portions of the roller contact 24 which engage the contacts 22 do not pick up foreign matter from the raceway, all as explained in my copending application Serial No. 710,796.

The energy stored in the springs 68 and 70 now causes the roller contact 24 to roll along the raceway between two of the recesses 20 at high speed, the springs causing the rotor 40 to rotate relative to the actuator 56 to accomplish this. As will be evident from a comparison of Figs. 3 and 4 of the drawing, the rotor 40 has been rotated relative to the actuator 56 by the energy stored in the springs 68 and 70, the actuator 56 being substantially in its new centered or neutral position corresponding to the recess 20 toward which the roller contact 24 is rolling.

Ultimately, as shown in Fig. 5, the roller contact 24 drops into the next recess 20, the pressure arms 76 and 78 of the springs 68 and 70 forcing the contact carrier 26 radially outwardly as this occurs. Now, the various parts occupy the same relative positions as in Fig. 1 of the drawing, except that the roller contact 24 has been advanced one step.

Summarizing the operation of the switch 10, the roller contact 24 is positively "kicked" out of the recess 20 in which it is disposed upon displacement of the advancing arm 82 into engagement with the kicker pin 50 by the kicker 66, the roller contact being firmly held in the recess in which it is disposed until this occurs. After the roller contact 24 has been kicked out of the recess in which it was originally disposed, the energy stored in the springs 68 and 70 causes the roller contact to jump to the next recess very rapidly to minimize arcing, this occurring without any necessity for further movement of the rotary actuator 56.

Thus, the switch 10 operates with a snap action to provide a fast break and a fast make to minimize arcing operates in a positive manner in a sense that the roller contact 24 jumps from one operative position to the next without any possibility of hesitating therebetween, operates in this manner irrespective of how the switch may be manipulated after the roller contact is forced out of the recess 20 in which it was disposed, provides a positive "feel" so that the operator can readily tell that the roller contact has advanced from one recess to the next, is vibration proof in that even severe vibration will not cause the roller contact to move from one recess to the next, and the like.

It will be noted that the springs 68 and 70 perform dual functions, in that they serve both as pressure springs to maintain contact pressure between the roller contact 24 and the stationary contacts 22, and as advancing springs for advancing the roller contact from one set of stationary contacts to the next. Thus, a considerable simplification of the spring system is provided, which is an important feature. Also, since the springs 68 and 70 are utilized for advancing the roller contact 24, as well as for maintaining contact pressure, the act of advancing to the point at which the roller contact is about to be kicked out of the recess 20 in which it is disposed results in an increase in contact pressure over and above that normally provided by the springs. Thus, variations in spring size, spring rate, and the like, do not result in unbalance and an inherently balanced spring system is achieved, which is an important feature.

Another important feature of the switch 10 is that the pressure and advancing arms 76 and 82 of the spring 68 extend in generally opposite directions and are generally perpendicular to the radial contact-carrier path, the same being true of the pressure and advancing arms 78 and 84 of the spring 70. This locates the outer or free ends of the advancing arms 82 and 84 at points remote from the center of curvature 16 of the contact path 14 and thus permits remotely locating the kickers 66 and 67 relative to the center of curvature. Preferably, the kickers 66 and 67 are located radially outwardly from the center of curvature 16 distances approaching the distance that the contact path 14 is located radially outwardly therefrom, the kickers 66 and 67 being located radially outwardly from the center of curvature, a distance more than half the radius of the contact path. This results in maximum leverage for the rotary actuator 56 and reduces the input torque that must be applied to the shaft 54 to operate the switch 10, which is an important feature.

Although an exemplary embodiment of the invention has been disclosed herein for purposes of illustration, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiment without departing from the spirit of the invention as defined by the claims which follow.

I claim:

1. In a switch, the combination of: an arcuate contact path having a center of curvature and having circumferentially spaced, stationary contacts thereon; a contact carrier movable adjacent and parallel to said contact path; a movable contact carried by said contact carrier and engageable with each of said stationary contacts; actuating means movable about said center of curvature of

said contact path for moving said contact carrier adjacent and parallel to said contact path, said actuating means including a rotor and a rotary actuator rotatable relative to said rotor about said center of curvature of said contact path, said contact carrier being carried by said rotor and being movable relative thereto toward and away from said contact path along a path extending radially from said center of curvature; and spring means mounted on said rotor and interconnecting said rotor, said rotary actuator and said contact carrier, and providing a resilient lost-motion connection between said rotor and said rotary actuator, for transmitting rotation of said rotary actuator to said rotor after limited rotation of said rotary actuator relative to said rotor, and for biasing said contact carrier toward said contact path so as to bias said movable contact into engagement with said contact path, said spring means including at least one spring mounted on said rotor and having one arm engaging said contact carrier and another arm engaging said rotary actuator and said rotor, said other arm engaging said rotary actuator at a point sped from said center of curvature a distance approaching the distance said contact path is spaced therefrom.

2. In a switch, the combination of: an arcuate contact path having a center of curvature and having circumferentially spaced recesses therein and having thereon at least one stationary contact in which one of said recesses is formed; a contact carrier movable adjacent and parallel to said contact path; a roller contact carried by said contact carrier and engaging and movable along said contact path and receivable in each of said recesses; actuating means movable about said center of curvature of said contact path for moving said contact carrier adjacent and parallel to said contact path, said actuating means including a rotor and a rotary actuator rotatable relative to said rotor about said center of curvature of said contact path, said contact carrier being carried by said rotor and being movable relative thereto toward and away from said contact path along a path extending radially from said center of curvature; and spring means mounted on said rotor and interconnecting said rotor, said rotary actuator and said contact carrier, and providing a resilient lost-motion connection between said rotor and said rotary actuator, for transmitting rotation of said rotary actuator to said rotor after limited rotation of said rotary actuator relative to said rotor, and for biasing said contact carrier toward said contact path so as to bias said roller contact into engagement with said contact path, said spring means including at least one spring mounted on said rotor and having one arm engaging said contact carrier and another arm engaging said rotary actuator and said rotor, said other arm engaging said rotary actuator at a point spaced from said center of curvature a distance approaching the distance said contact path is spaced therefrom.

3. In a switch, the combination of: an arcuate contact path having a center of curvature and having circumferentially spaced recesses therein and having thereon at least one stationary contact in which one of said recesses is formed; a contact carrier movable adjacent and parallel to said contact path; a roller contact carried by said contact carrier and engaging and movable along said contact path and receivable in each of said recesses; actuating means movable about said center of curvature of said contact path for moving said contact carrier adjacent and parallel to said contact path, said actuating means including a rotor and a rotary actuator rotatable relative to said rotor about said center of curvature of said contact path, said contact carrier being carried by said rotor and being movable relative thereto toward and away from said contact path along a path extending radially from said center of curvature; and spring means mounted on said rotor and interconnecting said rotor, said rotary actuator and said contact carrier, and providing a resilient lost-motion connection between said rotor and said rotary actuator, for transmitting rotation of said rotary actuator to said rotor after limited rotation of said rotary actuator relative to said rotor, and for biasing said contact carrier toward said contact path so as to bias said roller contact into engagement with said contact path, said spring means including at least one torsion spring having a coil mounted on said rotor and having one arm engaging said contact carrier and another arm engaging said rotary actuator and said rotor, said other arm engaging said rotary actuator at a point sped from said center of curvature a distance approaching the distance said contact path is spaced therefrom.

4. In a switch, the combination of: an arcuate contact path having a center of curvature and having circumferentially spaced recesses therein and having thereon at least one stationary contact in which one of said recesses is formed; a contact carrier movable adjacent and parallel to said contact path; a roller contact carried by said contact carrier and engaging and movable along said contact path and receivable in each of said recesses; actuating means movable about said center of curvature of said contact path for moving said contact carrier adjacent and parallel to said contact path, said actuating means including a rotor and a rotary actuator rotatable relative to said rotor about said center of curvature of said contact path, said contact carrier being carried by said rotor and being movable relative thereto toward and away from said contact path along a carrier path extending radially from said center of curvature; and spring means mounted on said rotor and interconnecting said rotor, said rotary actuator and said contact carrier, and providing a resilient lost-motion connection between said rotor and said rotary actuator, for transmitting rotation of said rotary actuator to said rotor after limited rotation of said rotary actuator relative to said rotor, and for biasing said contact carrier toward said contact path so as to bias said roller contact into engagement with said contact path, said spring means including at least one spring mounted on said rotor and having one arm engaging said contact carrier and another arm engaging said rotary actuator and said rotor, said arms extending in generally opposite directions and extending generally transversely of said carrier path.

5. In a switch, the combination of: an arcuate contact path having a center of curvature and having circumferentially spaced recesses therein and having thereon at least one stationary contact in which one of said recesses is formed; a contact carrier movable adjacent and parallel to said contact path; a roller contact carried by said contact carrier and engaging and movable along said contact path and receivable in each of said recesses; actuating means movable about said center of curvature of said contact path for moving said contact carrier adjacent and parallel to said contact path, said actuating means including a rotor and a rotary actuator rotatable relative to said rotor about said center of curvature of said contact path, said contact carrier being carried by said rotor and being movable relative thereto toward and away from said contact path along a carrier path extending radially from said center of curvature; and spring means mounted on said rotor and interconnecting said rotor, said rotary actuator and said contact carrier, and providing a resilient lost-motion connection between said rotor and said rotary actuator, for transmitting rotation of said rotary actuator to said rotor after limited rotation of said rotary actuator relative to said rotor, and for biasing said contact carrier toward said contact path so as to bias said roller contact into engagement with said contact path, said spring means including at least one spring mounted on said rotor and having one arm engaging said contact carrier and another arm engaging said rotary actuator and said rotor, said arms extending in generally opposite directions and extending generally transversely of said carrier path, said other arm engaging said rotary actuator at a point spaced from said

center of curvature a distance approaching the distance said contact path is spaced therefrom.

6. In a switch, the combination of: an arcuate contact path having a center of curvature and having circumferentially spaced recesses therein and having thereon at least one stationary contact in which one of said recesses is formed; a contact carrier movable adjacent and parallel to said contact path, a roller contact carried by said contact carrier and engaging and movable along said contact path and receivable in each of said recesses; actuating means movable about said center of curvature of said contact path for moving said contact carrier adjacent and parallel to said contact path, said actuating means including a rotor and a rotary actuator rotatable relative to said rotor about said center of curvature of said contact path, said contact carrier being carried by said rotor and being movable relative thereto toward and away from said contact path along a carrier path extending radially from said center of curvature; and spring means mounted on said rotor and interconnecting said rotor, said rotary actuator and said contact carrier, and providing a resilient lost-motion connection between said rotor and said rotary actuator, for transmitting rotation of said rotary actuator to said rotor after limited rotation of said rotary actuator relative to said rotor, and for biasing said contact carrier toward said contact path so as to bias said roller contact into engagement with said contact path, said spring means including at least one torsion spring having a coil mounted on said rotor and having one arm engaging said contact carrier and another arm engaging said rotary actuator and said rotor, said arms extending in generally opposite directions and extending generally transversely of said carrier path, said other arm engaging said rotary actuator at a point spaced from said center of curvature a distance approaching the distance said contact path is spaced therefrom.

7. In a switch, the combination of: an arcuate contact path having a center of curvature and having circumferentially spaced recesses therein and having thereon at least one stationary contact in which one of said recesses is formed; a contact carrier movable adjacent and parallel to said contact path; a roller contact carried by said contact carrier and engaging and movable along said contact path and receivable in each of said recesses; actuating means movable about said center of curvature of said contact path for moving said contact carrier adjacent and parallel to said contact path, said actuating means including a rotor and a rotary actuator rotatable relative to said rotor about said center of curvature of said contact path, said contact carrier being carried by said rotor and being movable relative thereto toward and away from said contact path along a path extending radially from said center of curvature; and spring means mounted on said rotor and interconnecting said rotor, said rotary actuator and said contact carrier, and providing a resilient lost-motion connection between said rotor and said rotary actuator, for transmitting rotation of said rotary actuator to said rotor after limited rotation of said rotary actuator relative to said rotor, and for biasing said contact carrier toward said contact path so as to bias said roller contact into engagement with said contact path, said spring means engaging said rotary actuator at a point spaced from said center of curvature a distance approaching the distance said contact path is spaced therefrom.

8. In a switch, the combination of: an arcuate contact path having a center of curvature and having circumferentially spaced recesses therein and having thereon at least one stationary contact in which one of said recesses is formed; a contact carrier movable adjacent and parallel to said contact path; a roller contact carried by said contact carrier and engaging and movable along said contact path and receivable in each of said recesses; actuating means movable about said center of curvature of said contact path for moving said contact carrier adjacent and parallel to said contact path, said actuating means including a rotor and a rotary actuator rotatable relative to said rotor about said center of curvature of said contact path, said contact carrier being carried by said rotor and being movable relative thereto toward and away from said contact path along a path extending radially from said center of curvature; and spring means mounted on said rotor and interconnecting said rotor, said rotary actuator and said contact carrier, and providing a resilient lost-motion connection between said rotor and said rotary actuator, for transmitting rotation of said rotary actuator to said rotor after limited rotation of said rotary actuator relative to said rotor, and for biasing said contact carrier toward said contact path so as to bias said roller contact into engagement with said contact path, said spring means including at least one spring mounted on said rotor and having one arm engaging said contact carrier and another arm engaging said rotary actuator and said rotor, said other arm engaging said rotary actuator at a point spaced from said center of curvature a distance approaching the distance said contact path is spaced therefrom, and said other arm engaging said rotor intermediate said point at which it engages said rotary actuator and the point at which said spring is mounted on said rotor.

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