United States Patent

[11] 3,569,655

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[54] **ROLLER-ACTUATED SWITCH-OPERATING ASSEMBLY**
12 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **200/172,** 200/67, 200/153
[51] **Int. Cl.** **H01h 13/28**
[50] **Field of Search** 200/67, 153.19, 68, (166SD), (172A); 74/96, 97, 107

[56] **References Cited**

UNITED STATES PATENTS

2,267,203	12/1941	Krieger	200/67.7(UX)
2,506,196	5/1950	Bourne	200/68
3,399,285	8/1968	Haderer	200/67.7

FOREIGN PATENTS

580,865	6/1933	Germany	200/67.7

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ABSTRACT: Actuator assembly for actuating a plurality of pushbutton switches from a single toggle lever having a roller mounted thereon includes a pivoted rocker member having switch-button-actuating portions on its ends and a pair of opposed side flanges which are pivotally mounted to a support. Each of the side flanges includes a series of five holes spaced in a curved path along its length and adapted to receive and support one or more rod or roller members which may engage the lever-mounted roller for nonteasable actuation of the switches. By selectively mounting rods in one or more sets of opposed holes, the toggle lever can be alternatively caused to have nonteasable maintained contact at both ends of its movement, momentary contact at both ends, or maintained contact at one end and momentary contact at the other. In addition, where the assembly is to provide a maintained contact at both ends of its movement, it can be assembled so as to have a center "off" position if desired.

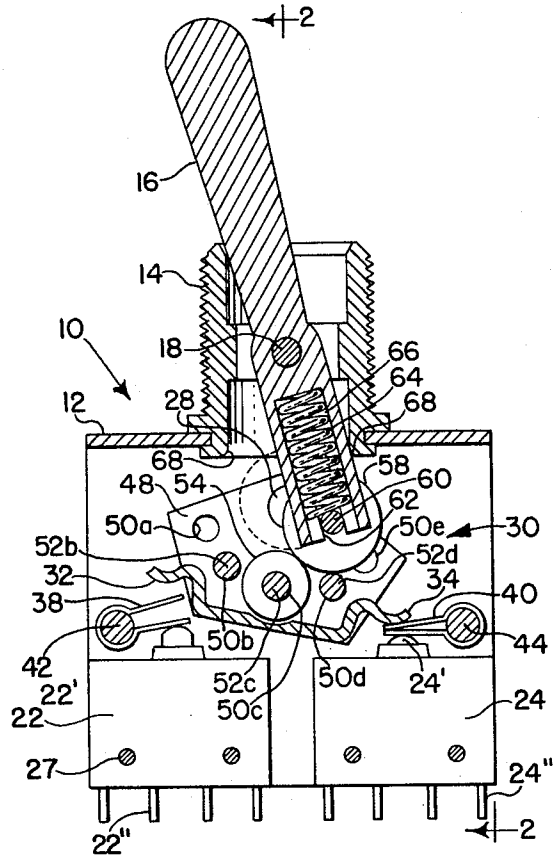


Fig. 1

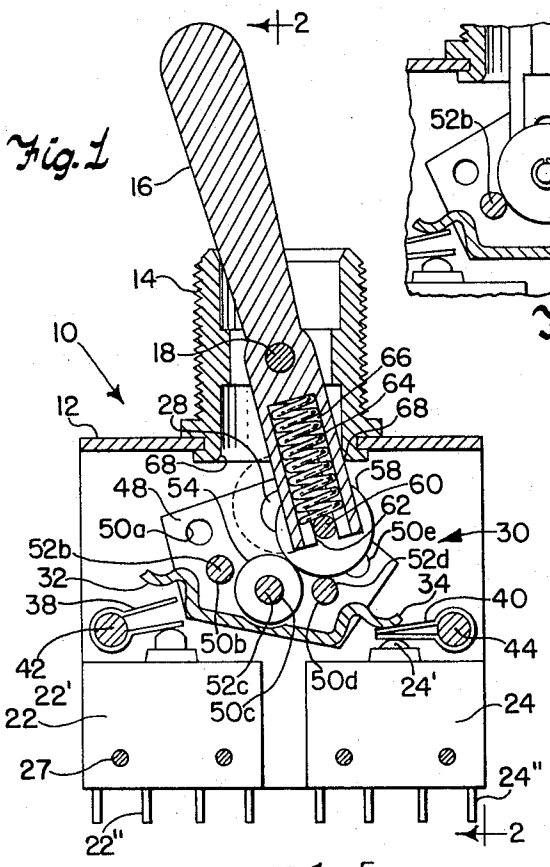


Fig. 5

Fig. 2

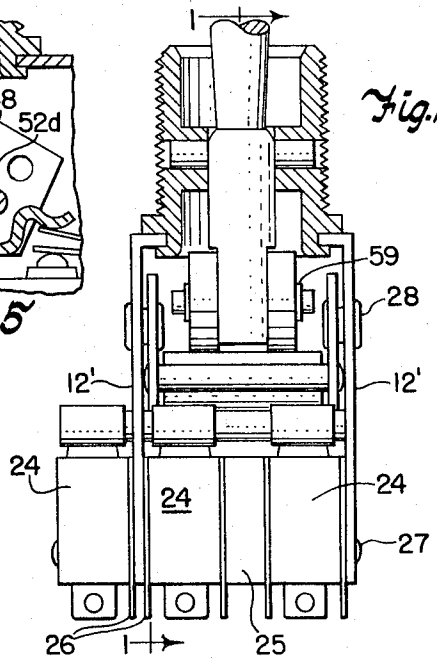


Fig. 3

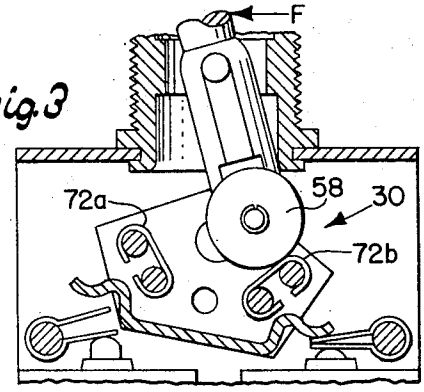


Fig. 4

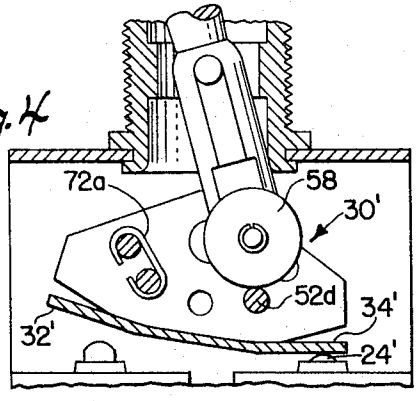


Fig. 6

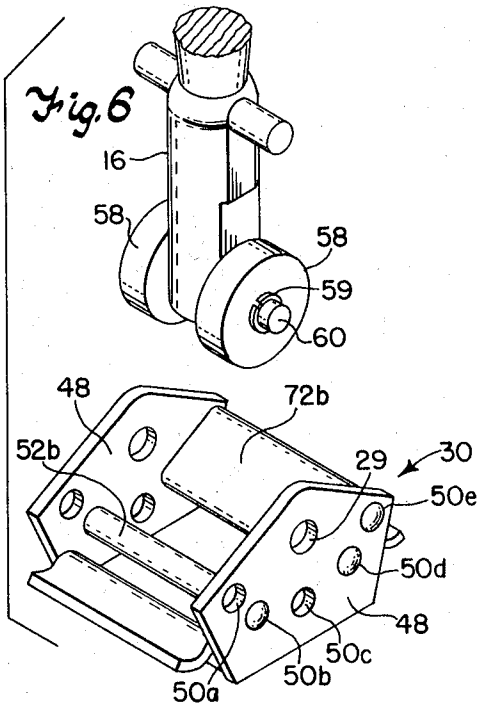
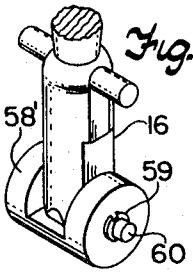


Fig. 7



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ROLLER-ACTUATED SWITCH-OPERATING ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electrical switches and particularly to an actuator assembly which can be alternatively assembled so as to operate switches associated with it in a maintained action mode, a momentary action mode or a combination of both.

2. Description of the Prior Art

Electrical toggle switches having a capability of being modified to operate in various modes of operation are known as evidenced by U.S. Pat. No. 2,506,196. In this patent a plurality of complete cam assemblies may be alternatively pinned to a rocker member and engaged by sliding contact with a ball mounted in a toggle lever. By requiring a separate and distinctively shaped cam member to be produced for each mode of operation desired in U.S. Pat. No. 2,506,196, it follows that an extensive amount of material, tooling, and separate parts must be kept in inventory to produce switches having all of the various modes of operation desired. Other patents, such an U.S. Pat. Nos. 2,633,510; 2,780,691 and 3,322,914, show the use of a single roller member within a switch housing which coacts with a cam surface to operate one or more sets of switch contacts.

SUMMARY

It is an object of the present invention to provide an actuator assembly which can be easily modified to permit the switch to provide maintained, momentary, or a combination of maintained and momentary operation.

It is another object of this invention to provide a switch actuating assembly which is economical and requires a minimum number of parts.

It is an additional object of this invention to provide an actuator assembly which has a minimal degree of friction between its moving parts and is nonteasable.

It is a further object of this invention to provide an actuating assembly which exerts sufficient force to actuate a plurality of switches at one time.

These objects are attained by the actuator assembly of the present invention wherein the actuator assembly includes a first movable member comprising a pivoted toggle lever having a single roller or a pair of rollers mounted at one end and spaced from the pivot in spring-biased engagement with one or more rod or rollerlike members mounted on a pivoted rocker member. The rocker member includes a pair of axially spaced side flanges having a plurality of aligned holes therein, preferably five, into which rods may be selectively placed depending upon the mode of operation of the switches desired. The holes are arranged generally along a curved line. Actuator portions on the opposite ends of the rocker member are adapted to be alternatively moved into engagement with adjacently disposed pushbuttons of a plurality of switches which are mounted in a fixed position relative to the rocker member pivot point.

In one embodiment of the invention, the toggle lever can provide maintained contact operation in either of its two extreme positions by placing a rod with a roller mounted on it in the center hole alone or a rod and roller in the center hole and rods in the two adjacent holes. However, when only a center roller is used, the force available for actuating the switches is greatly reduced since the moment arm at which the force is applied is much shorter. By removing the center rod (and roller) and having rods mounted only in the two holes adjacent the center hole, the toggle lever will operate to provide maintained contact operation in either of its extreme positions and will also have a center "off" position where the rocker member is held out of engagement with the switches at either of its ends. By placing rods only in the adjacent pairs of holes at each end of the rocker member and placing a smooth surfaced means such as a metal band in contact with each of the pairs of rods, the toggle lever can operate the switches in a momentary fashion at either extreme of its operating movement or can be moved to a centered "off" position. Finally, by placing rods in the adjacent pair of holes at one end of the rocker and placing a smooth surfaced member around them and by placing a roller in the hole between the center hole and the hole at the opposite end of the rocker, the toggle lever can be made to have momentary action in one direction and maintained action in the other together with a center "off" position.

Since the maintained action mode of operation of the actuator assembly is provided by engagement and overcenter movement of a pair of rollers mounted for rotation at points spaced from the pivot points of their supports, it will be readily appreciated that such mode of operation will be extremely nonteasable. This is so since the roller-roller engagement is unstable and because all of the friction between the two engaging members is rolling rather than sliding friction. Therefore, the rollers will immediately snap over each other as they reach their overcenter position. The tendency to snap over is enhanced by the fact that the rollers exert their maximum pressure on each other at their overcenter position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side sectional view of a switch housing incorporating the improved actuator assembly in a form capable of providing two positions of maintained actuation, taken on the line 1–1 of FIG. 2, except that the working parts other than the toggle lever are left whole;

FIG. 2 is an end sectional view taken on the line 2–2 of FIG. 1 showing the toggle lever in the instantaneous position assumed as the rollers move overcenter;

FIG. 3 is a side sectional view similar to FIG. 1 showing a modified form of actuator assembly wherein the toggle lever has a maintained center "off" position and two nonmaintained or momentary positions of actuation at its ends;

FIG. 4 is a side sectional view similar to FIG. 1 showing another modification of the actuator assembly wherein the toggle lever has a maintained position of actuation at one end of its movement, a momentary position of actuation at its other extreme of movement and a maintained "off" position at its center between the maintained and momentary positions;

FIG. 5 is a fragmentary side sectional view similar to FIG. 1 showing a modification of the actuator assembly of FIG. 1 in which the center roller is omitted to provide a center "off" position;

FIG. 6 is an exploded perspective view showing the relationship between the toggle lever and its rollers and the actuator or rocker member; and

FIG. 7 is a fragmentary perspective view showing a modification of the toggle mounted roller shown in FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The actuator assembly of the present invention can be seen in FIG. 1 wherein a switch housing indicated generally at 10 adapted to be assembled to a hole in a panel has a U-shaped metal support bracket member 12 and a bushing member 14 fastened to the bracket and adapted to receive a nut member (not shown). A toggle lever 16 is pivoted by means of a pivot pin 18 within the bushing 14. Mounted at the lower open end of the U-shaped bracket 12 to the bracket legs 12' are a plurality of individual miniature switches 22, 24 having pushbutton operator members 22' and 24' respectively. Where, as in FIG. 2, the width of the individual switches 24 is not a multiple of the distance between the legs 12' of the U-shaped bracket 12 a spacer member 25 may be inserted between a pair of switches. To insulate the downwardly extending switch terminals 22'', 24'' from the terminals of immediately adjacent switches and from the bracket legs 12', thin sheets of insulating material 26 may be provided. A plurality of switches 24 may be aligned with each other at opposite ends of the bracket 12 either within the bracket 12 or outside of it, and held to

each other and to the bracket **12** by rivets or other fastening means **27**. As seen in FIG. **2**, rivets **28** pass through aligned holes (not shown) in the legs **12'** of bracket **12** and into holes **29** (FIG. **6**) in a rocker or actuator member indicated generally at **30** to provide a pivot axis for the same. At the opposite ends of the lower portion of the rocker member **30** (FIG. **1**) are a pair of actuator arms, **32, 34** adapted to respectively engage elongated spring members **38, 40** mounted on rods **42, 44**, respectively attached to legs **12'**. Although the arms **32, 34** could engage the pushbuttons **22', 24'** directly as shown at **32'** and **34'** in FIG. **4**, it has been found that by using springs **38, 40** a wide range of manufacturing tolerances in the actuator member **30** and the switches **22, 24** can be accommodated.

The rocker member **30** includes a pair of parallel end plates **48** containing five aligned holes **50***a*, **50***b*, **50***c*, **50***d* and **50***e*. Depending upon the desired mode of operation of the actuator assembly, rod members **52** can be inserted in the holes **50** as shown at **52***b*, **52***c* and **52***d* in FIG. **1**. The rod members **52** are loosely mounted in the holes **50** and are prevented from falling out by being of a length just short of the distance between the legs **12'** of the bracket member **12**. In FIG. **1** a roller member **54** is mounted on the rod **52***c* for a purpose to be described later.

The rocker member **30** is pivoted about the axis of rivet **28** by a pair of axially aligned rollers **58** mounted by means of C-rings **59** on a shaft **60** movable axially of the lever **16** in slots **62** in the lower end of the lever. The rollers **58** are pressed downwardly with a relatively large force by means of spring **64** mounted in a recess **6** in toggle lever **16**. The pivotal movement of toggle lever **16** during actuation is limited by stop portions **68** formed on the lower end of bushing **14**.

When a large roller **54** is placed on rod **52***c* as shown in the embodiment of FIG. **1**, the toggle lever **16** will have two maintained positions of operation, namely, the one shown and another one wherein the lower end of the toggle lever **16** touches the lower left-hand stop portion **68** on the bushing **14**. Although the rocker member **30** can be pivoted to its two extreme positions by the coaction between rollers **58** and **54** alone, it has been found that such coaction alone would provide relatively little force at the ends of arms **32, 34** due to the short moment arm at the point where the force would be applied to roller **54** and would be incapable of actuating a large number of switches such as the six switches shown. However, by placing rod members **52***b* and **52***d* in the holes **50** *b* and **50***d* respectively, the total force imparted to rollers **58** by spring **64** as the rollers **58** are cammed upwardly by roller **54** is transferred instantly from the roller **54** to either rod **52***b* or rod **52***d* depending on the direction of actuation of the toggle lever **16**. Since the moment arm of forces applied to the rods **52***d* or **52***b* is much greater than the moment arm of forces applied to roller **54** it will be readily appreciated that the forces available for switch actuation at the arms **32, 34** are greatly increased over that available where rods **52***b* and **52***d* are not present and are sufficient to actuate a large number of switches **22, 24**.

In FIG. **3** the rocker **30** is shown as including rods **52***a*, **52***b*, **52***d*, and **52***e*. A metal member or band **72***a* is placed partially around the left-hand group of rods **52***a*, **52***b* and a similar member **72***b* is placed partially around the right-hand rods **52***d* and **52***e*. The center holes **50***c* are left open. Because of the smooth surface of members **72***a*, **72***b* and their downward slope, it can be readily seen that the rollers **58** will be pushed progressively upwardly against the spring **64** as the lever **16** is momentarily moved to either of its end positions. As soon as the lever **16** is released, the rollers **58** will immediately roll down the surface **72***a* or **72***b* and return to a centered position wherein each of the arms **32, 34** will be out of contact with the springs **38, 40** and the push buttons **22', 24'**. This type of actuation by lever **16** is commonly referred to as "momentary" action.

FIG. **4** shows a slightly different modification of an actuator assembly **30'** wherein a metal band **72***a* provides a momentary action when the rollers **58** are moved to the left. When the rollers **58** are moved to the right to the position shown, they will pass overcenter of the rod **52***d* and will thus provide a maintained position of actuation of the switch buttons **24'**. Since there is no rod in the center hole **50***c*, the toggle lever **16** will also have a third maintained "off" position in the center of its path of travel.

FIG. **5** illustrates a further embodiment of the invention wherein the roller **54** and the rod **52***c* shown in FIG. **1**, are removed in order to provide an actuator assembly which has two maintained positions of actuation and a center "off" position.

Since the rollers **58** of FIG. **6** only rotate over a small arc of revolution during actuation, it is unnecessary that they be mounted for 360° rotation. In FIG. **7**, the rollers **58** have been combined as a single roller with a hollowed out center portion which permits the limited degree of rotation required during actuation. By using one roller **58'** instead of two rollers **58**, it is possible to achieve an actuator assembly which eliminates any possibility of teasing which would be possible in the actuator shown in FIG. **6** if the axes of rod **60** and rod **52***b* were not mounted perfectly parallel. Referring to FIG. **6** it can be seen that if the rods **60** and **52***b* were not exactly parallel, then the two rollers **58, 58** could not engage the rod **52***b* on a common line parallel to its axis, but rather, would provide two overcenter operating points between which it might be possible to make the rollers **58, 58** remain (or be teased) without actuating the rocker **30**. By substituting a single elongated roller **58'** for the pair of separate rollers **58**, it becomes immaterial whether the rods **60, 52***b* are exactly parallel since there can be only one point of contact and thus one point of overcenter action between roller **58'** and rod **52***b*.

I claim:

1. An actuator assembly for simultaneously operating with a single pivoted toggle lever a plurality of separate switch devices mounted to a common housing comprising:

a rocking actuator member pivotally mounted on said housing;

at least one actuating arm portion at at least one end of said actuator member adapted to be selectively moved into operative engagement with a plurality of switch devices by movement of the toggle lever;

at least one toggle lever roller having its axis normal to the axis of said toggle lever and supported by said toggle lever for movement axially relative thereto as said toggle lever is moved between its two end extremes of movement;

a plurality of rod members mounted on said actuator member with their axes parallel to the axis of the said at least one toggle lever roller; and

means biasing said at least one toggle lever roller toward said rod members for applying a force to said at least one toggle lever roller which may be selectively transferred from at least one of said rod members to at least one other rod member to move said at least one actuating arm portion as said toggle lever is moved.

2. An actuator assembly as defined in claim **1** wherein said rocking actuator member comprises a pair of opposed sidewalls having a plurality of sets of aligned holes therein spaced from each other and from the pivot axis of the actuator member, said plurality of rod members being supported by at least some of said sets of aligned holes.

3. An actuator assembly as defined in claim **2** wherein said sidewalls of said actuator member include at least three sets of aligned holes.

4. An actuator assembly as defined in claim **2** wherein said sidewalls of said actuator member include five sets of aligned holes, said holes being arranged along a curved path and including a center hole, a pair of intermediate holes, and a pair of outer holes.

5. An actuator assembly as defined in claim **2** wherein said actuator member has rod members mounted in a center hole and the immediately adjacent holes on either side of said center hole, the center hole having its axis normal to a line which is also normal to the pivot axis of the actuator member, said line being normal to the length of the actuator member;

An actuator roller mounted on the center rod member, said actuator roller being operative to engage said at least one toggle lever roller and to compress said biasing means to a greater extent than said adjacent rod members whereby to cause said toggle lever and actuator member to snap to a maintained position of actuation at either of its extreme positions of travel and in a nonteasable manner as the axis of said toggle lever is first moved past the line containing the axis of the actuator pivot and the actuator roller and then moved past the line containing the axis of the actuator pivot and one of said adjacent rod members, the adjacent rod members being positioned relative to said actuator roller and the extremes of movement of said toggle lever so as to permit substantially all of the force generated by the compression of the biasing means by the actuator roller to be transferred to one of the adjacent rod members as the toggle lever is actuated.

6. An actuator assembly as defined in claim 2 wherein said actuator member has rod members mounted only in the sets of aligned holes immediately adjacent a center set of holes, said rod members being selectively operative to engage said at least one toggle lever roller and compress said biasing means to cause said toggle lever and actuator member to snap to a maintained position of actuation at one extreme of travel and in a nonteasable manner as the axis of said toggle lever is moved from a centered "off" position between said rod members and past the line containing the pivot axis of the actuator and the axis of one of said rod members.

7. An actuator assembly as defined in claim 2 wherein said actuator member has pairs of rod members mounted in adjacent sets of aligned holes at each end of the actuator member, and means carried by each of said pairs of rod members and engageable by said at least one toggle-mounted roller for providing a smooth path for the said at least one toggle roller as it is moved to its extreme positions, said at least one toggle roller having a diameter greater than the minimum distance between the intermost rod members of each of said pairs of rod members so as to be retained by said intermost rod members in a central "off" position, said at least one toggle roller being movable progressively further against said biasing means as said at least one toggle roller is moved into engagement with and along the length of said means carried by the rod members in response to force being applied to the toggle lever to move it to one of its extremes of movement, said toggle lever returning to its "off" position when said force is released.

8. An actuator assembly as defined in claim 7 wherein said means carried by each of said pairs of rod members comprises a band which at least partially encircles each of the rod members forming the pair.

9. An actuator assembly as defined in claim 2 wherein said actuator member has a pair of rod members mounted in adjacent sets of aligned holes at one end thereof, and means carried by said pair of rod members and engageable by said at least one toggle mounted roller for providing a smooth path for said at least one toggle roller and for moving said at least one toggle roller against its biasing means as it is moved by the momentary application of force to the toggle lever to one of its extreme positions, said actuator member further comprising a third rod member mounted at its opposite end in an aligned set of holes spaced from the innermost of said rod members comprising said pair by a distance less than the diameter of the said at least one toggle roller, said third rod member being engageable by said at least one toggle roller to compress said biasing means to cause said toggle lever and actuator member to snap to a maintained position of actuation in a nonteasable manner as the axis of said at least one toggle lever is moved from a centered "off" position between said pair of rod members and said third rod member to its extreme position past the line containing the axis of the actuator and the axis of said third rod member.

10. An actuator assembly as defined in claim 1 wherein said toggle lever supports a pair of identical rollers mounted on a common axis.

11. An actuator assembly as defined in claim 1 wherein said toggle lever supports a single roller.

12. An actuator assembly as defined in claim 11 wherein said single roller is elongated and has solid circular end portions which support a shaft for mounting the roller to the toggle lever, said roller being partially hollow between said end portions for permitting a limited degree of rotation of said roller and a limited degree of movement of said mounting shaft axially of said toggle lever, said roller including a solid sector joining said circular end portions having a circular peripheral extent which is at least as great as the extent of rolling contact of the roller with the actuator member.