

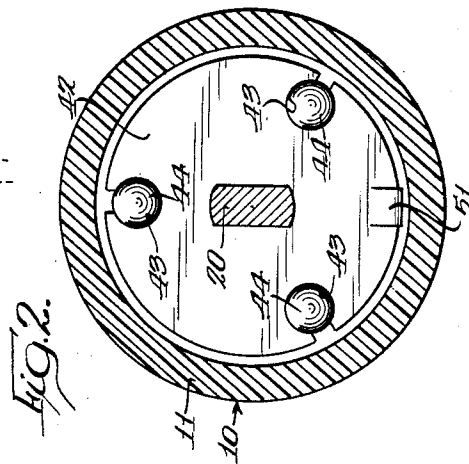
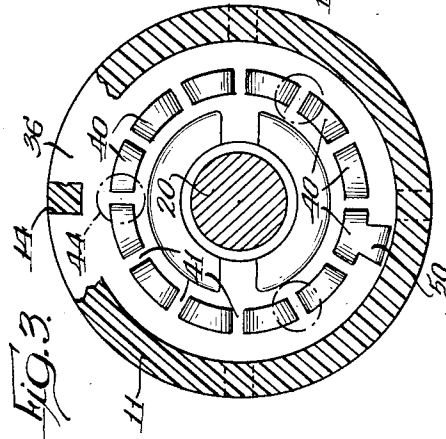
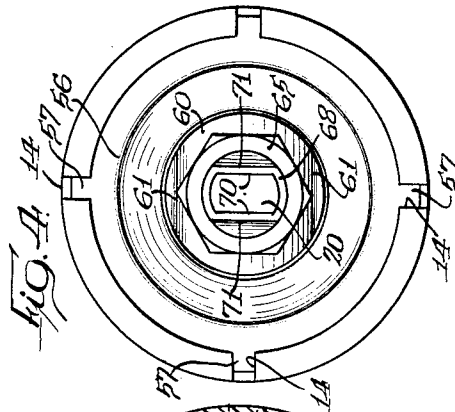
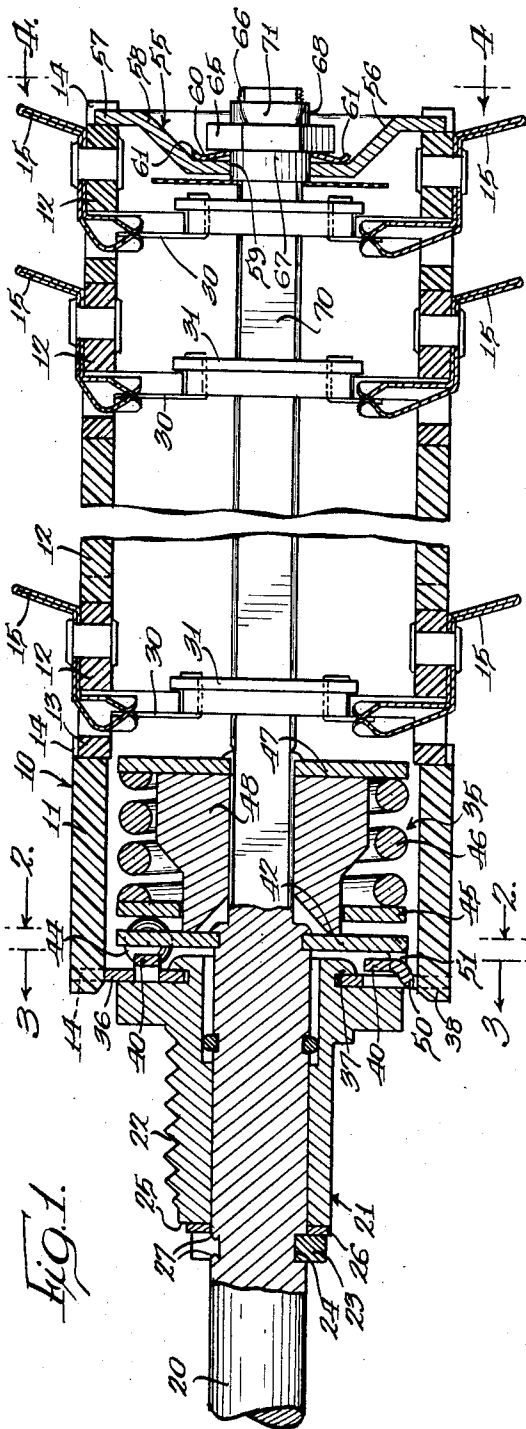
June 8, 1965

L. J. FICHTER

3,188,404

ROTARY ELECTRIC SWITCH WITH INTERFITTING MEANS

Filed May 29, 1962



INVENTOR:
Ludwig J. Fichter
 BY *Hofgren, Brady,*
Hegner, Allen & Stillman
 Attys

1

3,188,404

ROTARY ELECTRIC SWITCH WITH INTERFITTING MEANS

Ludwig J. Fichter, Crystal Lake, Ill., assignor to Oak Manufacturing Co., a corporation of Delaware
Filed May 29, 1962, Ser. No. 198,534
8 Claims. (Cl. 200-14)

This invention relates to a rotary switch and more particularly to a very small rotary switch.

The illustrated embodiment of the invention is directed to a miniature switch generally of the type disclosed in copending patent application of Mastney for "Rotary Electric Switch Means," Serial No. 21,414, filed April 11, 1960. The Mastney application refers to an Allison et al. Patent 2,186,949, granted in 1940, and the Mastney and Allison disclosures are generally indicative of such rotary switch constructions. The manufacture of miniature switches entails numerous problems not encountered in the manufacture of similar, but larger switches. For example, miniature switches must be very compact in design to conserve space and provide a switch with small outside dimensions. Furthermore, miniature switches must be sufficiently strong for normal handling, but because of the small size of the parts, expedients usually encountered in larger switch manufacture are often unsuited for miniature switches. Similarly, the construction of miniature switches must be modified to facilitate use of commercially practical assembly techniques.

The primary object of this invention is to provide a new and improved rotary switch.

Another object of this invention is to provide a new and improved miniature switch.

A further object is to provide a new and improved rotary shaft mounting assembly in a rotary switch.

A more specific object is to provide a new and improved retaining ring assembly on a shaft of a rotary switch.

Still another object is to provide a new and improved assembly for holding switch sections operatively assembled.

Still another object is to provide a new and improved indexing assembly for a rotary switch.

Other objects and advantages of the invention will become readily apparent from the following detailed description taken in connection with the accompanying drawings, in which:

FIGURE 1 is a fragmentary, longitudinal sectional view of a preferred embodiment of a miniature rotary switch, to a scale much larger than the actual switch;

FIGURE 2 is a transverse section taken generally along the line 2-2 of FIGURE 1;

FIGURE 3 is a transverse section taken generally along the line 3-3 of FIGURE 1, with parts broken away for clearer illustration; and

FIGURE 4 is a rear end view taken generally along the line 4-4 of FIGURE 1.

While an illustrative embodiment of the invention is shown in the drawings and will be described in detail herein, the invention is susceptible of embodiment in many different forms, and it should be understood that the present disclosure is to be considered as an exemplification of the principles of the invention and it is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

The invention is, in brief, directed to a miniature rotary switch having a casing with front and rear ends and defined by a series of end abutting stator sections. A rotary shaft extends through the casing for operating switch contacts on the shaft and casing. This shaft is journaled at the front end of the casing in a bushing and is held against rearward movement by a ring fixedly installed to the shaft

2

and seated against the bushing front. An index assembly includes a plurality of balls mounted about the shaft and urged into engagement with an index plate by a spring, providing smoother and more reliable operation than that previously obtained in miniature switches, and this index assembly further cooperates in maintaining the shaft operatively assembled in the switch. The rear end of the shaft is journaled in an end assembly which retains the casing switch sections in operative end abutting association. This end assembly includes novel spring means acting against the shaft and the casing sections, and retaining means particularly suited for miniature switch construction.

Referring to FIGURE 1 of the drawings, a miniature rotary switch assembly includes a casing 10 which in an actual switch may be about a half inch in diameter. This casing is defined by a plurality of cylindrical sleeve-like sections including a spacer section 11 at the front end of the casing, and one or more stator sections 12 extending rearwardly from spacer section 11. These sections are in end abutting relationship, and are detachably interlocked in operatively fixed association with each other by any suitable means such as mating prongs 13 and notches 14 in facing ends of adjacent sections, as shown in FIGURES 1, 3 and 4. Any number of stator sections 12 may be provided, as required by a number of circuits to be controlled. Suitable stator contacts 15 are mounted in any required number on each of the stator sections 12. This casing construction may be of any suitable type, for example, as described in the aforementioned patent application.

A rotary operating shaft 20 extends longitudinally through casing 10 and in the illustrated embodiment is coaxial therewith. Its front end is adapted to receive a suitable control knob (not shown) and is journaled in a mounting member here in the form of a bushing 21 at the front end of casing 10. This mounting member has a forwardly extending threaded boss 22 for receiving a nut in mounting the switch in an apertured control panel. A split ring, such as a C-ring 23, is received in a circumferentially extending groove 24 disposed forwardly of a front shoulder 25 of bushing 21 and in abutting relationship with this shoulder. More particularly, a suitable friction reducing washer 26 is received between bushing shoulder 25 and ring 23 to provide for easier operation of shaft 20.

It should be noted that in a miniature switch the ring receiving groove 24 must be relatively shallow in order that the shaft is not excessively weakened by the groove, and therefore the bearing surface area between ring 23 and the side wall of the groove, that is the abutting surfaces transverse to the rotational axis of shaft 20, is relatively small. The seating area between ring 23 and bushing shoulder 25 is usually relatively great to provide an adequate bearing surface. Thus, the ring would normally tend to rotate in groove 24 rather than against shoulder 25 or washer 26, and excessive wear could easily occur between ring 23 and shaft 20. In order to prevent relative rotation between ring 23 and shaft 20, means is provided for holding the ring fixed on the shaft, and herein this means is in the form of staked portions 27 of the shaft which bite into the side faces of ring 23. By fixing ring 23 to shaft 20 such wear is effectively eliminated and the ring glides on friction washer 26. For reasons which will become apparent hereinafter, shaft 20 is preferably received in bushing 21 prior to installation of ring 23 on the shaft, and staking the ring on the shaft has been found to be an expedient method of preventing relative rotation between the ring and the shaft.

Within casing 10, suitable rotor contacts 30 are mounted on rotors 31 secured to shaft 20 for rotation therewith. The mounting of rotors 31 and their contacts 30 may be of any suitable type, and preferably as disclosed in the aforementioned patent and patent application. Thus, by

rotating shaft 20 the stator contacts 15 cooperate with rotor contacts 30 for operation between opened and closed positions.

In order to selectively operate these cooperating stator and rotor contacts, an indexing mechanism 35 is provided. In the illustrated embodiment this indexing mechanism is housed within spacer section 11 of casing 10 and includes a front end member in the form of an index plate 36 fixedly secured to bushing 21 as by a rolled portion 37 of the bushing. Index plate 36 extends radially outwardly from bushing 21 and is provided with outwardly extending tabs 38 received in the notches 14 in the front end of spacer section 11. These parts are associated so that bushing 21 and index plate 36 may be assembled on the front end of casing 10 by axial rearwardly movement of the casing to seat prongs 38 in notches 14 and thereby connect bushing 21 in operatively nonrotatable relationship with casing 10 and hold the bushing against rearward movement with respect to the casing.

As may best be seen in FIGURE 3, a plurality of teeth 40 are stamped in index plate 36 concentric about shaft 20, and therebetween define pockets 41. A ball retaining plate 42 illustrated in the form of a yoke is telescoped on shaft 20 for rotation therewith and in the illustrated embodiment is fixedly mounted on the shaft. Plate 42 may be best seen in FIGURE 2, and is provided with a plurality of generally circular openings 43, here three in number equally spaced about shaft 20. Balls 44 are received in these openings and are selectively and releasably normally removably received in pockets 41 of index plate 36. Openings 43 may be located in any suitable manner so as to support the balls and a thrust member, here in the form of a thrust washer 45 urged against balls 44 by resilient means. This means is here in the form of a spiral compression spring 46 having one end seated on thrust washer 45 and an opposite end seated on a retaining member. This retaining member is illustrated in the form of a retaining washer 47 operatively axially fixed on shaft 20. Spring 46 urges balls 44 against index plate 36 and normally into pockets 41, and further urges shaft 20 rearwardly of casing 10 to seat ring 23 against bushing shoulder 25, and more particularly against anti-friction washer 26. Spring 46 is telescopically received on a hub 48 seated at one end against plate 42 and at its opposite end against retaining washer 47. This hub is of such outside diameter adjacent the retaining washer as to retain spring 46 effectively concentric with shaft 20 so that the spring presses thrust washer 45 against balls 44 with an evenly distributed force. It should be noted that in the illustrated embodiment thrust washer 45 is telescoped on hub 48. Thus, as shaft 20 is rotated balls 44 move step by step from pocket to pocket for indexing rotation of the shaft resulting in opening and closing of contacts 15 and 30.

In order to limit rotation of shaft 20, if desired, stop means may be provided. As illustrated this means includes an abutment 50 stamped in index plate 36 and extending in the same direction as teeth 40. Preferably this abutment is integral with and extends radially outwardly from one of the teeth 40, as may best be seen in FIGURE 3. One or more abutments may be provided depending on the degree of rotation desired of shaft 20, and in the illustrated embodiment the abutment 50 cooperates with an axially extending finger 51 fixed with respect to shaft 20 and more particularly extending from the peripheral portion of plate 42. Thus, if but one abutment 50 is provided, shaft 20 may be rotated almost 360 degrees with finger 51 engaging opposite sides of this abutment 50 to limit such rotation.

Shaft 20 is journaled at the rear end of casing 10 by an end assembly 55. This end assembly includes an end member in the form of a cupped plate 56 having tabs 57 extending from the periphery thereof and received in the notches 14 in the rear end stator section 12 of casing 10, so that the cupped plate is operatively nonrotatably

mounted with respect to the casing. Plate 56 has a cup-shaped center portion 58 extending inwardly of casing 10 with an opening 59 in the base of the cup-shaped portion and herein concentric with casing 10. The rear end of shaft 20 extends through this opening and resilient means in the form of a bowed spring washer 60 is telescoped on shaft 20. This washer is normally bowed outwardly from the base of cup-shaped portion 58 and has opposite outer edge portions 61 seated against this base with the remainder of the outer edge of the washer spaced rearwardly from the base. A nut 65 is threadedly received by a threaded rear end 66 of shaft 20, and has a pair of collars 67 and 68 extending axially in opposite directions from the nut body. Collar 67 extends inwardly through opening 59 in cupped plate 58 and is telescoped on the rear end of shaft 20 thus providing a journal for the shaft. Nut 65 is tightened against bowed spring washer 60 to securely mount shaft 20 in casing 10 and urge ring 23 against friction reducing washer 26, and also urge cupped plate tabs 57 against the base of notches 14 in the end stator section 12 of casing 10 to urge the casing sections into operative end abutting association as illustrated in FIGURE 1.

Means is provided locking nut 65 on shaft 20 and herein this means includes flattened sides 70 on shaft 20, and nut collar 68 crimped at opposite side portions 71 into firm engagement with flattened shaft sides 70. This locking expedient is particularly desirable in miniature switches as disclosed herein, in that none of the parts of the switch need be weakened to facilitate such locking.

I claim:

1. In a rotary switch, a casing having front and rear ends, a mounting member at said front end, said mounting member being detachably interlocked with said casing front end against rotation with respect to said casing and movement inwardly of said casing, a rotary switch operating shaft within said casing and journaled in and extending outwardly from said mounting member, said shaft having an index portion intermediate the ends thereof, a retaining ring separate from said shaft and received on said shaft in abutting relationship with said member to hold said shaft against movement rearwardly of said casing and position said shaft index portion within said casing, means effectively preventing relative rotation between said ring and said shaft and retaining said ring operatively axially fixed on said shaft, means defining pockets about said shaft index portion and stationary with respect to said casing, balls releasably and normally received in said pockets, means disposing said balls in spaced relationship about said shaft index portion and mounting said balls for rotation with said shaft, a thrust member adjacent said balls, resilient means including a spiral compression spring telescoped on said shaft index portion and seated against said thrust member for urging said thrust member against said balls and said balls into said pockets, and urging said shaft rearwardly of said casing to seat said ring against said mounting member, an end member seated against the rear end of said casing and having a central opening receiving said shaft with an end of the shaft extending outwardly from said end member, a spring washer received on said shaft outwardly of said end member and seated against said end member, a retaining member on said shaft rearwardly of said spring washer and seated against said spring washer for stressing said spring washer and resiliently urging said end member against said rear end of said casing, said retaining member having a first collar extending rearwardly about said shaft, and a second collar extending through said opening to center said shaft relative to said casing and align said balls with said pockets, and means locking said retaining member on said shaft and including a flattened side of said shaft and said first collar engaging said flattened side.

2. In a rotary switch, a casing having front and rear ends, a mounting member detachably interlocked with said casing front end, a rotary switch operating shaft

5

within said casing and journaled in and extending outwardly from said mounting member, a retaining ring received on said shaft in abutting relationship with said member, means effectively preventing relative rotation between said ring and said shaft and retaining said ring operatively axially fixed on said shaft to hold said shaft against movement rearwardly of said casing, index means including pockets fixed about said shaft and balls releasably and normally received in said pockets, a thrust member adjacent said balls, resilient means urging said thrust member against said balls and said balls into said pockets, and urging said shaft rearwardly of said casing to seat said ring against said mounting member, an end member seated against the rear end of said casing and having a central opening receiving said shaft with an end of the shaft extending outwardly from said end member, a spring washer received on said shaft outwardly of said end member and seated against said end member, and a retaining member on said shaft rearwardly of said spring washer and seated against said spring washer for stressing said spring washer and resiliently urging said end member against said rear end of said casing, said retaining member having centering means thereon received in said opening for centering said shaft within said casing and for aligning said balls with said pockets.

3. In a rotary switch, a casing having a front end and a rear portion, a mounting member at said end, a shaft journaled in said mounting member and held against movement rearwardly of said member, cooperating switch contacts on said shaft and casing, an index plate fixedly mounted on said mounting member and detachably interlocked with said casing end against rotation with respect to said casing and movement inwardly of said casing, a plurality of teeth stamped in said plate concentric about said shaft and defining pockets therebetween, at least three balls selectively and releasably normally received in said pockets, a ball carrier plate operatively axially fixed on said shaft and rotatable therewith, said carrier plate being rearward of said index plate and having opening there-through freely receiving said balls, said openings being spaced about said shaft to dispose said balls in stable supporting relationship with said index plate, a retaining washer held against rearward movement on said shaft and positioned rearwardly of said carrier plate, a hub received on said shaft and firmly seated against said carrier plate and retaining washer, a thrust washer freely received on said hub between said retaining washer and said balls, and resilient means including a spiral compression spring closely telescoped on said hub and retained thereby generally concentric with said shaft, said spring being seated against said thrust washer and retaining washer and urging said thrust washer against said balls and said balls into engagement with said index plate and normally into said pockets, and urging said shaft rearwardly of said casing end.

4. The switch of claim 3 and stop means including an abutment stamped in said index plate and integral with one of said teeth, and a cooperating finger on said thrust washer for limiting rotation of said shaft.

5. In a rotary switch, a casing having a front portion and a rear end and defined by a series of end abutting sections, a mounting unit detachably interlocked with said casing front portion against rotation with respect to said casing and movement inwardly of said casing, a shaft journaled in said mounting unit and within said casing and held against movement rearwardly of said mounting unit, cooperating switch contacts on said shaft and casing, a cupped end plate having a peripheral portion detachably and non-rotatably seated against the rear end of said casing and having a cup-shaped center portion extending inwardly of said casing rear end, said center portion having a base with a central opening receiving said shaft and an end of the shaft extending outwardly from said base, a

6

spring washer received on said shaft outwardly of said base, said washer being normally bowed outwardly from said base and having opposite outer edge portions freely seated against said base with the remainder of the outer edge of the washer spaced rearwardly from said base, a nut threaded on said shaft end rearwardly of said spring washer and seated against said spring washer for resiliently urging said cupped plate against the rear end of said casing to hold said casing sections assembled and said mounting unit interlocked with said casing, said nut having collars extending axially in opposite directions about said shaft, one of said collars being received in said base opening and defining a journal for said shaft to rotatably support said shaft centrally in said casing and to align the contacts on said shaft with the contacts on said casing, and means locking said nut on said shaft and including a flattened side of said shaft and the other of said nut collars crimped into firm engagement with said flattened side.

6. In a rotary switch, a casing having a rear end, a shaft rotatably mounted within said casing, an end member separate from said casing having a portion seated against the rear end of said casing and fixed against rotation with respect thereto, said end member having an opening receiving said shaft with an end of the shaft extending outwardly from said end member, a spring washer received on said shaft outwardly of said end member and seated against said end member, a retaining member on said shaft rearwardly of said spring washer and seated against said spring washer for resiliently urging said end member against the rear end of said casing, said retaining member having a first forwardly extending collar snugly received in said opening to provide a journal for said shaft and a second collar extending rearwardly about said shaft, and means locking said retaining member on said shaft and including a flattened side of said shaft and said second collar engaging said flattened side.

7. In a switch, a casing having an end and a shaft rotatably mounted in the casing, an end member separate from said casing seated against the end of said casing and fixed against rotation with respect thereto, said end member having an opening receiving said shaft, resilient means seated against said end member, a retaining member seated against said resilient means and having a first forwardly extending collar snugly received in said opening to provide a journal for said shaft and a second collar extending rearwardly about said shaft, and means locking said retaining member on said shaft and including a flattened side of said shaft and said second collar engaging said flattened side.

8. The rotary switch construction of claim 6 wherein said retaining member is threaded on said shaft against said spring washer.

References Cited by the Examiner

UNITED STATES PATENTS

1,069,877	8/13	Hurst	285—119
1,298,469	3/19	De Young et al.	151—2
2,020,000	11/35	Schellenger	338—132
2,186,949	1/40	Allison	200—15
2,508,655	5/50	Silverman	285—119
2,577,654	12/51	Gates.	
2,701,161	2/55	Cain.	
2,821,580	1/58	Black	200—11 X
2,864,923	12/58	Mathews	200—166
2,947,826	8/60	Pelletier	200—15

FOREIGN PATENTS

286,315	6/31	Italy.
---------	------	--------

BERNARD A. GILHEANY, *Primary Examiner.*