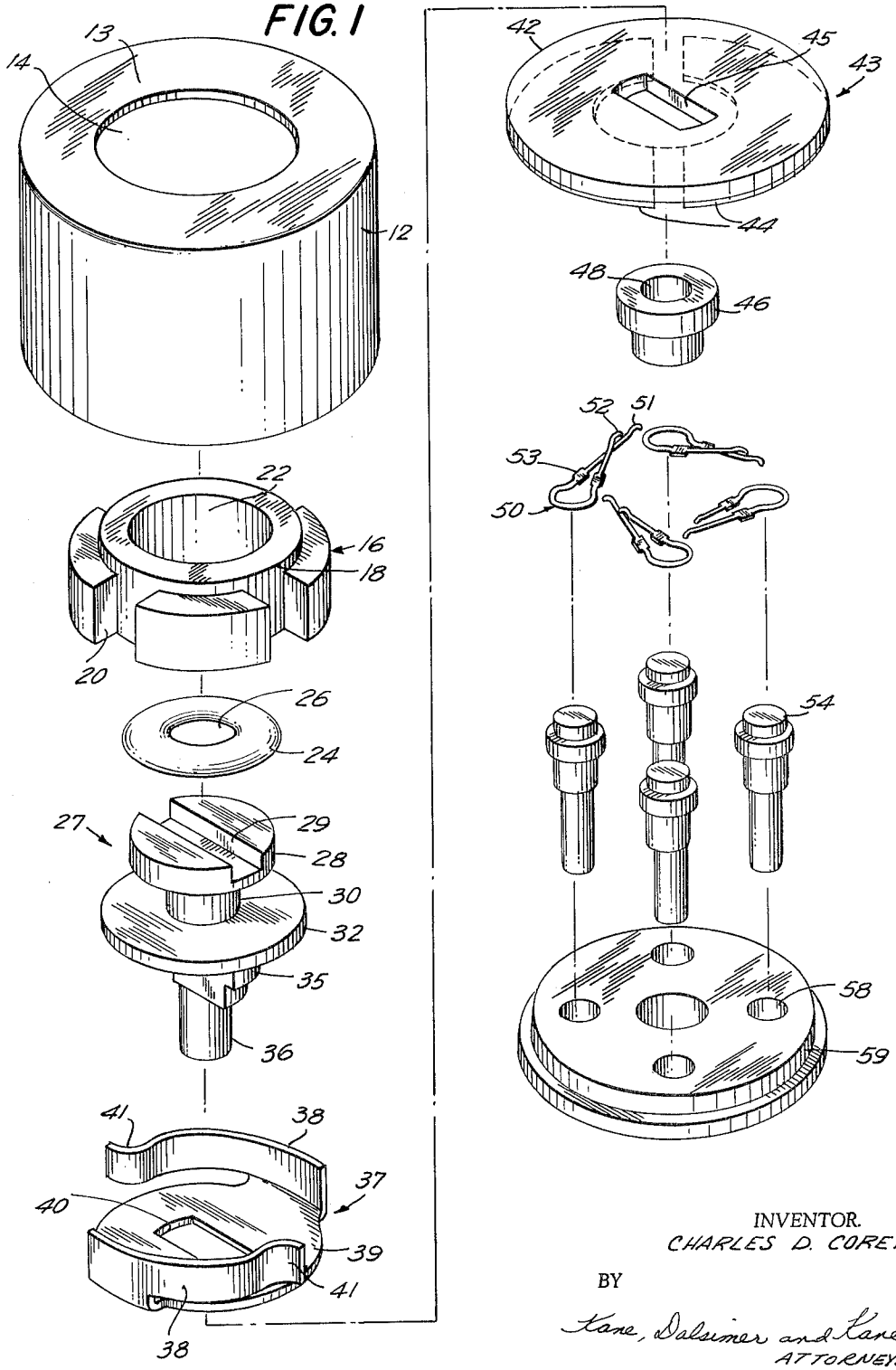
Jan. 4, 1966 C. D. COREY 3,227,822

SUB-MINIATURIZED ROTARY SWITCH WITH STATIONARY SPRING CONTACT MEMBERS AND LOCKING MEANS

Filed Nov. 20, 1962 3 Sheets-Sheet 1

FIG. 1



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FIG. 2

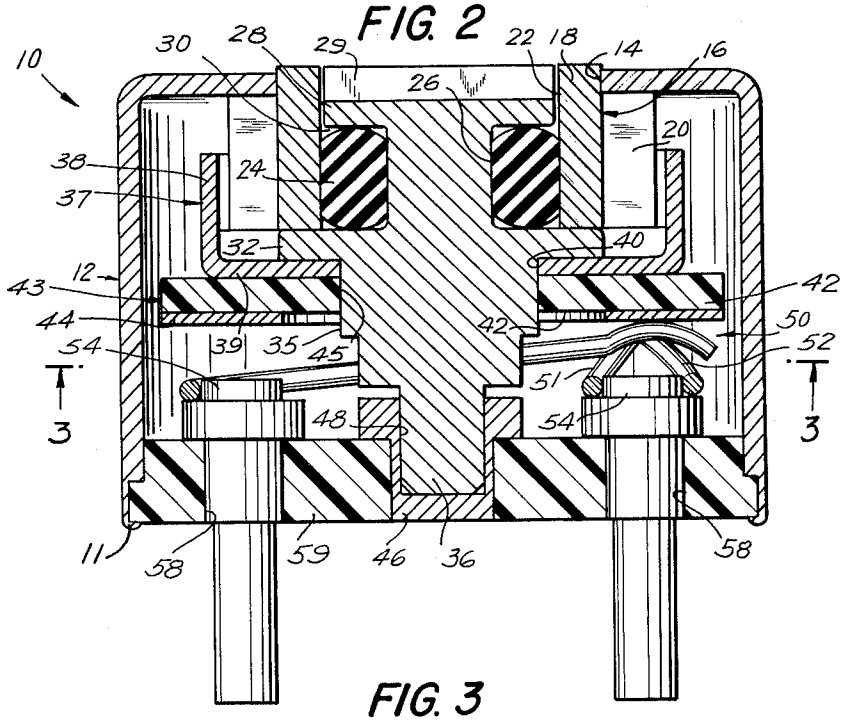
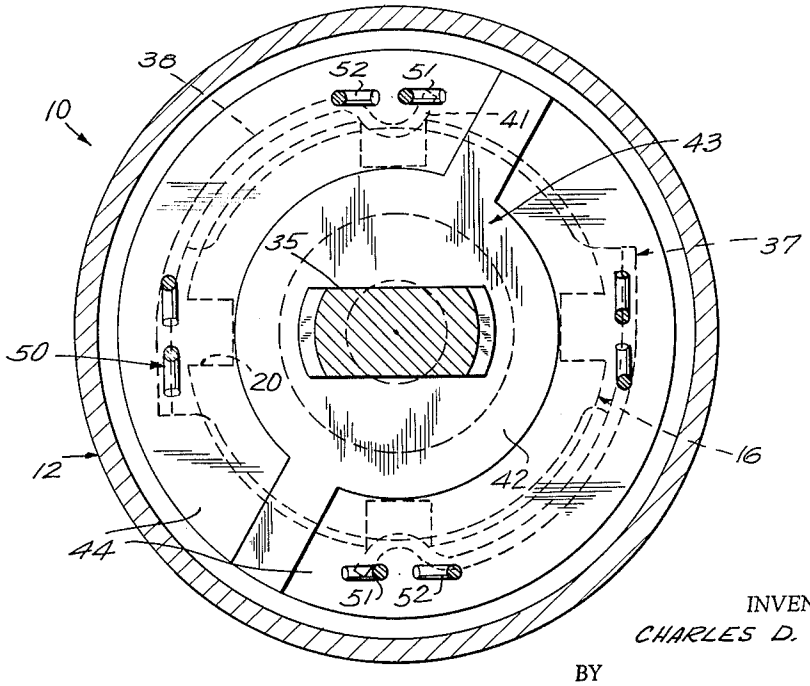


FIG. 3



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FIG. 4

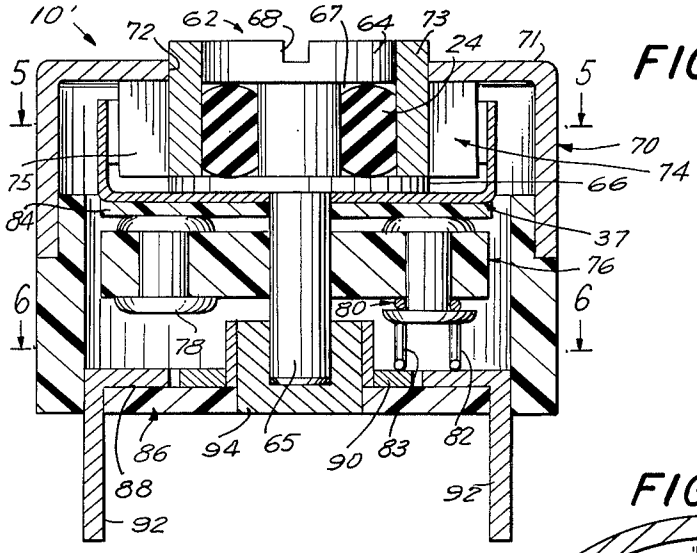


FIG. 5

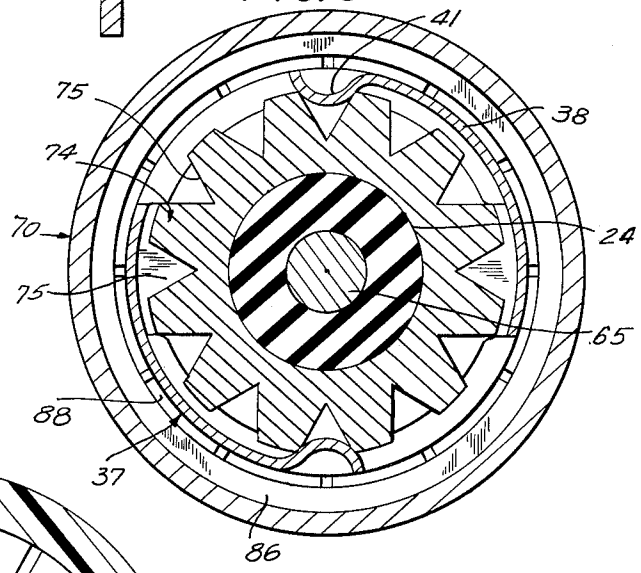
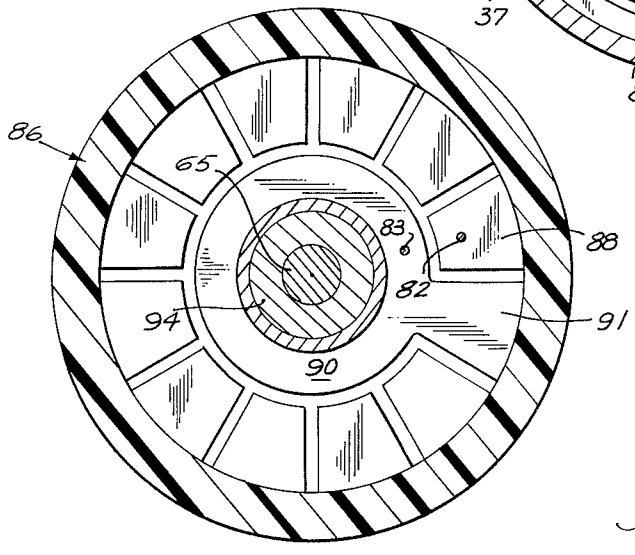


FIG. 6



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SUB-MINIATURIZED ROTARY SWITCH WITH STATIONARY SPRING CONTACT MEMBERS AND LOCKING MEANS

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15 Claims. (Cl. 200—11)

This invention relates to a miniaturized rotary switch and, more particularly, to sub-miniaturized rotary switches for use in sub-miniaturized circuitry systems.

In recent years miniaturized circuitry systems have become of great importance to the electrical and electronics fields. The need for durable and ruggedly constructed sub-miniaturized rotary switches for use in industry raised many problems. When the design of a standard rotary switch was miniaturized the parts were found to be too small to be manually handled and too fragile to meet the requirements of a durable ruggedly constructed switch. Consequently, these switches could not be used where they would be subjected to extreme physical conditions such as the extreme gravitational forces and wide temperature ranges encountered in satellite and missile circuitry systems.

Previous sub-miniaturized rotary switches have many other disadvantages when used as part of a miniaturized circuitry system because the several operative parts of the switch would fail after a short time under normal use. The difficulties of maintaining a hermetic seal when subjected to wide pressure ranges particularly when subjected to reduced pressures which cause an increased electron flow across the contacts of the switch resulting in its failure. Also when the switch is subjected to wide temperature ranges the difficulty of maintaining a hermetic seal serves to prevent corrosion due to corrosive, dust laden atmosphere. Also, the locking means that held the switch in fixed yielding position would not withstand great impact or gravitational forces and which would fail when subjected to normal rotational movement.

It is therefore an object of my invention to provide a sub-miniaturized rotary switch which is of rugged and durable construction; which may be subjected to extreme temperature ranges; which may be hermetically sealed to provide for normal atmospheric pressure when subjected to extreme pressure ranges; and which will withstand corrosive and dust laden atmospheres.

It is a further object of my invention to provide a locking means in which the switch will remain in a desired position when subjected to extreme gravitational forces and stresses. Also, to provide a rotary switch having electrical contacts which will remain in electrical contact when subjected to extreme gravitational forces.

Still another object of my invention is to provide a rotary switch that may be subjected to many rotational cycles which is inexpensive to manufacture and easy to assemble.

An embodiment of my invention contemplates providing a sub-miniaturized rotary switch for use in electrical and electronic circuitry systems which comprises a supporting structure, a commutator rotatably supported by the supporting structure and having a plurality of circumferentially spaced conducting surfaces with intervening circumferentially spaced insulating surfaces and a contact assembly formed of an electrically conducting spring member having a pair of spaced spring contacts integrally formed therewith. The contact assembly is mounted on the supporting structure so that the spring contacts engage the surface of the commutator.

The switch is provided with a ratchet means which serves to yieldingly hold the switch in a fixed position even when subjected to extreme gravitational forces and

yet which will operate over extended periods of time under all operating conditions. Also, the switch is provided with a means to facilitate the rotation thereof so that when the switch is rotated to a new position it is positive in action, and is instantly and yieldably locked into place.

In the accompanying drawings there are illustrated various possible embodiments of my invention in which:

FIG. 1 is an exploded view of one form of my rotary switch in perspective;

FIG. 2 is an elevational view in vertical cross-section taken through the center of the switch;

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 2;

FIG. 4 is another embodiment of my invention shown in vertical cross-section;

FIG. 5 is a sectional view taken on the line 5—5 of FIG. 4, showing another embodiment of a locking means, and

FIG. 6 is a sectional view taken on the line 6—6 of FIG. 5 showing another embodiment of my commutator.

For a better detailed description of my invention and illustrated by the drawings reference is made by numerals to the specific construction of my switch in which FIGS. 1–3 illustrate the construction of a make before break type of rotary switch. This type of switch is used where components in a circuitry system are either placed in or taken out of the system without interruption of any other part of the system. Numeral **10** referes to the assembled switch as shown in FIG. 2. Tubular casing **12** has a surface **13** adjacent an end thereof and an opening **14** disposed in said surface **13**. A cylindrical ring **16** has an annular surface **18** adapted to be received by opening **14** of casing **12** when mounted therein. Vertical and parallel spaced notches or grooves **20** are provided on ring **16**. Any convenient method may be used to mount ring **16** in fixed position to casing **12**. Actuating assembly **27** includes a shaft **36** having a flanged surface **28** disposed at one end thereof. A transverse groove **29** is provided in flange **28** as a means for rotating the actuating assembly. A second flanged surface **32** is in spaced relation and parallel to flange **28** so that a groove **30** is provided for mounting an elastic ring **24** having an opening **26** when hermetic sealing is desired. The ring **24** is mounted in groove **30** and retained in position by the corresponding surfaces of the flanges **28** and **32**. A spring assembly **37** is mounted on the actuating assembly **27** by passing the shaft **36** through opening **40** of the base **39** of the spring assembly **37** and held in position by a rectangular section **35** on shaft **36**. A pair of symmetrical arcuate spring members **38** perpendicular to and integral with base member **39** is attached thereto at a portion of the lower edge of the arcuate member **38** as shown in FIG. 1. A pair of curved ends **41** forming a pawl at the opposite ends of the arcuate members **38** are adapted to engage the notches **20** of the ring **16** to form a detent assembly which comprises the ratchet or locking means. The commutator **43** is provided with a nonconducting surface **42** and mounted thereon is a pair of symmetrical electrically conducting surfaces **44** in spaced relation to each other so that a section of the non-conducting surface **42** forms an insulating means between the symmetrical conducting surfaces **44**. An opening **45** is provided in the commutator assembly **43** so that the commutator assembly **43** is mounted on shaft **36** having the insulating surface **42** mounted against the spring assembly **37** on shaft **36** at **35**.

The contact assembly consists of electrical conducting spring **50** which is wrapped around the electrical conducting post **54** so that the contacts **51** and **52** are in overlapping staggered relationship to each other and at substantially equal radii with respect to the commutator

assembly 43. The contacts or ends 51 and 52 are spaced from each other a distance greater than the width of the insulating surfaces separating commutator assembly 43. A flatened surface 53 of electrical conducting spring 50 is provided adjacent electrical conducting post 54 to increase the spring flexibility of compliance in a plane facing away from the flat surfaces. Post 54 is supported by a nonconducting base member 59 at opening 58. A bushing 46 is supported by base 59 to receive the shaft 36 of the actuating assembly 27. The switch is assembled by inserting the actuating assembly 27 into casing 12 so that the detent spring assembly 37 engages the notched ring 16. The elastic ring or O-ring 24 is such that the peripheral edge thereof is in yielding and sealing relationship against the walls of opening 22, thus providing a seal sufficient to enable the switch to be hermetically sealed. The base assembly comprising the posts 54, contact springs 50 and bushing 46 is placed in position so that shaft 36 is inserted in opening 48 of bushing 46. The casing 12 is locked into fixed position on base 59 by any conventional means such as crimping the peripheral edge 11 of casing 12 to base 59.

In FIGS. 4, 5 and 6 of my invention is another form that may be used for my sub-miniaturized rotary switch design. The switch assembly is denoted by numeral 10'. The actuating assembly 62 comprises a pair of parallel flanges 64 and 66 in which flange 64 is mounted adjacent the end of shaft 65. A groove 68 extending transversely on flange 64 is provided as a means to rotate the actuating assembly 62. A resilient ring 24 as hereinbefore described is mounted in the groove 67 formed by the parallel flanges 64 and 66 when hermetic sealing is desired. Cylindrical casing 70 comprising an end surface 71, an opening 72 is provided in surface 71 to receive annular ring 73 of the cylindrical notched surface 74. Notches 75 are spaced radially around the extension surface of the cylindrical surface 74. A spring assembly 37 is mounted on shaft 65 in fixed position and adapted to engage notched surface 74 hereinbefore described.

A nonconducting ring 76 having supported therein a pair of electrical conducting posts 78 one of which has a contact spring member 80 mounted on post 78 forming a pair of spring contacts 82 and 83 in spaced relation and parallel to each other. The above assembly is mounted on shaft 55. Interposed between the spring means 37 and said assembly is an insulating ring 84 so that post 78 does not conduct any current through casing 70.

Mounted on a nonconducting base member 86 is a plurality of electrical conducting surfaces 88, radially and circumferentially spaced having intervening radially and circumferentially spaced insulating surfaces of base 86. Disposed centrally on said base member 86 and insulated from conducting surfaces 88, is a substantially circular electrically conducting ring 90 and extending therefrom an electrical conducting member 91. Extending through the base member 86 and forming a part of the radially spaced surfaces 88 are conducting posts 92. Member 91 forms a post which is a common conductor. Bushing 94 is supported in base member 86 to receive shaft 65 thereby causing contact 82 to be tensioned against surface 88 and contact 83 to be tensioned against ring 90.

It is obvious that my switch as shown by the drawings and described may be varied in construction for many different uses. For example, FIGS. 1, 2 and 3 show a rotary switch that may be used as an insertion switch such as placing a component of a circuit into a circuit without interrupting the entire circuit. It is obvious that the removal of a component will have the same effect. Also contemplated would be to have a plurality of components of the circuit electrically connected to the commutator so that one component may be inserted in place of a component in the circuit. The switch may also be used as a simple on and off type switch.

In FIGS. 4, 5 and 6 by splitting the common conducting surface 90 and providing a post 91 thereon, the switch becomes a multiple pole, multiple circuit switch and the uses for which it may be used would increase and be obvious to one skilled in the art. Also contacts 82 and 83 may be in staggered relationship to each other to provide a make before break type of switch or they may be aligned with each other as shown in FIG. 6 to provide a make before break type of switch.

Thus, I have described and illustrated a sub-miniaturized rotary switch which is durable and ruggedly constructed, having a locking means which is sufficiently miniaturized to be used in a miniaturized switch and yet sufficiently large to be manually handled for rapid assembly. I also provide contacts which are durable, which may also be manually handled and yet miniaturized for use in my switch. Further, I have provided a switch that is easily manufactured and inexpensively assembled for use for electrical and electronic circuitry systems.

The materials that may be used for constructing my switch are many and are a matter of choice to those skilled in the art. Also the reversal of parts to effect the same result is contemplated within the scope of my invention as defined by the appended claims.

I claim:

1. A sub-miniaturized rotary switch for use in miniaturized circuitry systems which comprises in combination a casing, an actuating assembly and supporting structures mounted on said casing at each end thereof, said actuating assembly being rotatably mounted between said supporting structure, a locking means, said locking means comprising a first portion mounted in fixed position on said actuating assembly and rotatable relative to said casing, a second portion of said locking means mounted in fixed position on one of said supporting structures to yieldingly hold said actuating assembly in fixed position, a commutator mounted on said actuating assembly in fixed position and electrically insulated from said locking means, said commutator having a plurality of radially disposed and circumferentially spaced conducting surfaces with intervening circumferentially spaced insulating surfaces, a plurality of circumferentially spaced electrically conducting spring members, each of said spring members having a pair of spaced spring contacts integrally formed therewith, said spring members being mounted on one of said supporting structures electrically insulated from each other and from said supporting structures so that each pair of spring contacts engages the surface of said commutator and each pair of said spring contacts being spaced apart a distance greater than the width of said insulating surfaces of the commutator.

2. A sub-miniaturized rotary switich for use in miniaturized circuitry systems as set forth in claim 1 wherein an O-ring is yieldingly mounted on said actuating assembly to hermetically seal said casing and to provide means for rotary motion of the actuating assembly while maintaining conditioned atmosphere within the sub-miniaturized rotary switch.

3. A sub-miniaturized rotary switch for use in miniaturized circuitry systems as set forth in claim 1 wherein said spring contacts are in substantially staggered and overlapping relationship to each other and are spaced substantially at equal radii with respect to the center of said commutator.

4. A sub-miniaturized rotary switch for use in miniaturized circuitry systems which comprises in combination a casing, an actuating assembly and supporting structures mounted on said casing at each end thereof, said actuating assembly being rotatably mounted between said supporting structures, a locking means, said locking means comprising a first portion mounted in fixed position on said actuating assembly and rotatable relative to said casing, a second portion of said locking means mounted in fixed position on one of said supporting structures to yieldingly hold said actuating assembly in fixed position, an electri-

cally conducting contact assembly mounted on said actuating assembly and insulated from said locking means, said contact assembly having a plurality of circumferentially spaced contact spring members electrically insulated from each other and from said actuating assembly each of said spring members having a pair of spaced spring contacts integrally formed therewith, a commutator mounted on one of said support structures and having a plurality of circumferentially spaced conducting surfaces with intervening circumferentially spaced insulating surfaces and electrically insulated from said casing, said spring contacts electrically engaging said conducting surfaces so that when said actuating assembly is rotated a change in current flow is effected thereby.

5. A sub-miniaturized rotary switch for use in miniaturized circuitry systems as set forth in claim 4 wherein said spring contacts are disposed in spaced relation and substantially parallel to each other.

6. A sub-miniaturized rotary switch for use in miniaturized circuitry systems as set forth in claim 4 wherein an O-ring is yieldingly mounted on said actuating assembly to hermetically seal said casing and to provide means for rotary motion of the actuating assembly while maintaining conditioned atmosphere within the sub-miniaturized rotary switch.

7. A sub-miniaturized rotary switch for use in miniaturized circuitry systems which comprises in combination, a casing having side and end walls, an actuating assembly rotatably mounted between the end walls thereof and an electrically conducting and switching assembly disposed in said casing and including commutator means electrically insulated from said casing and having a plurality of circumferentially spaced conducting surfaces with intervening circumferentially spaced insulating surfaces and circumferentially spaced contact spring means each having a pair of spaced spring contacts integrally formed therewith and electrically insulated from each other and from said casing, one of said means being connected to the actuating assembly and the other of said means being mounted on said casing, each one of said means being in electrical contact with each other so that upon rotation of the actuating assembly the contact spring means and commutator means are rotated relative to each other to effect a change in current flow.

8. A sub-miniaturized rotary switch for use in miniaturized circuitry systems as set forth in claim 7 wherein said actuating assembly includes a locking means, said locking means comprising a first portion mounted on said actuating assembly and a second portion of said locking means mounted on said casing, both of said portions being mounted in fixed position and rotatable relative to said casing to yieldingly hold said actuating assembly in fixed position.

9. A sub-miniaturized rotary switch for use in a miniaturized circuitry system as set forth in claim 8 wherein said locking means includes a notched ring mounted adjacent the inner surface of an end wall of said casing, said ring having circumferentially spaced notches and a spring assembly mounted on said actuating assembly, said spring assembly including a base member, an arcuate spring member disposed substantially perpendicular to said base member, and extending circumferentially with respect to said base member and a pawl disposed at an end of said spring member, said notched ring concentrically positioned within said spring assembly whereby said pawl yieldingly engages said notches to retain said actuating assembly in fixed position relative to said casing.

10. A sub-miniaturized rotary switch for use in miniaturized circuitry systems as set forth in claim 7 wherein an O-ring is yieldingly mounted on said actuating assembly to hermetically seal said casing and to provide a means for rotary motion of the actuating assembly while maintaining a conditioned atmosphere within the sub-miniaturized rotary switch.

11. A sub-miniaturized rotary switch for use in miniaturized circuitry systems as set forth in claim 7 wherein said spaced spring contact means is mounted on said actuating assembly so that upon rotation of the actuating assembly, the spring contact means engage the conducting surfaces of the commutator means mounted on an end wall of said casing thereby effecting a change in current flow.

12. A sub-miniaturized rotary switch for use in a miniaturized circuitry system as set forth in claim 7 wherein said commutator means is mounted on said actuating assembly, so that upon rotation of the actuating assembly, the spring contact means mounted on an end wall of said casing engage the conducting surfaces of the commutator means thereby effecting a change in current flow.

13. A locking means for use in a sub-miniaturized rotary switch of the type having a casing with side and end walls, an actuating assembly extending longitudinally in said casing and rotatably mounted between the end walls thereof, said locking means comprising a detent assembly including a notched ring mounted adjacent the inner surface of an end wall on said casing, said ring having circumferentially spaced notches and a spring means disposed on said actuating assembly, said spring means including a base member, an arcuate spring member disposed substantially perpendicular to said base member and extending circumferentially with respect to said base member and a pawl disposed at one end of said spring member whereby said pawl yieldingly engages said notches to retain said actuating assembly in fixed position.

14. A locking means as set forth in claim 13 wherein said spring means comprises a plurality of arcuate spring members, said members having a pawl disposed at an end thereof to yieldingly engage the notches on the notched ring so that the actuating assembly is held in fixed position.

15. A locking means as set forth in claim 14 wherein an O-ring is yieldingly mounted on said actuating assembly in said notched ring to hermetically seal said casing of said sub-miniaturized rotary switch.

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