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3,261,930

ROTARY SELECTOR SWITCH WITH IMPROVED SPRING BIASING STRUCTURE

Filed Nov. 6, 1964

3 Sheets-Sheet 1

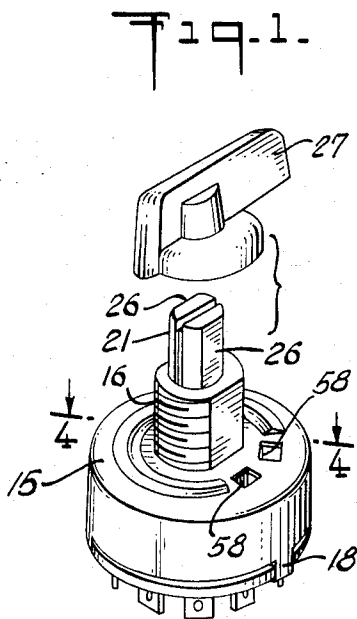


Fig. 3.

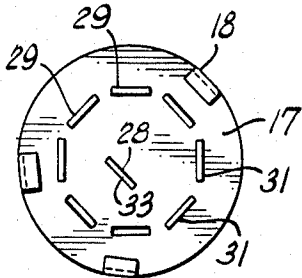


Fig. 4.

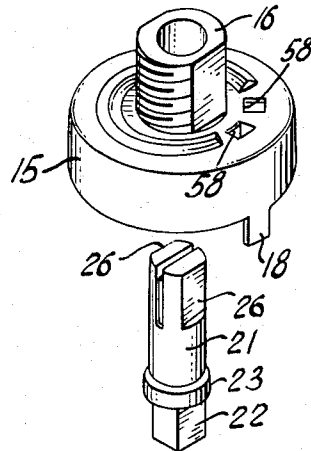
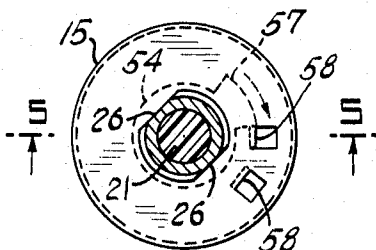
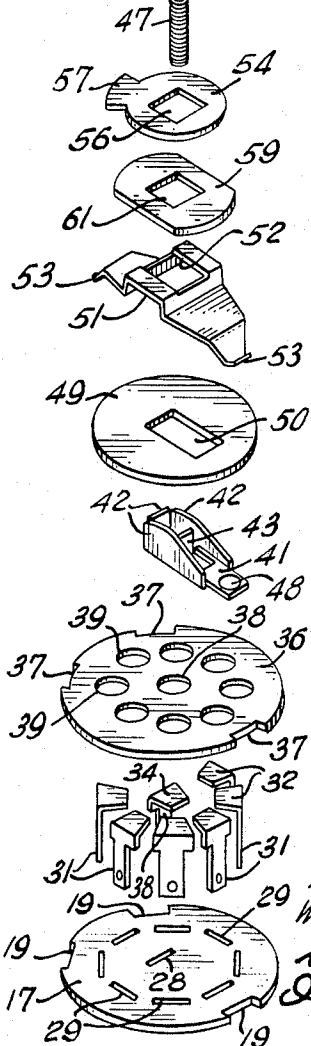


Fig. 2.



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FIG. 5.

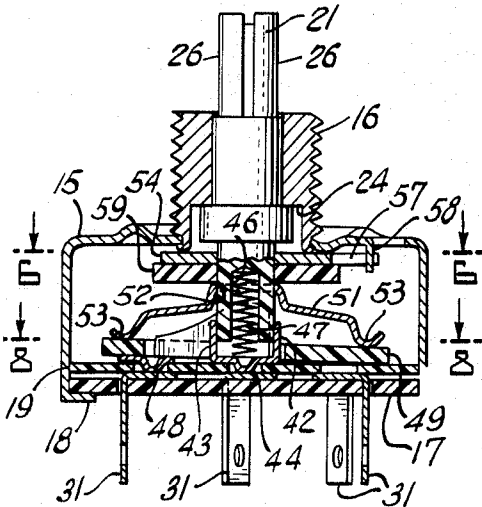


FIG. 6.

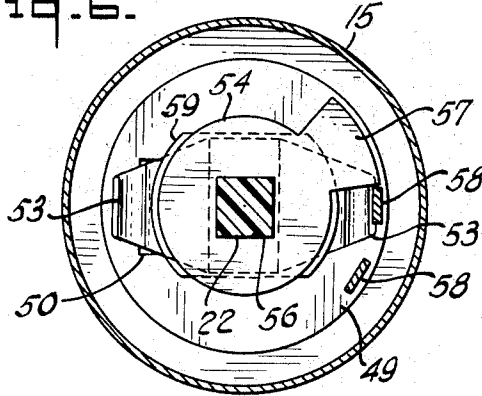


FIG. 7.

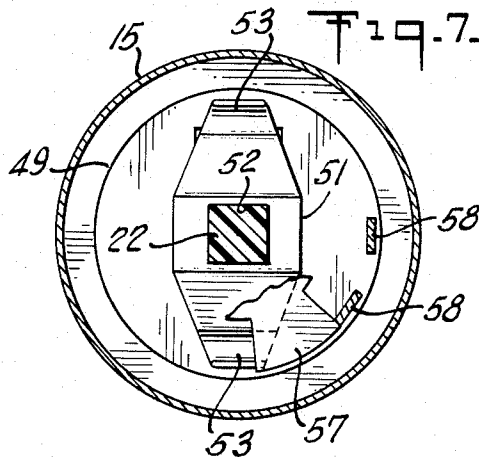


FIG. 8.

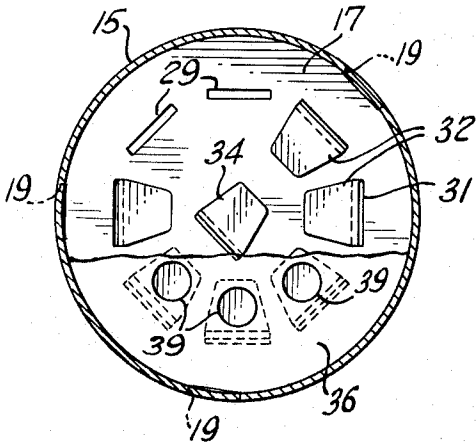
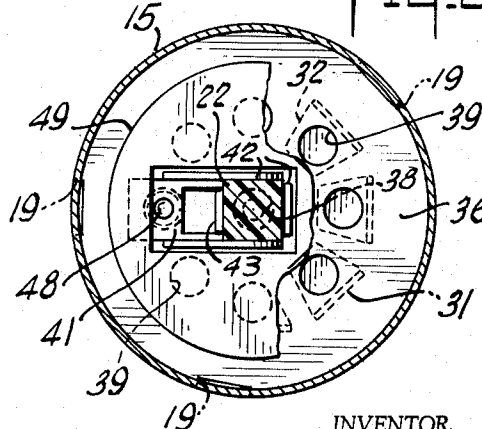


FIG. 9.



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Fig. 10

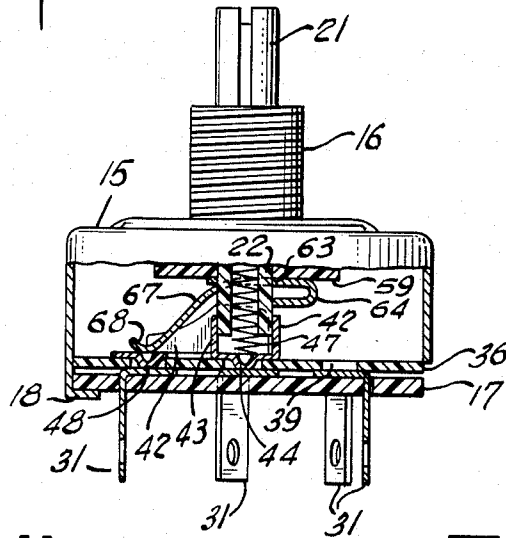


Fig. 11.

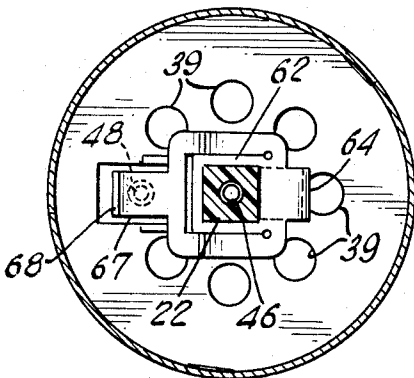
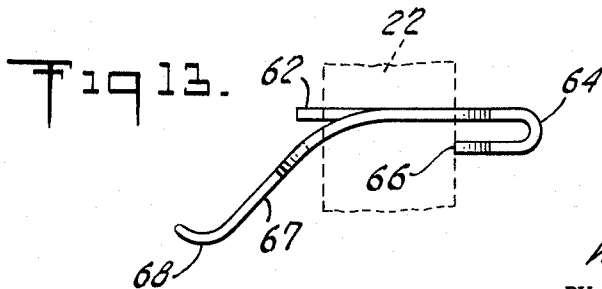
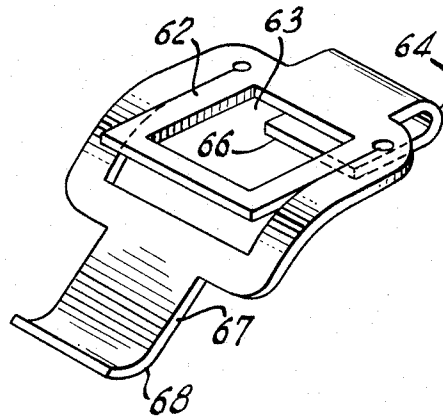


Fig. 12.



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ROTARY SELECTOR SWITCH WITH IMPROVED SPRING BIASING STRUCTURE

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11 Claims. (Cl. 200—11)

This invention relates to electric switches, and particularly to the rotary, multiple selector type such as may be mounted on a panel and rotated to activate successively a plurality of circuits. Switches of this type should be as compact, simple, durable, and inexpensive as possible.

An object of this invention is to provide a rotary, multiple selector switch, which will be relatively compact and small dimensioned, which may be formed largely of parts made by stampings, die castings, drawings and forming operations which may be easily and rapidly assembled by relatively unskilled labor, and which will be practical, dependable, durable and relatively inexpensive in construction.

A salient feature of the invention is the provision of a contact arm connected in such manner to the rotatable shaft of the switch whereby said arm is movable relative to said shaft in a direction substantially parallel to the axis thereof. By this means the contact arm may move yieldably from one switching location to another as said shaft rotates to accommodate for the thickness of an indexing disc which has apertures coinciding with each of the circuit contacts where electrical connection is established.

In one embodiment, a floating insulating disc is also connected to said contact arm which is also movable in the same manner as said contact arm relative to said shaft, with biasing means bearing both upon said disc and said contact arm to yieldably urge the latter into electrical connection with respective circuit contacts in the base of the switch. Also, biasing means are provided for maintaining the electrically conductive contact arm continuously in electrical connection with a central common contact, notwithstanding the movement of both said contact arm and said floating disc apart from the base of the switch when said arm is lifted from the circuit contacts over the indexing means that are located between each of the circuit contacts.

By providing a movable and yieldable coupling between the contact arm and the switch shaft, continuous circuit connection between said contact arm and a central common contact is ensured notwithstanding any angular or longitudinal movement of said arm relative to said shaft during the stepping action of said arm over an indexing disc from one circuit contact to another.

Notwithstanding the fact that the contact arm is not firmly fixed to the switch shaft, nevertheless positive circuit connections are established between said contact arm and the various contact elements with which it cooperates. Such a result cannot readily be achieved with a contact arm that is rigidly fixed upon the rotatable shaft of the switch. The separability of the contact arm relative to the switch shaft enables unskilled labor to assemble the switch without the necessity for making adjustments in order to assure positive contact action. The biasing elements incorporated on the switch shaft which bear yieldably upon the contact arm as well as upon the floating disc, are self-adjusting for accomplishing the positive co-

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operation between said contact arm and its cooperating contacts.

Still other objects and advantages of the invention will be apparent from the specification.

The features of novelty which are believed to be characteristic of the invention are set forth herein and will be best understood, both as to their fundamental principles and as to their particular embodiments, by reference to the specification and accompanying drawings, in which:

FIGURE 1 is a perspective view of an assembled switch constructed in accordance with this invention, but with the operating handle detached;

FIGURE 2 is an exploded perspective view of all of the parts of said switch, except the operating handle;

FIGURE 3 is a bottom plan view of the switch;

FIGURE 4 is a sectional plan view taken approximately along line 4—4 of FIGURE 1;

FIGURE 5 is a sectional elevation taken approximately along line 5—5 of FIGURE 4;

FIGURE 6 is a sectional plan view taken approximately along line 6—6 of FIGURE 5;

FIGURE 7 is a plan view similar to FIGURE 6, and partly broken away, but with the shaft turned through a partial revolution to a different angular position;

FIGURE 8 is a sectional plan view, partly broken away, taken approximately along line 8—8 of FIGURE 5;

FIGURE 9 is a sectional plan view, similar to FIGURE 8, and partly broken away, but with the section taken somewhat nearer the base than in FIGURE 8;

FIGURE 10 is a side elevation, partly in section, of another switch constructed in accordance with this invention, but illustrating a modification of the same;

FIGURE 11 is a sectional plan view taken approximately along line 11—11 of FIGURE 10;

FIGURE 12 is a greatly enlarged perspective view of the spring arm of the embodiment of FIGURE 10; and

FIGURE 13 is an edge view of the spring arm illustrated in FIGURE 12.

In the embodiment of the invention illustrated in FIGURES 1—9, the novel switch comprises a circular housing shell 15, preferably of sheet metal, to which is axially secured an externally threaded upwardly extending bushing 16. The bottom open end of shell 15 is closed by a disc 17 of insulating material. The bottom edge of shell 15 has a plurality of spaced apart integral lugs 18 that, when bent, cooperate with notches 19 in the edge of disc 17 to secure the latter and form a closure for said shell. A shaft 21 of insulating material, molded or otherwise formed from any of the electrically nonconducting plastics, extends through the axial bore of bushing 16, in which it is rotatably mounted. The upper end of shaft 21 extends externally upwardly from bushing 16. The lower end portion 22 of shaft 21 extends into the interior of shell 15 and has a noncircular shape such as a square cross-section. Intermediate its ends, shaft 21, within the shell, has an integrally formed collar 23 of enlarged diameter, which is freely rotatable in an enlarged portion of the bore in bushing 16. The intersection of the two portions of the bore in bushing 16 form a shoulder 24 against which collar 23 rotatably bears to limit the upward axial movement of shaft 21.

The outer end of the shaft 21 has opposite flat sides 26 to cooperate with a recess in an operating button 27 by means of a friction fit whereby shaft 21 is rotated by the manual rotation of button 27.

Disc 17 has a slightly off-center slot 28 and a circular array of spaced apart slots 29 (FIGURE 2) surrounding slot 28. Electrical terminals 31 extend through respective slots 29, the inner ends of said terminals being bent flat over the top surface of disc 17 to form spaced apart electrical circuit contacts 32 in circular array. Another terminal 33 extends through slot 28, the inner end of said terminal being bent flat over the top surface of disc 17 to form a common electrical contact 34 axially aligned with the inner end of the shaft 21. See FIGURE 9.

An indexing disc 36 of insulating material is disposed against contacts 32 and 34 within housing 15, and its periphery has notches 37 cooperating with lugs 18 so as to be secured against rotation. Disc 36 abuts against the open edge of housing 15 so as to be confined firmly against the inner face of the disc 17 by the action of lugs 18. Disc 36 has a central aperture 38 axially aligned with the shaft 21, and also a plurality of spaced apart apertures 39 in circular array around aperture 38, each aperture 39 being disposed over and coinciding with a respective contact 32 (FIGURE 2).

An electrically conductive contact arm 41, of sheet metal or the like, has one end thereof bent upwardly to form three walls 42 while a fourth wall 43 is struck up from the central portion of arm 41. Walls 42 and 43 form a box which accommodates the lower square end 22 of shaft 21 with a close but movable fit, whereby rotation of said shaft causes rotation of contact arm 41.

Formed integrally in the bottom of arm 41 and located substantially centrally of the box formed by walls 42 and 43 is a downwardly extending boss 44 (FIGURE 5) which extends through aperture 38 in disc 36 and establishes electrical connection with common contact 34.

The lower portion of shaft 21 has an axially extending bore 46, accommodating a helical spring 47 which extends outwardly therefrom and bears upon that portion of contact arm 41 located over center contact 34 whereby boss 44 is urged yieldably against said common contact. The free end of contact arm 41 has an integrally formed downwardly extending boss 48 which is capable of extending through any of apertures 39 in disc 36 to establish electrical connection with any of respective contacts 32.

A floating stabilizing disc 49 of insulating material has, in its interior area, a rectangular aperture 50 which accommodates walls 42 and 43 of an arm 41 with a snug fit, whereby said disc is coupled to shaft 21 for rotation therewith. A biasing yoke 51 has, intermediate its ends, a square-shaped aperture 52 which accommodates the square shank of shaft 21 and is slidable axially therealong while being rotated thereby. The free spring legs 53 of yoke 51 bear yieldably and resiliently upon the outer portions of the upper face of disc 49. Since the outer end of arm 41 is disposed against the bottom surface of disc 49, boss 48 is urged through any aperture 39 to make electrical connection with a respective circuit contact 32 depending upon the location to which shaft 21 has been angularly rotated. Aperture 52 in yoke 51 is cut in such a manner that one of the spring legs 53 bears directly over boss 48 to ensure its engagement electrically with any of the selected circuit contacts 32. The other spring leg 53 of yoke 51 is arranged substantially 180° apart from the first leg and bears upon disc 49 to stabilize the latter in proper operating position.

A disc 54 has a square aperture 56 (FIGURE 2) through which shaft 21 extends, said disc being slidable along said shaft while rotating therewith. Disc 54 abuts against the inner closed end wall of housing 15, opposite base disc 17. Disc 54 has an outwardly extending arm 57 which limits the rotation of said disc when coming into engagement with two depending, spaced apart lugs 58 (FIGURES 5 and 7) struck inwardly from the closed end wall of the housing into the path of movement of arm 57. This prevents shaft 21 from making a complete rotation. Disc 54 may be made of metal or any other suitable material.

Another disc 59 of insulating material has a square aperture 61 accommodating shaft 21 whereby said disc is slidable along and rotates with said shaft. Disc 59 abuts against disc 54 while biasing yoke 51 is under compression between discs 59 and 49. By the action of biasing yoke 51, discs 54 and 59 are urged upwardly against the closed end wall of housing 15 while disc 49 is urged downwardly against the free end of contact arm 41 whereby boss 48 is also urged downwardly against disc 36.

In the operation of this embodiment of the switch, the rotation of button 27 causes the rotation of shaft 21 whereby boss 48 on contact arm 41 is moved over the row of apertures 39 in disc 36 successively to engage circuit contacts 32 electrically. Helical spring 47 urges arm 41 continuously into contact with common contact 34. Circuit wires, not shown, are connected to the contact terminals 31 and 33, with the connection to terminal 33 being a common lead or wire for all of the circuits. The rotation of button 27 rotates disc 49 and contact arm 41 and as the boss 48 of arm 41 becomes aligned with each successive aperture 39, it will snap through such aperture and electrically engage a corresponding contact 32 coinciding therewith. Apertures 39 serve as detents to hold the contact arm 41 yieldingly and resiliently in each of several circuit activating closing positions.

As shaft 21 is rotated to cause the movement of contact arm 41, boss 48, moving successively from one aperture 39 in disc 36 to another, will rise upon the intervening surface of said disc thereby causing contact arm 41 and a portion of floating disc 49 to rise at a tilted angle against the resilient action of a spring leg 53 of biasing yoke 51 in the region of boss 48. Because of the movable coupling between shaft 21 and arm 41, the latter will tilt as necessary when it rotates from one circuit contact location to another against the yieldable action of spring 47 to accommodate for the rise of boss 48 and of disc 49. Accordingly, biasing spring 47 and biasing yoke 51 not only ensure the establishment of electrical connection between contact arm 41 and contacts 32 and 34 but also the indexing action of said contact arm when boss 48 makes electrical connection with any one of the circuit contacts 32. The second leg 53 of biasing spring 51 serves to stabilize the position of floating disc 49 during the intermittent tilting action that takes place when contact arm 41 passes from one circuit contact 32 to another.

In the embodiment of the invention shown in FIGURES 10-13, the construction is the same as that of FIGURES 1-9, except that disc 49 is omitted and biasing yoke 51 is replaced by a differently formed biasing yoke 62, formed of sheet metal, as shown separately in FIGURES 12 and 13.

Yoke 62 has a square aperture 63 through which shaft 21 extends, said yoke being slidable along said shaft as it is rotated thereby. A portion of yoke 62 is formed into a bight 64, the terminal edge 66 of which abuts a side face of shaft 21. A portion of yoke 62 is cut and bent into a downwardly and outwardly extending arcuate leg 67 whose knee 68 bears resiliently and yieldingly upon the free end of contact arm 41. By determining the suitable dimensions and resilience of yoke 62 and leg 67, said yoke is urged upwardly against disc 59 while knee 68 urges the free end of arm 41 against disc 36 and cause its boss 48 to snap through any aperture 39 in disc 36 with which it may coincide and thus establish electrical connection with a corresponding contact 32. Helical spring 47 urges boss 44 of arm 41 continuously through aperture 38 into electrical connection with the central contact 34.

The operation of the embodiment shown in FIGURES 10-13 is generally the same as explained for the embodiment shown in FIGURES 1-9. As shaft 21 is rotated, boss 48 of contact arm 41 will move over a face of disc

36 and will establish electrical connection successively with contacts 32 through apertures 39 in said disc. Knee 69 of the spring yoke 62 will continuously bear downwardly upon the free end of contact arm 41 as they rotate together with the shaft 21. Disc arm 57 cooperates with lugs 58 of the housing shell to limit rotation of shaft 21, as in FIGURES 1-9.

It will be noted that all of the parts of this switch, for both embodiments, are easily made of stampings, die castings, and by forming and drawing tools. They are easily and quickly assembled by relatively unskilled labor so that the final switch is compact, durable, dependable and relatively inexpensive.

It will be understood that various changes in details, materials and arrangements of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

I claim:

1. A rotary multiple selector switch comprising a housing, a base connected to said housing, a plurality of spaced apart electrical circuit contacts arrayed in a circle on said base, a common contact on said base located centrally of said circular array of circuit contacts, a rotatable shaft mounted in said housing, an electrically conductive contact arm mounted on said shaft and rotated thereby, said arm being yieldably coupled and angularly movable relative to said shaft, first biasing means on said shaft yieldably urging a portion of said contact arm into electrical connection with said common contact, and second biasing means on said shaft yieldably urging another portion of said contact arm to make electrical connection selectively with any one of said circuit contacts.

2. A switch according to claim 1 and further comprising an indexing disc in said housing and mounted over said contacts, a plurality of apertures in said disc coinciding with each of said circuit contacts and with said common contact, a first boss on said contact arm located over said common contact and extending through the coinciding aperture in said disc, a second boss on said contact arm located in a position where it extends through any one of the disc apertures coinciding with respective circuit contacts depending upon the position to which said shaft is rotated.

3. A switch according to claim 2 and further comprising a floating disc mounted on said shaft and rotatable therewith, a portion of said floating disc bearing upon said contact arm in the region of said second boss, said second biasing means bearing upon said floating disc in the region where the latter bears on said second boss, and a biasing extension on said second biasing means bearing against said pressure disc at a location substantially 180° apart from the region bearing upon said second boss.

4. A rotary multiple selector switch comprising a housing, a base connected to said housing, a plurality of spaced apart electrical circuit contacts arrayed in a circle on said base, a common contact on said base located centrally of said circular array of circuit contacts, a rotatable shaft mounted in said housing, a radial electrically conductive contact arm mounted on said shaft and rotated thereby above said base, said arm being yieldably coupled and angularly movable relative to said shaft, an axial recess in the end of said shaft, a spring in said recess yieldably urging the inner end portion of said contact arm into electrical connection with said common contact, and a spring mounted around and rotated by said shaft yieldably urging another portion of said contact arm into electrical connection selectively with any one of said circuit contacts depending upon the position to which said shaft has been rotated.

5. A switch according to claim 4 and further comprising indexing means on said base for locating said other

portion of said contact arm on respective circuit contacts.

6. A switch according to claim 4 and further comprising a member coupled to said shaft and rotating therewith and stop means on said housing in the path of said member for limiting the rotation of said shaft.

7. A rotary multiple selector switch comprising a housing, a base connected to said housing, a plurality of spaced apart electrical circuit contacts arrayed in a circle on said base, a common contact on said base located centrally of said circular array of circuit contacts, a rotatable shaft mounted in said housing, a radial electrically conductive contact arm mounted on said shaft and rotated thereby above said base, said arm being yieldably coupled and angularly movable relative to said shaft, a floating disc of insulated material mounted on said contact arm and rotating therewith, said arm and said disc being movable in a direction normal to said base, an indexing disc adjacent said base, a plurality of apertures in said disc, each of said apertures coinciding with a respective circuit contact, a boss on said contact arm for making electrical connection with any one of said circuit contacts through said respective apertures, first biasing means on said shaft yieldably urging a portion of said contact arm into electrical connection with said common contact, and second biasing means bearing upon said floating disc and yieldably urging said boss into electrical connection selectively with any one of said circuit contacts depending upon the position to which said shaft has been rotated.

8. A switch according to claim 7 and further comprising third biasing means on said shaft bearing upon said floating disc in a region substantially 180° apart from the region of said boss for stabilizing the action of said floating disc when the latter and said contact arm are rotated.

9. A rotary multiple selector switch comprising a housing, a base connected to said housing, a plurality of spaced apart electrical circuit contacts arrayed in a circle on said base, a common contact on said base located centrally of said circular array of circuit contacts, a rotatable shaft mounted in said housing, a radially electrically conductive contact arm mounted on said shaft and rotated thereby above said base, said arm being yieldably coupled and angularly movable relative to said shaft, an indexing disc adjacent said base, a plurality of apertures in said disc, each of said apertures coinciding with a respective circuit contact, a boss on said contact arm for making electrical connection with any one of said circuit contacts through said respective apertures, first biasing means on said shaft yieldably urging a portion of said contact arm into electrical connection with said common contact, and second biasing means yieldably urging said boss into electrical connection selectively with any one of said circuit contacts depending upon the position to which said shaft has been rotated, said contact arm tilting upwardly from said base when passing from one circuit contact to another while being maintained in electrical connection with said common contact by said first biasing means.

10. A switch according to claim 9 and further comprising a floating disc mounted on said contact arm and rotatable and tiltable therewith, said second biasing means bearing upon said floating disc in the region of said boss, and third biasing means bearing upon another portion of said floating disc for stabilizing the action of said arm and said floating disc.

11. A rotary multiple selector switch comprising a base, a plurality of spaced apart electrical contacts arrayed in a circle on said base, a common contact on said base located centrally of said circular array of contacts, a housing connected to said base, a rotatable shaft mounted in said housing and arrayed perpendicularly to said base opposite said central common contact, a contact arm mounted on said shaft and rotatable thereby, said arm

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being yieldably coupled and angularly movable relative to said shaft, a first boss on said contact arm making electrical contact with said central contact, a second boss on said contact arm movable by rotation of said shaft to make contact selectively with any one of said contacts in said circular array, a spring in said shaft operative upon said contact arm in the location of said first boss to urge the latter against said central contact, a biasing element mounted on said shaft and rotatable therewith, said biasing element bearing upon said contact arm in the region of said second boss to urge the latter yieldable upon any of the selected contacts in the circular array.

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