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MULTIPLE CONTACT ROTARY SWITCHES

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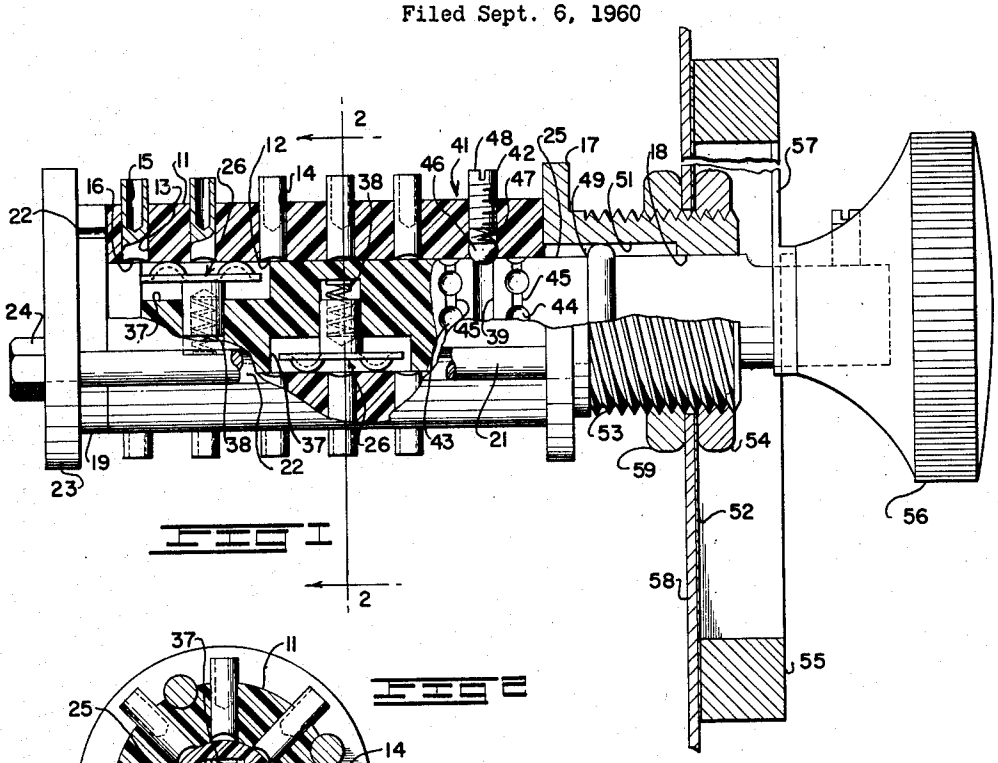


FIG. 1

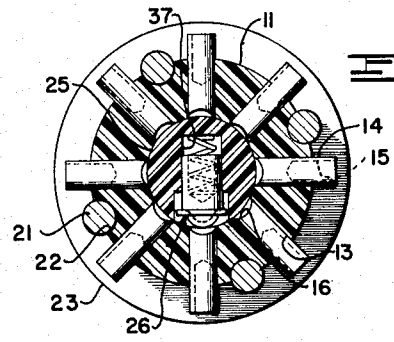


FIG. 2

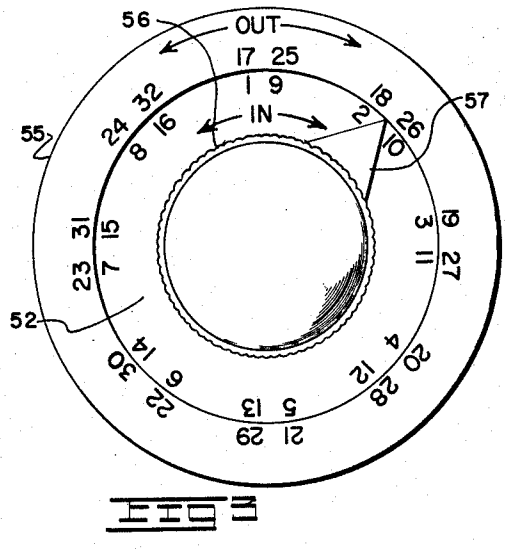


FIG. 3

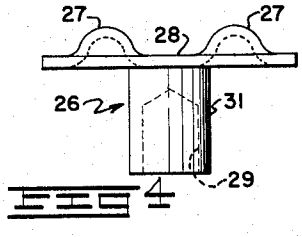


FIG. 4

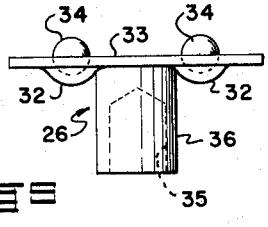


FIG. 5

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MULTIPLE CONTACT ROTARY SWITCHES

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This invention relates to multiple contact switches, and more particularly to a rotary switch for controlling a plurality of circuits.

In many instances it is frequently desirable to have relatively large numbers of switching adjustments for selecting proper values of electrical quantities. However, in the past, a problem has arisen in designing a switch which is relatively small but capable of performing the functions from a single control arrangement. In addition problems have arisen in the use of sliding contact switches in the form of increased contact resistance.

One object of this invention is to provide a new and simple multiple contact switch.

An additional object resides in a control by which a relatively large number of switching operations may be performed by actuation of a single element.

Another object of this invention is to provide a control arrangement for selecting any desired position from a plurality of switch positions by single control means.

A further object of this invention is to provide contact members of novel form to resiliently engage terminals thereby decreasing effective resistance due to wear on the contacts.

A still further object of this invention is to provide a novel dial arrangement to cooperate with an axially and rotatably movable switch actuator to indicate the various axial and circumferential positions thereof.

With these and other objects in mind, the present invention contemplates an electrical switch having rotatable, slidably mounted contact members for completing any of a number of electrical connections. A rotatable, slidable plunger having bridging contact members mounted thereon is positioned within an axial bore of a cylindrical housing. A plurality of rows or rings of radially arranged terminals are axially positioned within the housing. As the plunger is axially and rotatably positioned, the bridging contact members electrically connect successive pairs of axially spaced terminals.

The invention also contemplates a dial with which the contact member cooperates to indicate both axial and rotary displacement.

Other objects and advantages of the invention will become apparent by reference to the following detailed description and the accompanying drawings illustrating a preferred embodiment thereof, in which—

FIG. 1 is a fragmentary sectional view of a rotary switch for making electrical connections embodying the principal features of the present invention;

FIG. 2 is a cross-sectional view taken on line 2—2 of FIG. 1 showing the radial arrangement of a ring of terminals;

FIG. 3 is a reduced scale end view of FIG. 1 disclosing the dial arrangement of the switch;

FIG. 4 is an enlarged view of abridging contact member shown in FIG. 1; and

FIG. 5 is a view of an alternate bridging contact member interchangeable with that shown in FIG. 4.

Referring now in detail to the drawings, a cylindrical housing **11**, composed of Teflon or some suitable insulating material having heat resistant and minimum friction properties, has an axial bore **12** extending therethrough. Also, as shown in FIG. 2, the housing **11** is provided with a series of axially spaced, radially arranged apertures **13**, extending therethrough for receiving a plurality

of rows or rings I–V of terminals or jacks **14**. The terminals **14** are formed with openings **15** at the outer extremity and recesses **16** of generally hemispherical shape at the inner extremity which extend to the bore **12** of the housing **11**. A hub **17** is positioned adjacent the housing **11** such that an axial bore **18** of the hub **17** is coaxial with the bore **12** of the housing **11**. Positioned at the opposite end of the housing **11** is a spacer **19**. Four rods **21** are brazed at one end to the hub **17** and are threaded at the opposite extremity. The housing **11** and the spacer **19** have longitudinal slots **22** formed therein for receiving the rods **21** thereby preventing a rotary slipping action of the housing **11** and the spacer **19**. An end plate **23** having apertures selectively placed is positioned on the rods **21** and fastened thereto by nuts or other fastening members **24**, thereby retaining the hub **17**, the housing **11**, and the spacer **19** in the previously described relation.

A plunger **25**, composed of a suitable insulating material, has electrical connecting means mounted thereon in the form of a pair of resiliently urged bridging contact members **26** and is slidably positioned within the axial bores **12** and **18** of the housing **11** and the hub **17**, respectively. The bridging contact member **26**, as shown in FIG. 4, is of a generally T-shaped form and has axially spaced projections **27** on a cross bar **28** and an opening **29** in a lower leg **31**. An alternate arrangement of the bridging contact member **26**, for example as shown in FIG. 5, is also of a generally T-shaped form and has cup-like recesses **32** formed in a cross bar **33** for receiving spherical members **34** and an opening **35** in a lower leg **36**. The spherical members **34** are composed of a hard material of high electrical conductivity such as beryllium copper. The plunger **25** has a pair of cutaway sections or slots **37** for receiving the bridging contact members **26**. A spring **38** is positioned within the openings **29** of the bridging contact members **26** to resiliently urge the projections **27** outwardly from the plunger **25**.

The plunger **25** is formed with a circumferential groove **39** for receiving a retaining means or ball check **41** which is contained within a partially threaded aperture **42** in the housing **11**. There is also formed on the plunger **25** a pair of rows of circumferentially arranged recesses **43** and **44** of generally hemispherical shape where the recesses of each row are interconnected by slots **45**. The rows are positioned on each side of the groove **39** for receiving the ball check **41** upon axial positioning of the plunger. The ball check **41** consists of a spherical member **46**, a spring **47**, and an adjustable set screw **48** positioned in a threaded section of the aperture **42**, as shown in FIG. 1. The spring **47** acts on the spherical member **46** to insure resilient engagement of the ball check **41** with the groove **39** or the recesses **43** and **44**. A lock ring **49** is mounted in a groove formed in the plunger **25** and cooperates with an enlarged section **51** of hub bore **18** to limit the axial positioning of the plunger **25**.

A dial arrangement, as shown in FIG. 3, consists of a disk **52** concentrically positioned about the plunger **25** adjacent to a threaded portion **53** of the hub **17** and attached thereto by a pair of lock nuts **54** and **59**, an annulus **55** firmly attached to the disk **52**, and a knob **56** secured to the plunger **25** and having a pointer **57** fastened thereto being rotatable with the plunger **25**. The arrangement of the disk **52** and the annulus **55** could be machined from a single piece. As shown in FIG. 3, the disk **52** and the annulus **55** are provided with indicia representative of the various positions of the bridging contact members **26**. The switch, as shown in FIG. 1, may be mounted on a cabinet frame **58** and fastened thereto by the cooperation of lock nuts **54** and **59** and the threaded portions **53** of the hub **17**.

In operation of the switch, a number of circuits may

be connected to the switch by the insertion of plug connectors into the openings 15 of the terminals 14. It is to be understood that the circuits may also be connected to the switch by soldering wire leads to the terminals 14. The plunger 25 then can be adjusted to any one of three axial positions. In a first position, the plunger 25 is positioned such that the ball check 41 engages one of the recesses 43 of the plunger 25. The projections 27 of a first of the bridging contact members 26 engages the recesses 16 of a pair of axially spaced terminals 14 of rings I and II, thereby providing an electrical connection between the terminals 14. Additionally, a second bridging contact member 26 electrically connects another pair of axially spaced terminals 14 of rings III and IV in the same manner. Each connection is designated as a switch position and is represented by indicia as shown on disk 52 and indicated by pointer 57. Therefore, as the plunger 25 is maintained in the position as previously described, switch positions 2 and 10, as shown in FIG. 3, indicate the position of bridging contact members 26 with terminals 14 of rings I and II, and III and IV, respectively. Rotation of plunger 25, as controlled by knob 56, further positions bridging contact members 26 at positions which connect other sets of circumferentially and axially spaced terminals 14 of rings I and II, and III and IV, as indicated, for example, by positions 1 and 9, respectively, on disk 52. As the plunger 25 is indexed, the ball check 41, guided by the slots 45, cooperates with the circumferentially arranged row of recesses 43 to hold the projections 27 in engagement with the terminals 14.

Axial movement of the plunger 25 towards the right, as shown in FIG. 1, places the plunger 25 in a second position where the groove 39 of the plunger 25 receives the ball check 41 thereby preventing sliding movement of the plunger 25 regardless of the rotary position of the plunger. As the plunger 25 is moved as described, the projections 27 of bridging contact members 26 disengage with the recesses 16 of terminals 14 and rest on the bore wall 12 of the housing 11 thereby placing the switch in a neutral or non-connecting position. This is indicated by the position of the pointer 57 being midway between the surface of the disk 52 and the upper surface of the annulus 55. The resilient action provided by the springs 38 of the bridging contact members 26 decreases the wear on the contacting elements resulting from sliding contact thereby decreasing the effective resistance of the contacts due to wear.

Additional movement of plunger 25 to the right, as shown in FIG. 1, places the plunger 25 in a third position where the ball check 41 engages one of the recesses 44 of the plunger 25 and also positions the pair of bridging contact members 26 to engage and electrically connect axially spaced terminals 14 of rings II and III, and IV and V, respectively. Again, as shown in FIG. 3, the positions of bridging contact members 26 are indicated by the position of the pointer 57 in cooperation with the indicia on the annulus 55. Rotation of the plunger 25 further positions the bridging contact members 26 to other positions which are indicated by the indicia on the annulus 55. As previously described, the engagement of the ball check 41 with the recesses 44 of the plunger 25 provides a restraining action as the plunger 25 is indexed.

By increasing the diameter of the housing 11, additional terminals 14 may be added thereby increasing the number of possible switch positions. Further, the bridging contact members 26 may be radially arranged such that no two sets of terminals shall be in contact at the same time.

The miniature structure of the switch readily permits the use of the switch in precision operations for potentiometers, attenuators, and capacitor tuning circuits. Additionally, the switch is extremely useful in selectively connecting vast arrays of circuit components in a circuit.

It is to be understood that the above described arrangements are simply illustrative of an application of the principles of the application. Numerous other arrangements may be devised by those skilled in the art which will embody the principles of the invention and will fall within the spirit and scope thereof.

What is claimed is:

1. In a rotary switch,
a housing having an axial bore;
a plurality of pairs of axially spaced rings of radially disposed terminals mounted in said housing and extending to said bore of said housing;
an insulating plunger mounted within said bore of said housing, and axially movable inwardly and outwardly relative to said bore, and rotatably movable within said bore; and
means mounted on said plunger and responsive to:
the axial inward and outward movement of said plunger for engaging and electrically interconnecting successive pairs of said rings of said terminals, and
the rotational movement of said plunger for electrically interconnecting a selected pair of terminals in said interconnected rings.

2. In a rotary switch, a housing having an axial bore, a pair of axially disposed rings of radially displaced terminals mounted in said housing and extending to said bore, a plunger mounted within said bore of said housing for axial and rotational movement, and a spring-tensioned cross bar mounted on said plunger and having a pair of axially spaced spherical members mounted thereon for engaging successive pairs of axially displaced terminals upon axial and rotational movement of said plunger thereby electrically connecting said terminals.

3. In a rotary switch, a housing having an axial bore, a plurality of axially spaced rows of radially disposed terminals having recessed contact portions that are spaced apart equal angular distances, a plunger mounted in said bore having resilient contact elements mounted thereon, said resilient contact elements being complementary to said recessed contact portions, means mounted in said housing for resiliently engaging said plunger, said plunger having a circumferential row of recesses each of which is spaced apart an angular distance equal to the angular distance between said terminals, and means for rotating said plunger to engage said resilient contact elements with said recessed contact portions and to engage said recesses in said plunger with said means mounted in said housing.

4. In a rotary switch, a housing having an axial bore, a pair of rings of terminals mounted in the housing and extending to said bore, a plunger mounted within said bore for axial and rotational movement and having bridging means resiliently mounted thereon for engaging and electrically connecting an axially displaced pair of terminals of said rings, said plunger having formed therein a circumferential groove and a circumferential row of recesses adjacent said groove, a spring-tensioned spherical member mounted within said housing and engaging said circumferential groove in said plunger for retaining said bridging means in a disengaged position, and said spherical member upon axial movement of said plunger engaging said circumferential row of recesses of said plunger for providing a restraining action upon indexing of said plunger.

5. In a rotary switch, a housing having terminals mounted therein and extending to an axial bore thereof, a plunger mounted within said bore for axial and rotational movement and having bridging means mounted thereon for engaging and electrically connecting said terminals, means for shifting said plunger into two axial positions and a plurality of rotary positions whereby said connections are completed, a dial mounted on said housing concentric with said plunger having a pair of scales at different planes and radially arranged indicia on each scale where each scale is representative of an axial position of said plunger and said indicia is representative of a rotary position of said bridging means, and a pointer

fixedly mounted on and rotatable with said plunger positioned adjacent said scales for cooperating separately with each of said scales to indicate the axial position of said plunger and the rotary position of said bridging means.

6. In a rotary switch, a housing having an axial bore, a pair of axially spaced rings of radially disposed terminals mounted in said housing and extending to said bore, a plunger mounted within said bore for axial and rotational movement, said plunger having formed therein a circumferential groove and a pair of circumferential rows of recesses, one on each side of said groove, a spring-tensioned cross bar mounted on said plunger and having a pair of axially displaced spherical members mounted thereon for engaging successive pairs of axially spaced terminals and completing an electrical connection thereof, a spring-tensioned spherical member mounted in said housing and first engaging said circumferential groove of said plunger for retaining said pair of spherical members from engagement with said terminals and second upon axial movement of said plunger engaging one recess of said pair of circumferential rows of recesses of said plunger for providing a restraining action upon rotational movement of said plunger whereby said pair of spherical members engage and electrically connect a given pair of axially spaced terminals, a dial mounted on said housing and concentric with said plunger having a pair of scales at different planes with radially arranged indicia on each

scale, and a pointer fixedly mounted on and rotatably and axially positionable with said plunger for cooperating with each of said scales to indicate the rotary position of said plunger and said pair of spherical members.

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