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## ROTARY SWITCH

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This invention relates to rotary electric switches and more particularly to switches comprising a stator, having a plurality of circumferentially spaced, fixed contacts, and a rotor having one or more contact blades or units adapted simultaneously to engage two or more of the said fixed contacts, or one or more of the fixed contacts and a common contact, switches of this character being generally known as "selector" switches.

A rotary selector switch may comprise one or more, up to large number, of like assemblies or switching units, mounted on a single shaft and, if desired, associated with an indexing mechanism of known type for properly orienting the rotors of the several switching units, for simultaneously controlling a large number of circuits.

It is a general object of the present invention to provide a rotary switch unit of the character described, adapted if desired to be assembled with any number of like switch units, with or without an indexing mechanism, the individual switch units being complete in themselves, except for the operating shaft, and being suitable for separate packaging and sale if desired, the individual units being substantially tamper-proof and proof against loss or displacement of parts.

Another object is the provision of a switch unit such as described, comprising generally a stator having a plurality of fixed contacts, a rotor carrying the movable contacts or blades, and a cover permanently secured to the stator and permanently enclosing the rotor between the stator and cover, so that the latter may not be inadvertently lost, or displaced out of alignment.
Another object of the invention is the provision of a switch of the character described, so designed and constructed as to have relatively small physical dimensions considering the quantity of electrical energy to be handled.
Another object is the provision of a rotary switch in which the fixed contacts are permanently secured in a common plane to very close tolerances in order that uniform contact resistance, between the contact blades and the fixed contacts, may be maintained.

A further object is the provision of a switch of the character described, in which each rotary contact blade comprises at least two branches or arms of resilient material, electrically in parallel, the respective branches having different natural periods of vibration so that constant contact may be maintained during periods of shock or excessive vibration, such as occur, for example, on warships.

A further object of the invention is to provide a switch comprising a stator of plastic material having the fixed contacts permanently secured therein during the molding thereof, so as to prevent displacement or loss of any of the contact members and to insure their maintenance in a common plane.

Another object is the provision of a rotary switch having a rotor in which the contact blades are permanently secured during the molding of the rotor, for a like purpose.

Other and further objects, features and advantages will be apparent from the description which follows, read in connection with the accompanying drawings in which

Figure 1 is a side elevation, partly in section, showing a multi-unit rotary selector switch according to the invention;

Figure 2 is a section on line 2-2 of Figure 1, illustrating the indexing mechanism;

Figure 3 is an end elevation of a switch unit, with por-
tions of the common contact broken away to expose parts lying therebeneath;

Figure 4 is a vertical section on line 4-4 of Figure 3 ;
Figure 5 is an exploded view showing the several elements of a switch unit according to the invention;

Figure 6 is a perspective view of the rotor;
Figure 7 is a fragmentary perspective view of the opposite side of the rotor;

Figure 8 is a section on line $8-8$ of Figure 4;
Figure 9 is a fragmentary view of a unitary blank comprising all of the fixed contacts in an intermediate stage of manufacture; and
Figure 10 is a plan view of a rotor blade in an intermediate stage of manufacture.
In order to facilitate an understanding of the invention, reference is made to the embodiment thereof shown in the accompanying drawings and detailed descriptive language is employed. It will nevertheless be understood that no limitation of the invention is thereby intended and that various changes and alterations are contemplated such as would ordinarily occur to one skilled in the art to which the invention relates.

Referring to Figure 1, it will be seen that a rotary selector switch according to the invention may comprise a plurality of switching units 10 assembled in alignment and held together by tie-rods 11 and nuts 12 , the rotors of the several switching units being mounted on a common shaft 13 (Figure 3). The switch may be mounted between panel 14 and bracket 15 in any suitable manner, and is preferably provided with an indexing unit 16, the shaft 17 of which is operatively connected to the shaft 13 of the switching units. A handle 18 and dial plate 19 are preferably provided on the shaft 17, in known manner. The indexing mechanism 16 is illustrated in Figure 2 and comprises generally a starwheel 20 mounted on the shaft 17 and one or more roller type cam followers 21 carried on levers 22 pivoted adjacent the starwheel 20 and urged into engagement therewith by springs 23 . The details of the indexing mechanism form no part of the present invention.
A general understanding of the construction of each switching unit according to the invention, in one embodiment thereof, is best obtained from a consideration of Figure 5 from which it will be seen that each switch unit 10 comprises a stator 24 , rotor 25 (Figure 6), common contact 26 and cover plate 27, the whole being adapted to be secured, as a final stage in its manufacture, preferably by a thermosetting adhesive, a ring of which is indicated at 28 . The stator 24 is annular in form and comprises a base portion or deck 29 of non-conductive moldable plastic, with a plurality of circumferentially spaced, fixed contacts $\mathbf{3 0}$ molded in permanent association therewith. As a convenient manner of fabricating the stator, a blank may be formed (Figure 9) of suitable electrical contact material, the blank comprising the spoke-like contacts $\mathbf{3 0}$ and a peripheral connecting piece 31, the blank being unitary. After the blank is molded into the deck 29 and the latter has hardened and cooled, the peripheral connecting piece 31 is severed, leaving the separate contacts $\mathbf{3 0}$ in proper circumferentially spaced relation and occupying a common plane. Each contact 30 has a terminal portion 32, preferably provided with an aperture $\mathbf{3 3}$ to facilitate soldering a conductor thereto, the terminal portion 32 extending beyond the periphery of the deck 29. The latter is provided with the desired number of peripheral projections or lugs 34 having apertures 35 to accommodate the tierods by means of which a plurality of switch units are assembled together.
The deck 29 has generally the form of a centrally apertured dise provided with an axially extending thickened portion or flange 36 in which the contacts 30 are embedded, their contact making portions extending radially inwardly of the flange 36 and their terminal portions 32 extending radially outwardly thereof, the flange 36 being of sufficient height to accommodate the rotor 25 between the stator and the cover 27 when the latter is adhesively secured to the face of flange 36. Preferably the flange 36 is provided with molded indentations 37 and projections 38 to facilitate assem-
bly of the common contact 26 therewith, corresponding peripheral projections 39 on the common contact 26 being seated in the indentations 37, the apertures 40 in the projections 39 fitting over the projections 38 formed in the indentations 37 . The terminal portions 41 of the common contact 26 fit into corresponding grooves 42 formed in the face of the flange 36.

The rotor 25 likewise comprises a molded plastic hub-like member 43 having embedded therein one or more movable contact units or blades 44 during the process of manufacture. The member 43 is formed with a polygonal central aperture 45 for receiving the shaft 13 as will be understood, and with cylindrical bearing portions 46 at its respective ends, to fit the central apertures 47 of the stator and 48 of the cover 27. Preferably, the end faces of the bearing portions 46 are provided, one with a projection 49 and the other with a corresponding recess 50 to secure the proper orientation of the rotors of successive switch units when assembled on a common shaft.
Each contact blade 44, according to the present embodiment, comprises two leaves 51 and 52 and each leaf comprises inner and outer branches or arms 53 and 54, respectively. As will be understood, the contact blades are fabricated of suitable resilient, electrically conductive material (beryllium copper, for example) and the respective branches 53 and 54 of each leaf are so dimensioned as to have differing natural periods of vibration. Each branch is provided with a contact making projection 55 for actual engagement with the fixed contacts or common contact as the case may be, the circuits therefore, being established in parallel as will be understood. Due to the differing periods of vibration of the branches 53 and 54 , one or the other branch of each circuit will remain closed at all times, notwithstanding intensive vibrations, or shock, which feature renders the switch of the invention especially suitable for applications in which it is subjected to such heavy shocks.

Figure 10 illustrates a blank suitable for forming the contact blades 44 , the desired number of blanks 56 being folded double about the line 57 and inserted in place in the molded member 43 during molding thereof.

It will be noted that the deck 29 of the stator is formed to provide radially extending openings 58 (Figure 8) on either side of each contact 30, so that metal particles detached from the contacts during operation of the switch cannot form "tracking paths" which tend to shorten the life of the switch by promoting shortcircuits therein. Similarly, the deck 29 is provided with peripheral projections 59 between adjacent contacts in order to lengthen the leakage paths therebetween.

When the rotor 25 has been assembled within the stator 24, the common contact 26 has been put in place, and the cover 27 secured to the face of flange 36 by means of the thermosetting adhesive 28, a completely tamperproof, unitary device results. The rotor cannot be displaced, nor can any of the fixed contacts or the contact blades of the rotor become detached or displaced. It is only necessary, in order to place the device in operation, to assemble it on an operating shaft and make the necessary electrical connections to the terminals 32 and 41.

By virtue of the present construction, and particularly by reason of the common contact having the same diameter as the ring of fixed contacts, the two being connected through movable contact blades having separate leaves, and the separate leaves having separate branches in parallel, a switch of relatively small physical dimensions, considering the load to be carried, is produced, as well as a switch which is shock resistant, tamper-proof, and proof against inadvertent loss or displacement of any of its parts.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is: 1. A rotary switch comprising an annular stator of non-conductive material, a plurality of circumferential-ly-spaced, radially extending fixed contacts molded integrally with said stator, said stator having an axiallyextending annular flange and said contacts having portions extending radially outwardly and inwardly of said flange, said flange having a plurality of shallow recesses formed in its axial face, said stator including an annular common contact having a plurality of radial projections fitting into said shallow recesses so that the outer surface of said common contact is flush with the axial face of said flange, a rotor of non-conductive material coaxial with said stator, contact blades secured to said rotor and adapted to engage between said common contact and the inwardly extending portions of said fixed contacts, and means securing said stator and rotor in assembled relationship, said last means comprising a flat cover permanently secured to the axial face of said flange and enclosing said rotor between said stator and said cover.
2. A switch according to claim 1 , said cover having a central opening and said rotor having bearing portions extending axially through said stator and cover, respectively, into substantially flush relation with the outer surfaces thereof.
3. A switch according to claim 2, one of said bearing portions having an axially extending eccentric projection and the other said bearing portion having a corresponding recess.
4. A switch according to claim 1, each said contact blade comprising an integral pair of leaves of resilient material, one leaf engaging said fixed contacts and the other engaging said common contact, and each said leaf comprising an integral pair of flat, substantially parallel branches of differing natural periods of vibration, said branches of each leaf lying substantially in the same plane.

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