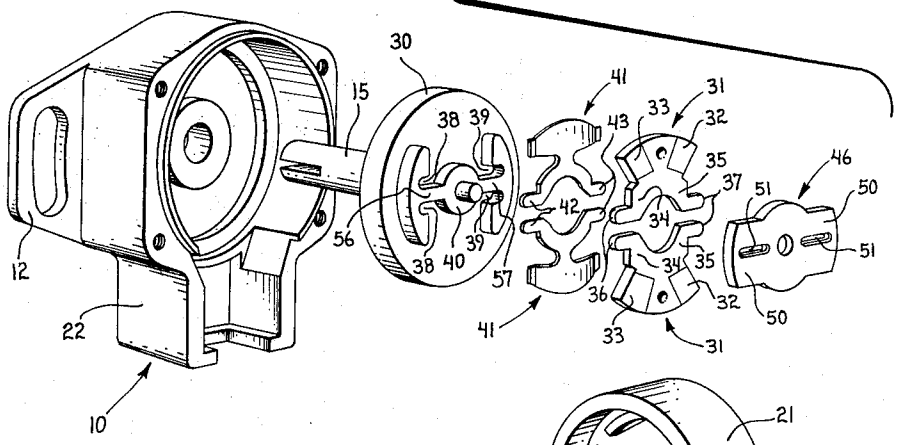
April 26, 1966 P. H. KORRELL ETAL 3,248,489

ROTARY SWITCH CONTACT WIPERS WITH WASHER AND EPOXY SEALING MEANS

Filed Oct. 16, 1963

Fig. 1.



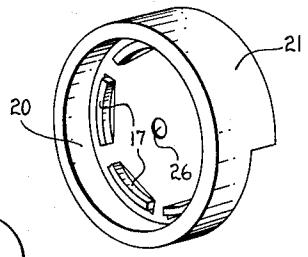


Fig. 2.

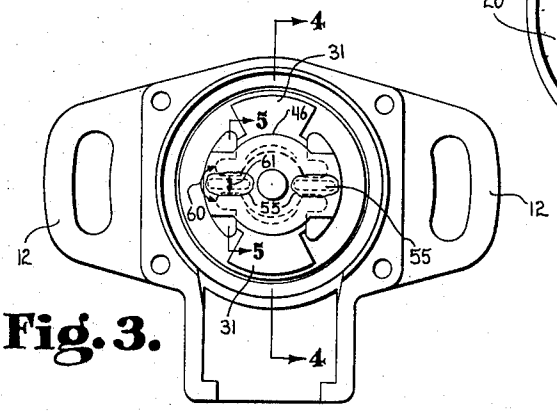


Fig. 3.

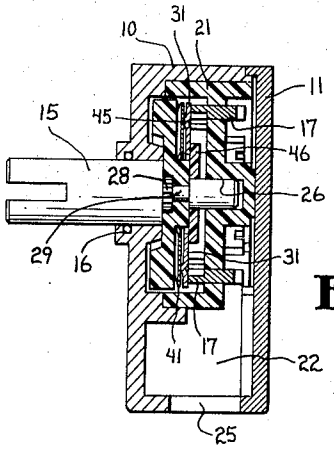


Fig. 4.

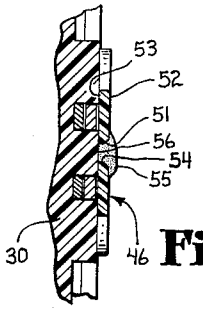


Fig. 5.

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ROTARY SWITCH CONTACT WIPERS WITH WASHER AND EPOXY SEALING MEANS

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5 Claims. (Cl. 200—11)

The present invention relates to electric switches.

In certain types of electrical switches, mechanical precision is of the utmost importance. Thus, in certain rotary type switches, the closing of the circuit should be effected within a fraction of a degree and should continue to be effected within that same fraction of the same degree throughout the life of the switch. In the United States patent to Crimmins, 2,777,908, there is disclosed a wiper type switch which is easily constructed with narrow mechanical tolerances and which has been found to maintain proper operation within narrow angular tolerances over a long and useful life. However, because of the specific design of the Crimmins' switch wherein electrodes of opposite polarity are spaced relatively closely to one another, there has been found to be room for improvement in the insulation resistance and voltage breakdown between current carrying parts and between current carrying parts and ground of the Crimmins' rotary switch.

Consequently, one object of the present invention is to provide an improved rotary switch of the above nature having a higher breakdown voltage.

A further object of the present invention is to provide an improved rotary switch.

Related objects and advantages will become apparent as the description proceeds.

One specific embodiment of the present invention might include a switch comprising a plurality of metal contact elements with planar wiping contact surfaces disposed in a circle in a plane perpendicular to an axial line, a shaft journalled on said line, a disk coextensive with, parallel to, and spaced from said plane of the contact surfaces and keyed to said shaft, a pair of wipers mounted on the disk and adapted to slide across said contact surfaces, said wipers each consisting of a flattened metal piece on the face of the disk and with legs straddling said shaft, said disk having recesses in the face thereof which receive the leg ends of the respective wipers, said recesses in said disk being located at points substantially on a diametrical line across the disk so that said wiper portion is fixed against rotational displacement on the disk, said recesses and the leg ends therein of one wiper being spaced in a direction parallel to said plane from the recesses and the leg ends therein of the other wiper, a washer of nylon, delrin or other suitable material and having two radially extending wings and received on said shaft on the side of said wipers which is away from said disk, said washer covering said wipers and retaining the legs thereof in said recesses, said washer having slots through said wings which slots taper from a larger width at the face of said washer which is away from said disk to a smaller width at the face of said washer which is toward said disk, epoxy filling said slots and adhered to the washer and the disk between the legs of one wiper and the legs of the other wiper.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims.

FIG. 1 is an exploded perspective view of certain portions of the switch of the present invention.

FIG. 2 is a perspective view of a stator plate forming a part of the switch of FIG. 1.

FIG. 3 is a plan view of the structure of FIG. 1 showing it in assemblied relation.

FIG. 4 is a section taken along the line 4—4 of FIG. 3 in the direction of the arrows.

FIG. 5 is an enlarged section taken along the line 5—5 of FIG. 3 in the direction of the arrows.

The illustrated switch is of the rotary type and is particularly adapted for assembly in a dirt or watertight housing. The particular housing shown comprises a receptacle **10** with a hermetically sealed cover plate **11** and with a flange **12** for panel mounting. A shaft **15** is journalled in one side of the housing and is sealed by the packing gland **16**.

Stationary contacts **17** are arranged in a circle concentric with the axis of rotation of shaft **4**. The contacts **17** may be, for example, cast in the stator plate **20** of insulating material such as the thermoplastics. In the illustrated device, the stator plate is cast integrally with the peripheral flange **21** which is externally machined to a close fit in the housing receptacle **10**. A key (not shown) or the like may be employed between the telescope surfaces of the flange **21** and the housing receptacle **10** to rotationally lock the stator in the housing receptacle. The outer ends of the contact elements **17** may be bifurcated as shown to receive soldered connecting wires. The connecting wires may lead laterally through the extension **22** of the housing receptacle **10** and out of the receptacle through the aperture **25**. After the cover plate **11** is in place, the space within the aperture **25** not filled by the connecting wires may be potted by suitable potting compound injected into the space to seal the switch.

The inner ends of the contacts **17** are machined and polished to a true coplanar surface by chucking the stator in a lathe and turning concentrically to the central bore **26** of the stator. The leading and trailing edges of each contactor surface may be milled to precisely define the rotational position of these edges with respect to the axis of the stator. Hence, by ordinary lathe turning technique, the axis of rotation of the rotor may be precisely located relative to the surface of contacts.

The rotor of the switch comprises a disk **30** of insulating material received on the reduced diameter portion **29** and retained against rotation relative to the shaft by the straight coarse knurl **28**. The disk bears on one side against the housing of the gland **16** to insure against axial displacement of the shaft and its rotor with respect to the stator structure. The wiper pieces **31** carried by the rotor disk are designed to bridge two adjacent contacts **17** on the stator. The present switch is a double-pole, double-throw switch and consequently, two of the wiper pieces are provided. Each wiper piece **31** may be stamped form a sheet of low-resistance, corrosion-resistant metal such as silver or silver alloy. Wiping surfaces **32** and **33** are pressed out by an embossing tool and polished to make extended face-to-face contact with the polished end surfaces of the contacts **17**. Each wiper **31** is made to float on the contacts **17** by means of an elongated hinge along one side of the wiper piece, said hinge being substantially parallel to a median line through the wiping surfaces **32** and **33** of the piece.

This hinge comprises two leg portions **34** and **35**, each of which terminate in hinge pins **36** and **37**. The hinge pins are set into notches or recesses **38** and **39** on the front face of the disk **30**. The recesses or notches **38** and **39** are conveniently and accurately made by casting raised embossments integrally with the face of the disk as shown. When the hinge pins **36** and **37** are held in the notches **38** and **39**, the respective wiper piece **31** may pivot about the hinge but is rigidly held against rotational displacement about the shaft. Each wiper piece

31 is formed so as to straddle the hub structure 40 of the disk and the shaft 15.

It should also be mentioned that the notches or recesses 38 and 39 are of sufficient axial depth that the hinge pins 36 and 37 are free to move axially a limited distance in the notches or recesses. Consequently, the wiper surfaces 32 and 33 may be pressed against contacts 17 of different heights. If one corner moves down, the hinge pin at the diametrically opposite corner can move up. A pair of leaf springs 41 are provided beneath the wipers 31 and function to maintain a pressure at a single point centrally of the wipers. The leaf springs 41 each have the same general plane configuration as the wipers 31. Each spring 41 is bowed outwardly so that a central portion thereof makes point contact with a head 45 pressed into the wiper piece 31. Each spring 41 is formed with pins 42 and 43 of the same dimensions as the hinge pins 36 and 37 so that the springs 41 drop into the recesses 38 and 39, respectively. The outer corners of the bowed portion of each spring bear against the flat surface of the disk 30 to transmit a fairly strong bias to each wiper 31 through the boss 45.

The hinge pins 36 and 37 and the pins 42 and 43 are locked into the notches 38 and 39 by a non-conducting washer 46 which may preferably be formed of nylon and which is pressed over the inner end of the shaft 15. The washer 46 is formed with two radially extending wings 50 which overlie the notches 38 and 39 and hence effectively lock the pins in their notches. Centrally of the wings 50 and extending radially of the axis of shaft 15 are located oppositely extending slots 51 which are tapered from a larger width at the surface 52 of the washer to a smaller width at the intermediate portion 54 of the washer and which extend at constant width from said intermediate portion to the surface 53 of the washer. Epoxy cement 55 is placed within the slots 51 and adhered to the washer 46 and also to the surfaces 56 and 57 of the the disk. The location of this epoxy is shown perhaps best in plan in FIG. 3. The tapered relationship of the slots 51 has been found to facilitate the placing of the epoxy within the slots and to facilitate the adhering of the epoxy to the surfaces 56 and 57 of the disk 30. It has been found that the voltage breakdown path between the wipers 31 is much longer in view of the fact that the charge must travel around the epoxy insulating material 55 rather than directly between the legs 36 or directly between the legs 37. In other words, the breakdown path is along the line 60 rather than along the line 61. It should also be pointed out that the undercut section or reduced diameter portion 29 of the shaft 15 positions the conductive material of the shaft 15 away from the adjacent pins 42 and adjacent pins 43 so that there is no possibility of voltage breakdown through the disk 30.

For the above reasons, it will be evident that the present invention provides an improved rotary switch having a much higher breakdown voltage and insulation resistance whereby a longer service life under rugged operating conditions can be expected.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention and the scope of the claims are also desired to be protected.

The invention claimed is:

1. A switch comprising a plurality of metal contact elements with planar wiping contact surfaces disposed in a circle in a plane perpendicular to an axial line, a shaft journalled on said line, a disk coextensive with, parallel to, and spaced from said plane of the contact surfaces and keyed to said shaft, a pair of wipers mounted on the disk and adapted to slide across said contact surfaces, said wipers each consisting of a flattened metal piece on the face of the disk and with legs straddling said shaft, said disk having recesses in the face thereof which receives the leg ends of the respective wipers, said recesses in said disk being located at points substantially on a diametrical line across the disk so that said wiper portion is fixed against rotational displacement on the disk, said recesses and the leg ends therein of one wiper being spaced in the direction of said plane from the recesses and the leg ends therein of the other wiper, a nylon washer having two radially extending wings and received on said shaft on the side of said wipers which is away from said disk, said washer covering said wipers and retaining the legs thereof in said recesses, said washer having slots through said wings which slots taper from a larger width at the face of said washer which is away from said disk to a smaller width at an intermediate portion of the thickness of said washer and which extend at constant width from said intermediate portion to the face of said washer which is toward said disk, epoxy filling said slots and adhered to the washer and the disk between the legs of one wiper and the legs of the other wiper.

2. A switch comprising a plurality of stationary metal contact elements, a rotatable shaft, a disk keyed to said shaft, a pair of wipers mounted on the disk and adapted to slide across said contact surfaces, said wipers each consisting of a flattened metal piece on the face of the disk and with legs straddling said shaft, said disk having recesses in the face thereof which receives the leg ends of the respective wipers, said recesses in said disk being located at points substantially on a diametrical line across the disk so that said wiper portion is fixed against rotational displacement on the disk, said recesses and the leg ends therein of one wiper being spaced from the recesses and the leg ends therein of the other wiper, a washer of insulating material having two radially extending wings and received on said shaft, said washer covering said wipers and retaining the legs thereof in said recesses, said washer having slots through said wings which slots have a larger width at the face of said washer which is away from said disk and a smaller width at the face of said washer which is toward said disk, and epoxy filling said slots and adhered to the washer and the disk between the legs of one wiper and the legs of the other wiper.

3. A switch comprising a rotatable shaft, a disk keyed to said shaft, a pair of electrical contact wipers mounted on the disk, said wipers each consisting of a flattened metal piece on the face of the disk and with legs straddling said shaft, said disk having recesses in the face thereof which receives the leg ends of the respective wipers, said recesses in said disk being located at points substantially on a diametrical line across the disk so that said wiper portion is fixed against rotational displacement on the disk, said recesses and the leg ends therein of one wiper being spaced from the recesses and the leg ends therein of the other wiper, a washer of insulating material having two radially extending wings and received on said shaft, said washer covering said wipers and retaining the legs thereof in said recesses, said washer having slots and epoxy filling said slots and adhered to the washer and the disk between the legs of one wiper and the legs of the other wiper.

4. In a switch including a shaft, a disk secured to said shaft, a pair of electrical contact wipers mounted on the disk, said wipers each consisting of a flattened metal piece on the face of the disk and with legs straddling said shaft, said disk having recesses in the face thereof which receives the leg ends of the respective wipers, said recesses in said disk being located at points substantially on a diametrical line across the disk so that said wiper portion is fixed against rotational displacement on the disk, said recesses and the leg ends therein of one wiper being spaced from the recesses and the leg ends therein of the other wiper, the improvement which comprises a washer of insulating material having two radially extending wings and received on said shaft, said washer covering said

wipers and retaining the legs thereof in said recesses, said washer having slots, and epoxy filling said slots and adhered to the washer and the disk between the legs of one wiper and the legs of the other wiper.

5. In a switch including an element formed of insulating material, a pair of electrical contact members mounted on the element, said members each consisting of a flattened metal piece each having a pair of spaced legs, said element having recesses in the face thereof which receive the leg ends of the respective members, said recesses in said element and the leg ends therein of one member being spaced from the recesses and the leg ends therein of the other member, the improvement which comprises a washer of insulating material having two outwardly extending wings and covering said members and retaining

the legs thereof in said recesses, said washer having slots through said wings and epoxy filling said slots and adhered to the washer and the element between the legs of one member and the legs of the other member.

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