

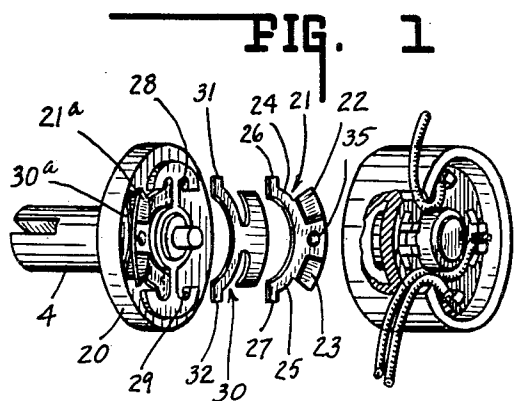
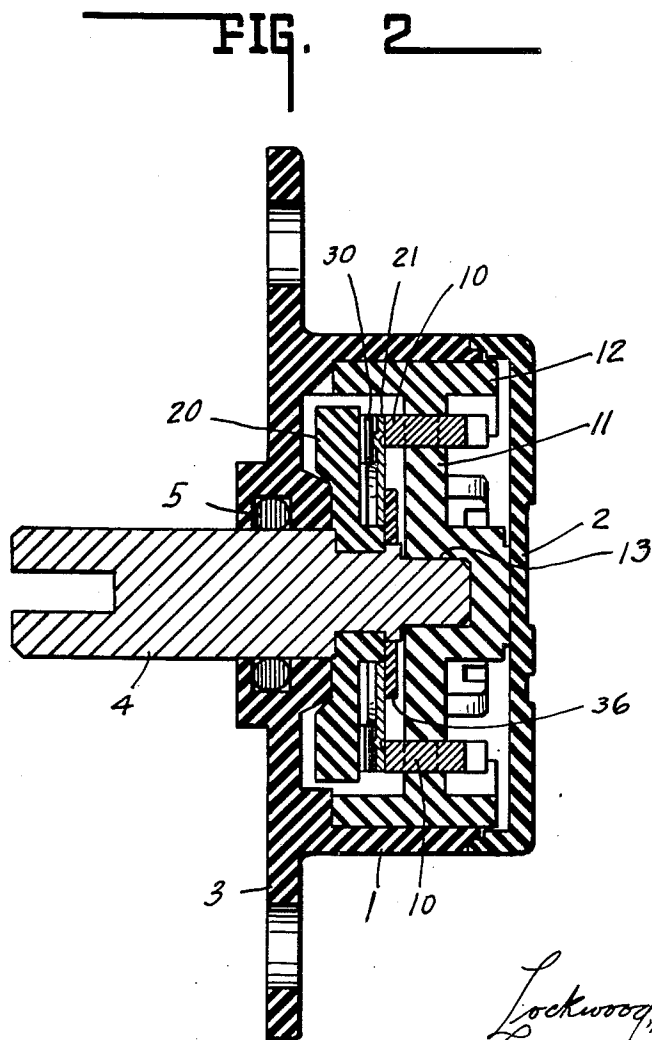
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ELECTRIC SWITCHES

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ELECTRIC SWITCHES

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This invention relates to electric switches.

In some applications of circuit closers, mechanical precision of the moving parts is of paramount importance. Where, for example, the switch is of the rotary type and must, without fail, selectively close one of a plurality of circuits, the rotational position of the rotor at which a given must circuit must close may be of the order of a fraction of a degree. Wiper-type switches are particularly vulnerable to this loss of rotation-versus-closure position where the wiper must bridge two coplanar stationary contacts. This is because of unevenness of the contact surfaces and although the various contact surfaces may be accurately machined, wear and arc burning may make the surfaces uneven and change the position of the wiper at which closure is effected. All mechanical tolerances, particularly backlash, must be very small.

The object of this invention is an improved switch of the type which can easily be made with narrow mechanical tolerances.

A more specific object of this invention is an improved switch which will retain a close rotation-to-closure position tolerances throughout a long useful life.

The objects of this invention are effected by a switching structure comprising a plurality of stationary contacts and a movable wiper for bridging one or more pairs at a time, said wiper comprising a sheet-like metal piece with two spaced wiping surfaces on one side of the piece and a single point support midway between said wiping surfaces on the other side of said piece, so that said piece will rock on said point support and permit said surfaces to level on the stationary contacts.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is an exploded perspective, partially sectioned, view of the switch of this invention; and

Fig. 2 is a one-half sectional view of an assembled switch of this invention.

The switch of Figs. 1 and 2 is of the rotary type and is particularly adapted for assembly in a dirt- or water-tight housing. The particular housing shown comprises a cylinder 1 with a hermetically sealed cover plate 2, with a flange 3 for panel mounting. The shaft 4 is journaled in one side of the housing and is sealed by the packing gland 5.

Stationary contacts 10 are arranged in a circle concentric with the axis of rotation of shaft 4. Contacts 10 may, for example, be cast in the stator plate 11 of insulating material, such as the thermoplastics. In the particular structure shown, the stator plate is cast integrally with the peripheral flange 12 which is exteriorly machined to a close fit in the housing 1. An embossing or key (not shown) between the telescoped surfaces of the flange 12 and the housing 1 may be employed, if

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desired, to rotationally index the stator in its housing. The outer ends of the contact elements 10 may be bifurcated, as shown, to receive soldered connecting wires. The connecting wires may lead laterally through the side of the flange 12 as shown in Fig. 1. After the cover plate 2 is in place, the space around the soldered connections may be potted by a suitable potting compound injected into the space.

The inner ends of contacts 10 are machined and polished to a true coplanar surface by chucking the stator in a lathe and turning concentric to center pole 13. The leading and trailing edge 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 with respect to the circle of contacts.

The rotor of the switch of this invention comprises a disk 20 of insulating material pressed on or otherwise keyed to shaft 4. Disk 20 bears on one side against the housing of gland 5 to insure against axial displacement of the shaft and its rotor with respect to the stator structure. The wiper piece 21 carried by the rotor disk is designed to bridge two adjacent contacts 10 on the stator. The wiper 21 may be stamped from a sheet of low resistance corrosion-resistant metal, such as silver or a silver alloy. Wiping surfaces 22 and 23 are pressed out by an embossing tool and polished to make extended face-to-face contact with the polished end surfaces of contacts 10. Since wear and arc burning may unevenly change the level of the ends of contacts 10, the wiper 21 is made to float on the contact 10, according to an improved feature of this invention. This floating action is effected by a novel structure which at the same time prevents backlash or rotational displacement of the wiper 21 on shaft 4. Said means consists of an elongated hinge along one side of said piece substantially parallel to a medium line through the wiping surfaces 22 and 23 of the piece.

The particular hinge shown in Fig. 1 comprises two leg portions 24 and 25 each terminating in hinge pins 26 and 27. The hinge pins are set into notches 28 and 29, respectively, on the front face of the disk 20. The hinge notches 28 and 29 are conveniently and accurately made by casting raised embossings integrally with the face of the disk, as shown. When the hinge pins 26 and 27 are held in the notches 28 and 29, the wiper piece 21 may pivot about the hinge but is rigidly held against rotational displacement about the shaft. Where the end of shaft 4 and the hub structure of the disk may lie across a line between the hinge notches 28 and 29, the stamping of the wiper 21 may be relieved as shown to straddle the shaft.

According to another and important feature of this invention, the hinge notches 28 and 29 are of such axial depth that the hinge pins 26 and 27 may move axially a limited distance in the notches. Hence, wiper surfaces 22 and 23 at outer corners of wiper piece 21 may be pressed against contacts 10 of different heights. If one corner moves down, the hinge pin at the diametrically opposite corner must move up. To permit such level-seeking action, the hinge pins 26 and 27 must be free to move axially in their notches.

The level-seeking action just described contemplates that pressure on the wiper 21 must be at a single point between wiper surfaces 22 and 23. Such a point pressure is conveniently effected by the leaf spring 30 of the same general plan configuration as the wiper 21. The spring is bowed outwardly so that a center point thereto will make point contact with a head 35 embossing in the wiper piece 21. The spring 30 is formed with pins 31 and 32 of the same dimensions as hinge pins 26

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and 27 so that they will drop into notches 28 and 29 under pins 26 and 27, respectively. The outer corners of the bowed portion of the spring bears against the flat surface of the disk 20 to transmit a fairly strong bias to wiper 21 through boss 35.

Hinge pins 26 and 27 and pins 31 and 32 are locked in notches 28 and 29, respectively, by a non-conducting washer 36 (Fig. 2) pressed over the inner end of the shaft 4. The washer may be fixed in place by upsetting the collar portion of the shaft over which the washer is pressed. The outside diameter of the washer is sufficient to overlay notches 28 and 29 and hence effectively lock the pins in their notches.

A double-pole double-throw switch is contemplated in the particular switch assembly illustrated. A second wiper piece 21a and spring member 30a are disposed diametrically opposite wiper 21 and spring 30. The notches for the pins of 21a and 30a are formed in the face of the disk 20 complementary to the notches 28 and 29, just described.

When the rotor is inserted into the stator and the small end of shaft 4 is guided into hole 13, the springs 30 and 30a are compressed slightly to apply measured pressure between the wiper surfaces 22 and 23 and the faces of contacts 10. As the contacts 10 wear, this pressure follows up these wiping surfaces and maintains good electrical contact. This means that even though the contacts 10 may deteriorate considerably, and shorten unevenly, the rotation-to-closure position tolerance built into the switch at the time of manufacture will be retained throughout a long useful life. Such close tolerances are particularly important where absolute reliability of the switch is necessary. In airborne equipment, for example, the switch of this invention could be relied upon to control the landing gear mechanism of the airplane.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention.

The invention claimed is:

1. A switch comprising a pair of stationary contacts, and a movable wiper for bridging the pair, said wiper comprising a substantially flat sheet-like metal piece with two spaced wiping surfaces at one edge on one side of the piece and a single point support midway between said wiping surfaces on the other side of said piece so

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that said piece will rock on said point support and permit said surfaces to level on said stationary contacts, and means to impart wiping and rocking motion to said piece across said stationary contacts, said means consisting of an elongated hinge along the opposite edge of said piece, spaced from and substantially parallel to a line through said wiping surfaces.

2. The switch defined in claim 1 further comprising a spring compressively bearing against said single point support.

3. A rotary switch comprising a housing, a shaft journaled in the housing, a disk of insulating material keyed to said shaft, a floating metal contact element carried on one face of the disk, said element consisting of a wiper portion at the periphery of the disk and two legs straddling said shaft, said legs being pivotally attached to the face of the disk at points substantially on a diametrical line across the disk so that said wiper portion is fixed against rotational displacement on the disk but is free to move axially and away from the disk, means to bias wiper portion away from the disk, and contacts circularly arranged in the housing opposite said wiper portion.

4. A switch comprising a plurality of metal contacts elements with planar wiping contact surfaces disposed in a circle in a plane perpendicular to an axial line; a shaft journaled on said line, a disk coextensive with, parallel to, and spaced from said plane of the contact surfaces and keyed to said shaft, a wiper mounted on the disk and adapted to slide across said contact surfaces, said wiper consisting of a flattened metal piece on the face of the disk and with legs straddling said shaft, the leg ends being pivotally attached to the face of the disk, and means for biasing the peripheral portion of the piece into contact with said contact surfaces of the contact elements.

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