

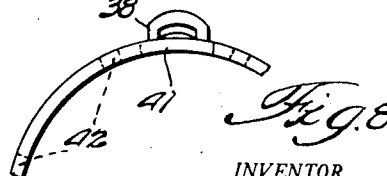
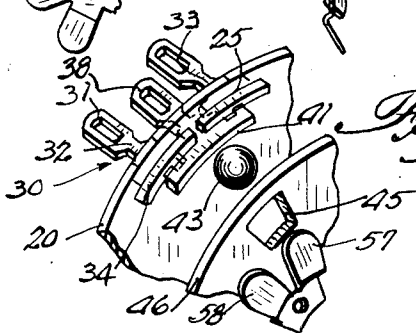
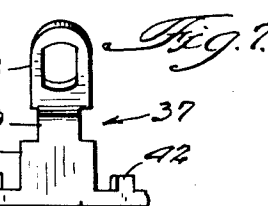
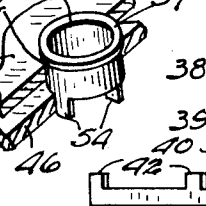
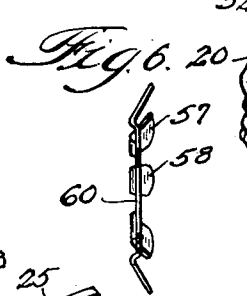
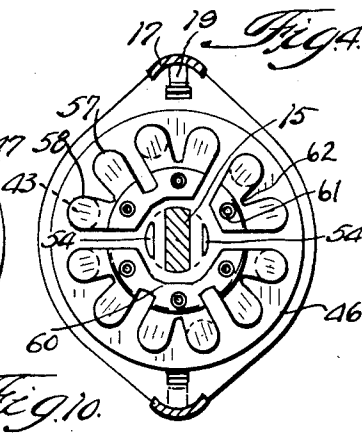
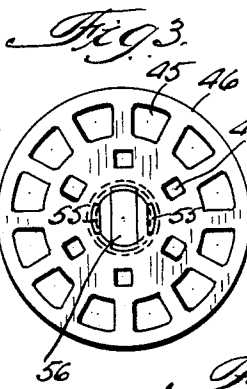
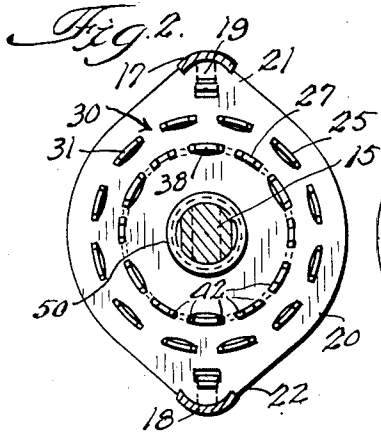
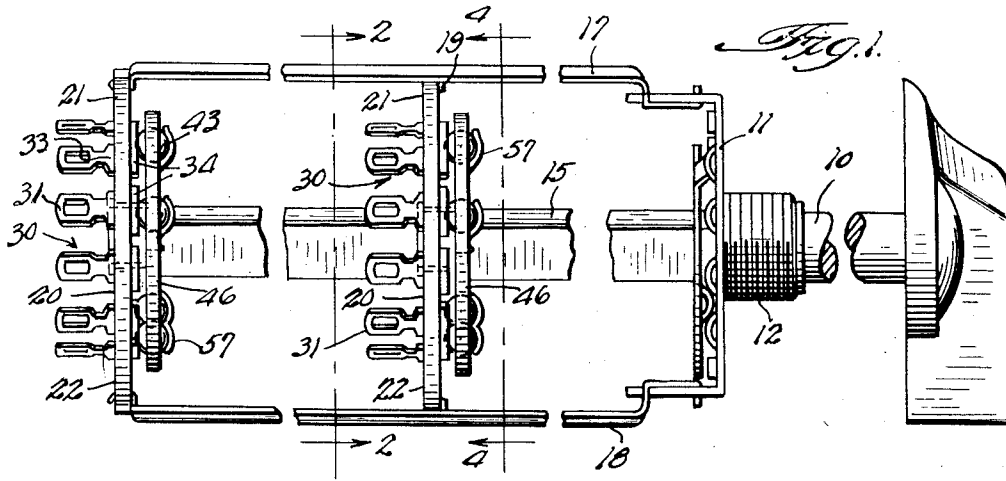
Sept. 3, 1957

M. F. EICKHORST ET AL

2,805,291

ELECTRIC SWITCH

Filed May 20, 1955



INVENTOR.
Melvin F. Eickhorst
BY Edward J. Mastney.
Robert L. Kahn
Attys.

1

2,805,291

ELECTRIC SWITCH

Melvin F. Eickhorst, Chicago, and Edward J. Mastney, Berwyn, Ill., assignors to Oak Mfg. Co., a corporation of Illinois

Application May 20, 1955, Serial No. 509,774

5 Claims. (Cl. 200—11)

This invention relates to an electric switch and while particularly adapted for rotary switches, may be applied to switches having a straight line movement. The preferred application of the inventive concept is to a rotary switch and accordingly a construction embodying this concept will be disclosed and described.

A rotary switch embodying the present invention has advantages in its susceptibility to miniaturization, flexibility in regard to various kinds of switching combinations, economy in manufacture and assembly, and its ruggedness. The invention both in its broader and in its more limited aspects can best be described in connection with a specific structure.

Referring therefore to the drawings,

Figure 1 is a side view of a gang switch utilizing two switch sections embodying the present invention.

Figure 2 is a section on line 2—2 of Figure 1 and illustrates a switch section from the side containing the terminal lugs.

Figure 3 is a detail of an insulating rotor plate for a switch section.

Figure 4 is a section along line 4—4 of Figure 1 and illustrates a switch section embodying the invention from the spring finger side thereof.

Figure 5 is a detail of a spring finger blank.

Figure 6 is an edge view of the blank illustrated in Figure 5.

Figure 7 is a detail of an inner circle arcuate contact.

Figure 8 shows an edge view of the arcuate contact of Figure 7.

Figure 9 is an exploded view of inner and outer circle contacts, portions of the stator and rotor with a ball contact and spring fingers.

Figure 10 is a perspective detail showing how the rotor and stator are joined.

A switch section embodying the present invention may be assembled as a unitary construction and as many switch sections as desired may be ganged together. Thus referring to Figure 1, operating shaft 10 is mounted in index plate 11. Shaft 10 is rotatively mounted in index plate 11 but is longitudinally locked with respect to bushing 12 carried by the index plate. Shaft 10 has switch section operating portion 15, this portion of the shaft being mutilated by flattening two opposite parts of the shaft. The index mechanism 11 together with its associated shaft 10 is used generally for rotary switches. The index mechanism may be any one of a number of different mechanisms and except for the fact that the index angle must be predetermined to cooperate with the switch sections, no particular index construction is necessary.

Secured to index plate 11 at two opposed regions are switch supporting straps 17 and 18. These straps are preferably of metal and have a curved cross section as illustrated in Figures 2 and 4. Straps 17 and 18 may be attached to index plate 11 in any desired fashion. At appropriate places along the length of straps 17 and 18,

2

lugs 19 may be punched out therefrom for supporting the switch sections.

A switch section has insulating stator 20 of suitable rigid material. Thus stator 20 may be made of "Bakelite" or any other suitable material and has wings 21 and 22 extending from opposite regions on the stator for engaging lugs 19 of the supporting straps. As indicated in Figures 2 and 4, wings 21 and 22 may be slotted for accommodating lugs 19.

Insulating stator 20 has an outer circle series of arcuate apertures 25 (see Figure 9). Apertures 25 are equal in length and are equally spaced and correspond to index positions. The angle subtended by an aperture 25 is somewhat less than an index angle, it being understood that the complete length of aperture 25 plus one adjacent space to the next aperture will subtend an index angle. The index angle, of course, is the angle through which shaft 10 can move from one index position to a succeeding index position.

Insulating stator 20 is provided with an inner circle series of arcuate apertures 27 equal in number to the outer circle series. The angular extent of each aperture 27 plus the angular extent of an adjacent space to the next aperture is equal to the angle between two successive index positions. Apertures 27 are angularly staggered with respect to apertures 25, the stagger disposing one series symmetrically with respect to the other series and resulting in an aperture of one series lying in line with a space between adjacent apertures in the other series.

The angular extent of the apertures in both series of apertures is greater than the angular extent of the adjacent spaces. Thus for example, in the outer circle series of apertures 25, the angular extent of the space between two adjacent apertures is less than the angular extent of an aperture 25. The same is true of the inner series of apertures 27. Since the two series of apertures are disposed along concentric circles, a radius arm will be able to bridge inner and outer contacts at each index position. This arrangement provides for an angular overlap between the apertures in the inner and outer circles at the index positions.

Disposed in any desired apertures 25 are outer circle stationary contacts 30 (see Figure 9). Each contact 30 may be formed of spring brass or spring copper. Outer circle contact 30 has terminal lug portion 31, neck 32 and body portion 33. Body portion 33 terminates in arcuate contact portion 34. It is understood that body portion 33 and arcuate contact portion 34 are curved to conform to the curvature of aperture 25. Contact portion 34 or the entire contact 30 may be silver plated.

Contact portion 34 has end portions extending beyond body 33 to provide shoulders for locking a contact in stator 20. Contact 30 is disposed in position by inserting terminal portion 31 through aperture 25, the contact being forced into the stator as far as it will go until the shoulders on arcuate portion 34 engage the insulating material of stator 20. As clearly indicated in Figures 1 and 9, arcuate contact portion 34 extends beyond the face of stator 20, this face of the stator being the inner face thereof when the switch section is assembled. An index position is at the space between adjacent outer circle contacts.

Inner circle series of apertures 27 of stator 20 are provided with inner circle arcuate contacts which may have a generally similar construction to the outer circle contacts except for the angular extent. Referring to Figures 7 and 8, an inner circle stationary contact, generally indicated by 37, has terminal lug portion 38, neck portion 39 and body portion 40. Adjacent to body portion 40 is arcuate contact portion 41 having staking fingers 42 extending inwardly from the contact portion and lat-

erally disposed with respect to body portion 40. Contact portion 41 and body 40 are curved as illustrated in Figure 8 to conform to the curvature of the inner circle containing apertures 27. Staking fingers 42 are disposed at angular intervals corresponding to the index angle. Inner circle contacts 37 may be stamped to provide contact portions 41 having any desired angular extent.

Like the outer circle contacts, the inner circle fixed contacts are made of spring brass or copper and preferably have at least the contact portions silver plated. It is possible to cut off any part of contact portion 41 that is not necessary for a desired switching combination. As is true of the outer circle fixed contacts, the inner circle fixed contacts are also inserted from the inside face of the stator. Whatever staking fingers 42 are provided on the contact as used in the switch may be spread or staked after such fingers have been inserted into proper apertures 27 of the inner circle. Each aperture 27 is substantially longer than staking finger 42 along the arcuate extent and the arrangement is such that fingers 42 of adjacent separate inner circle contacts may use one aperture 27 (Figure 2). Thus adjacent inner circle contacts may be electrically separate.

For providing movable contact action between the inner and outer arcuate fixed contacts, there may be provided one or more balls 43, these being large enough to bridge the opposing arcuate contacts of the inner and outer circle fixed contacts. Ball contact 43 may be of any suitable material such as steel, copper or brass and may be silver plated so that a desirable low resistance contact surface will be provided. The diameter of ball 43 and the spacing between the inner and outer circle series of stationary contacts as well as the spacing between adjacent stationary contacts should be such that ball 43 will bridge opposed inner and outer arcuate contact portions and will bridge adjacent outer circle contacts at index positions.

Also the arcuate contact portion in both inner and outer circle series of contacts, these being 34 and 41 respectively, should project far enough from the surface of stator 20 so that each ball 43 will ride on the contact edges and be clear of insulating material 20.

Movable contact balls 43 are retained in pockets 45 of captivating rotor plates 46 of insulating material. Rotor plate 46 preferably has sufficient thickness so that the contact balls are retained in the pockets. To that extent, therefore, there will be no tendency for balls 43 to slip out through spaces between adjacent contacts of the inner or outer series.

Rotor disc 46 has pockets 45 corresponding in number and angular spacing to the number of index positions. Pockets 45 are located at such a distance from the center of disc 46 that when disc 46 is properly disposed against stator 20, pockets 45 will overlie the space between the inner and outer circle series of contacts.

Rotor disc 46 is provided with an inner series of apertures 47. In number, apertures 47 may be equal to or less than the number of pockets 45. As illustrated in Figure 3, rotor disc 46 has half as many apertures 47 as index positions and these apertures are symmetrically disposed so that each aperture 47 is radially aligned with every alternate blank portion between adjacent pockets 45.

Stator 20 has the central portion thereof provided with a generally circular aperture 50 and within this aperture there is disposed shouldered coupling member 51. Coupling member 51 has shoulder 52 disposed against the outer surface of stator 20. The body of coupling member 51 is in the form of a short sleeve, long enough to extend to the inner surface of rotor 46 when the rotor and stator are assembled with contact balls therebetween as illustrated in Figure 1. Coupling member 51 has staking fingers 54 which extend into suitable apertures 55 in the rotor disc. After coupling member

51 is fitted, staking fingers 54 are spread and the coupling member thus maintains the stator and rotor in assembled relation.

The coupling member may be of brass and will accommodate a circular shaft equal in diameter to the largest dimension of shaft portion 15. Rotor disc 46 has non-circular aperture 56 stamped out of the central portion thereof, aperture 56 corresponding in shape and dimension to non-circular flattened shaft 15. It will thus be clear that shaft 15 can pass through a switch section and turn with respect to stator 20 but be rotatively locked to rotor 46.

Rotor 46 is provided with spring fingers for locking contact balls 43 in their respective pockets. As illustrated in Figure 5, blanks containing a number of spring fingers 57 may be provided. The spring fingers are so arranged that between every adjacent pair of fingers 57 and 58 there is body portion 60 having mounting aperture 61. In a complete blank, body portion 60 may have an angular extent of 360° to provide as many spring fingers as there are index positions. A blank may be cut to provide as many fingers as desired. To facilitate cutting the spring fingers, every pair of spring fingers 57 and 58 is connected to an adjacent pair of spring fingers 57 by deeply indented portion 62.

The spring fingers are so arranged and shaped that apertures 61 may register with apertures 47 in rotor plate 46 and any number of spring fingers may be riveted to the rotor plate as illustrated in Figure 4. The tips of the spring fingers overlie pockets 45 and press any balls 43 which might be in any pocket against the stationary contact portions.

Spring fingers 57 may also function as commutation contacts. If six adjacent connected fingers are provided as illustrated in Figure 4, it is clear that all fingers are electrically connected to each other. Those fingers not provided with contact balls are non-functioning.

It will be clear that by controlling the number and position of contact balls 43, the angular extent of the inner circle stationary contacts and the angular extent, number and pattern of the spring fingers, many different switching combinations may be obtained. Index mechanism 11 may be provided with stops for determining the range of movement of rotor 46 with respect to stator 20.

It is possible to reverse the inner and outer circle series of contacts. It is also possible to have the outer circle series of contacts constructed similarly to the inner circle series with regard to the extent of the contact portion so that an outer circle contact 30 may extend beyond one index position. In general, however, more switching combinations are possible by having the contacts in one circle series of contacts extend for one index position only and control the angular extent of the other circle contacts.

Each switch section has a natural tendency to index the rotor when a contact ball bridges the gap between the adjacent contacts in the outer circle series. This action is sufficiently pronounced so that an index mechanism as such is not necessarily required.

What is claimed is:

1. In an electric switch, a flat insulating stator disc having an outer and inner face and having two similar series of apertures therethrough along concentric circles of different radii, said two circles having the same number of apertures, the outer circle apertures being angularly offset from the inner circle apertures, stationary contacts extending through the various disc apertures, said contacts having terminal portions extending from the outer disc face and having active contact portions extending laterally from the inner face of said stator, the contacts in one circle having the same angular extent and an aperture in such one circle accommodating one contact, the stationary contacts in the other circle having portions annularly spaced passing through the disc apertures and also having terminal portions annularly spaced, said other series of contacts orig-

5

inally forming part of annularly larger contact members which are adapted to be cut to provide any desired annular contact arrangement, rotor means disposed adjacent the inner face of the stator disc so that the active contact portions extend toward the rotor means, contact balls for cooperation with said rotor means, said contact balls being properly dimensioned so that each contact ball may ride along the active contact portions of both the inner and outer series of contacts, said rotor means cooperating with the contact balls to retain the same in predetermined radial positions and to press the same against the active contact portions, each such contact ball when in proper angular position bridging the gap between adjacent contacts in either circle as well as bridging the gap between contacts in the inner and outer circles.

2. The construction according to claim 1 wherein said rotor means includes contact fingers pressing against the contact balls and wherein means are provided for electrically connecting desired contact fingers.

3. The construction according to claim 1 wherein said rotor means includes an insulating disc having apertures therethrough for accommodating the contact balls, each aperture accommodating one contact ball and wherein separate contact fingers are provided for pressing the contact balls into proper position, said separate contact fingers forming part of a multi-finger construction electrically connecting all said contact fingers, said multi-finger construction being adapted to be cut to provide a plurality of separate electrically distinct groups of separate fingers.

6

4. The construction according to claim 1 wherein the stationary contacts have edge portions constituting the active contact portions.

5. The construction according to claim 1 wherein said stationary contacts have edge portions as the active contact portions, said rotor means including an insulating disc disposed parallel to and opposite the inner face of said stator disc, said rotor disc having a series of apertures and having one aperture for a contact ball, said rotor means also including spring contact fingers disposed against the face of said rotor disc remote from the stator disc, said spring contact fingers retaining and pressing the contact balls into proper position, said contact fingers including means for electrically connecting as many fingers together as desired for switching combinations.

References Cited in the file of this patent

UNITED STATES PATENTS

20	734,438	Skinner	July 21, 1903
	1,254,331	Blanc	Jan. 22, 1918
	1,624,374	Swoboda	Apr. 12, 1927
	2,513,953	Minnecci	July 4, 1950
	2,549,998	Allison	Apr. 24, 1951
25	2,570,960	Lutsky et al.	Oct. 9, 1951

FOREIGN PATENTS

916,979	France	Sept. 2, 1946
---------	--------	---------------