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PRINTED CIRCUIT SWITCH

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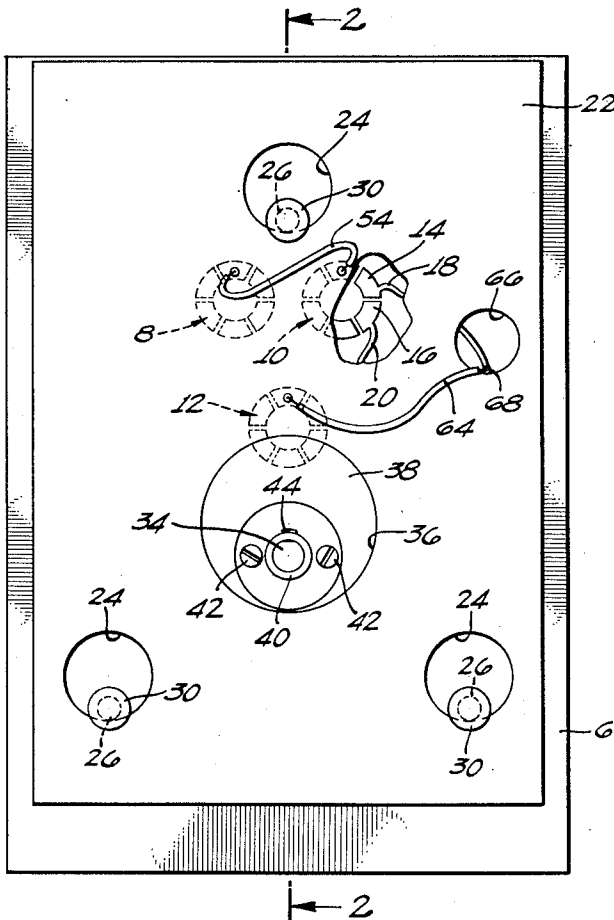


FIG. 1.

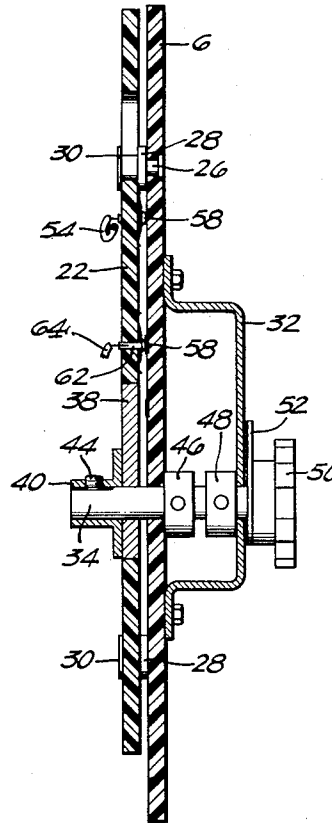


FIG. 2.

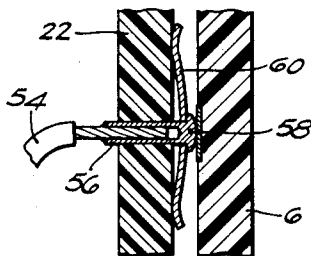


FIG. 3.

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PRINTED CIRCUIT SWITCH

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7 Claims. (Cl. 200—14)

This invention relates to an electrical switch particularly adapted for use in connection with printed circuits.

It has been common practice heretofore in designing switches for printed circuits to place various sets of conductor segments in concentric circles and to make contact with the sets of segments by a multiple rotating brush system whose center of rotation is coincident with the common center of the concentric sets of conductor segments. This system has certain disadvantages. One is that the position of the brush on the innermost circle or arcuate set of conductor segments becomes very critical because the arcuate movement is very small from contact to contact. Furthermore, on the outer segments or sets of segments a great deal of space is wasted due to the amount of motion necessary to go from one contact segment to the next. Also, these concentric arcs or circles may have enough electrostatic or inductive coupling between them to make performance unsatisfactory in either low level or high frequency circuits. A further disadvantage is that if a large number of switch circuits is required, such a switch unit takes up an abnormally large amount of space due to the inefficient use of the space on the outer sets of segments.

The present invention is concerned with the design of a switch in which the circuits or parts thereof are no longer connected to sets of segments on concentric circles but are connected to sets of conductor segments on individual non-concentric circles or arcs. It contemplates that the curvature of the two or more arcs of the arcuately arranged sets of segments or circles be uniform and consequently the same accuracy of brush position is obtained on all circuits. This accuracy is determined by the diameter of the circle or arc and electrostatic and inductive coupling may be controlled either by spacing between the various circuits or through the use of shielding.

Where the number of circuits required is of the order of 10 or more, for example, a definite reduction in the size of the plate may be made since each circuit requires the same area on the plate as distinguished from the steadily increasing circle or arc diameters of the former concentric arrangement. By way of illustration, as many as forty-nine 12-position circuits have been placed on one side of a panel 8 inches square. The concentric circle type of switch with the same number of circuits and positions would require on the order of a 12 inch diameter circle to obtain the same degree of accuracy.

It is a general object of the invention to provide a switch to accomplish the results outlined above.

Another object of the invention is to provide simple and efficient means for guiding the movable contact panel relative to the printed circuit with its sets of arcuately or circularly arranged conductor segments.

A further object of the invention is to provide a simply constructed and smoothly operating actuator for the movable switch panel.

Still a further object of the invention is to provide means whereby fixed connections can be made from portions of the printed circuit to the movable switch panel.

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Other objects and advantages of the invention will more fully appear from the following description in connection with the accompanying drawing.

Fig. 1 is a rear elevational view of an embodiment of the invention with a portion of the switch panel broken away to show the underlying printed circuit.

Fig. 2 is a section taken approximately on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged fragmentary sectional detail through one of the resilient brush contacts.

In the drawing there is shown a relatively stationary panel 6 of a dielectric material which carries a printed circuit of conventional type. Portions of the circuit are shown in Fig. 1. They include sets of circularly or arcuately arranged conductor segments, the sets being designated 8, 10 and 12. The set of segments 10 includes individual segments 14 and 16. For purposes of illustration the segment 14 has a conductor 18 connected thereto and segment 16 has a conductor 20 connected thereto. Obviously various circuit arrangements can be used.

Located closely adjacent the printed circuit panel 6 is a movable switch panel 22 having a plurality of circular apertures 24. Extending from the printed circuit panel 6 are pins 26 which in Fig. 2 are shown to have an intermediate flange 28 and an end flange 30. The pins 26 extend through the apertures 24 in the switch panel 22 and the flanges 28 and 30 lie at opposite sides of the switch panel 22 so that said switch panel is held against movement toward and away from the printed circuit panel 6 yet is capable of movement in a circular path defined by the edges of the apertures 24 as they bear against the pins 26.

Mounted on the opposite side of the printed circuit panel from the switch panel 22 is a bracket 32. A shaft 34 extends through the bracket, the printed circuit panel 6 and through an enlarged circular aperture 36 in the switch panel 22. Where the shaft 34 passes through the switch panel it is provided with an eccentrically mounted disc 38 secured to a flanged sleeve 40 by means of screws 42 as shown in Fig. 1. The flanged sleeve is secured to the shaft 34 by a set screw 44. At the outer face of the printed circuit panel 6 a collar 46 is secured to the shaft 34 and a second collar 48 is mounted on said shaft at the inner face of the bracket 32. That portion of the shaft which extends outwardly of the bracket 32 is provided with a suitable operating knob 50 which may carry an indicating pointer 52.

Extending between the sets of arcuate or circular contact segments 8 and 10 is a conductor 54 which is carried by the movable switch panel 22. This conductor has one end thereof shown in detail in Fig. 3. Each end is anchored by any suitable means such as soldering in a tubular socket 56 which extends through the switch panel 22 and is provided with a contact head 58 adapted to successively engage the individual segments of the sets 8 and 10. A small leaf spring 60 is bowed between the contact head 58 and the adjacent face of the switch panel 22 so that the head 58 will be held in yielding frictional engagement with the conductor segments of the sets 8 and 10. Consequently, when the knob 50, shaft 34 and eccentric 38 are rotated as a unit, and the switch panel 22 is likewise moved in a circular path, guided by the guide pins 26 in the apertures 24, the heads 58 of the movable contacts on the switch panel at the ends of the conductor 54 will engage successive segments of the arcuately or circularly arranged sets of segments 8 and 10. The circular set of conductor segments 12 is shown provided with a yielding brush contact arrangement 62 at one end of a conductor 64 in the same manner as the two ends of the conductor 54. However, the other end of the conductor 64 is not supported by the switch panel 22 but extends through a circular aperture 66 in the switch panel to a fixed connection 68 on the printed circuit panel 22. The circular aperture 66 is of

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such size that the switch panel 22 can be moved through its circular path by the knob 50 and the edges of said aperture will clear the end of the conductor 64 which is connected to the printed circuit panel 22.

From the foregoing it will be seen that I have provided a switch particularly adapted for printed circuits which is simple in construction and easy to operate. However, its principal advantage lies in the ability to provide a multiplicity of arcuately or circularly arranged sets of stationary contact or circuit segments such as the sets 8, 10 and 12, which are of a common diameter or curvature. As mentioned above, this eliminates the need for correlating the arcuate brush movements and segment spacings of the former type of multiple switch arrangement wherein the sets of segments were arranged on concentric arcs or circles. Furthermore, as stated above it is possible to place a much larger number of individual switch units or sets of segments in a given panel space. It can readily be seen that a considerably larger number of sets of segments can be included on the panel 6 shown in the drawing and where circuit requirements permit, all of the segments can be of uniform size and shape. With the other type mentioned herein, where a number of concentric sets are used, if it were desired to hold contact on the innermost set and the outermost set for the same period of time, the segments of the outermost set would have to be proportionally larger in arcuate extent and would take up a great deal more space than in the arrangement disclosed herein.

It should, of course, be understood that various changes can be made in the form, details, arrangement and proportions of the various parts without departing from the spirit of the invention.

I claim:

1. An electrical switch for use in conjunction with sets of arcuately arranged conductor segments having contact faces located about different centers, comprising a movable switch member adapted to be placed adjacent said conductor segments, guide means for the switch member confining movement of said member to a plane parallel to the adjacent contact faces of the conductor segments, said guide means confining the movement of the switch member in said plane to an arcuate path comparable to the arcs of said arcuately arranged conductor segments, and switch contacts on said switch member positioned to sweep said arcuately arranged conductor segments.

2. An electrical switch for use in conjunction with sets of arcuately arranged conductor segments having contact faces located about different centers, a movable switch member adjacent said conductor segments, arcuate guide paths carried by said switch member whose arcs are comparable to the arcs of said sets of conductor elements and offset therefrom radially, relatively stationary guide elements positioned in the guide paths of said switch member, and switch contacts on said switch member positioned to sweep said arcuately arranged conductor segments upon movement of the switch member.

3. In an electrical switch, a panel having sets of arcuately arranged conductor segments carried thereby, a switch member having arcuate guide paths carried thereby and in offset relationship to said sets of conductor seg-

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ments on said panel, relatively stationary guide elements supported by said panel and having portions thereof located respectively in said arcuate guide paths of said switch member, and switch contacts on said switch member positioned to sweep said arcuately arranged conductor segments.

4. In an electrical switch, a panel having sets of arcuately arranged conductor segments carried thereby, a relatively movable switch panel, means interconnecting the two panels for relative movement of the switch panel in a plane parallel to that of said first mentioned panel, and a switch panel actuator having a connection with said switch panel for moving the same in an arc corresponding to those of said arcuately arranged conductor segments, and switch contacts on said switch panel positioned to sweep said arcuately arranged conductor segments.

5. In an electrical switch, a support, sets of arcuately arranged conductor segments carried by said support and lying on different centers, a switch panel lying closely adjacent said arcuately arranged conductor segments and having arcuate guide paths carried thereby on arcs comparable to those of said sets of conductor segments but offset radially relatively to said conductor segments, switch panel guide means carried by said support and having portions thereof engaging the guide means of said switch panel, whereby the switch panel can be moved in a single plane on an arcuate path comparable to the arcs of said sets of conductor segments, and resilient switch contacts on said switch panel positioned to sweep said arcuately arranged conductor segments in resilient contact therewith.

6. In an electrical switch, a support, an electrical circuit carried by said support and including sets of arcuately arranged conductor segments located about different centers, a switch panel located closely adjacent said support and connected thereto for movement through an arcuate path comparable to the arcs of said sets of arcuately arranged conductor segments, switch contacts on said switch panel positioned to sweep said arcuately arranged conductor segments, said switch panel having an aperture therethrough with its edge on an arc comparable to those of said sets of arcuately arranged conductor segments, and a flexible conductor extending through said aperture in said switch panel and having its ends connected between a point on said switch panel and a portion of said circuit carried by said support.

7. In an electrical switch, sets of arcuately arranged conductor segments located about different centers, a switch panel located adjacent said sets of conductor segments, an actuator for said switch panel comprising a crank which will move said switch panel on an arc comparable to the arcs of said sets of conductor segments, and switch contacts on said switch member positioned to sweep said arcuately arranged conductor segments.

References Cited in the file of this patent

UNITED STATES PATENTS

1,799,438	Philbrick	Apr. 7, 1931
1,894,645	Trogner	Jan. 17, 1933
2,661,404	Wasserman	Dec. 1, 1953