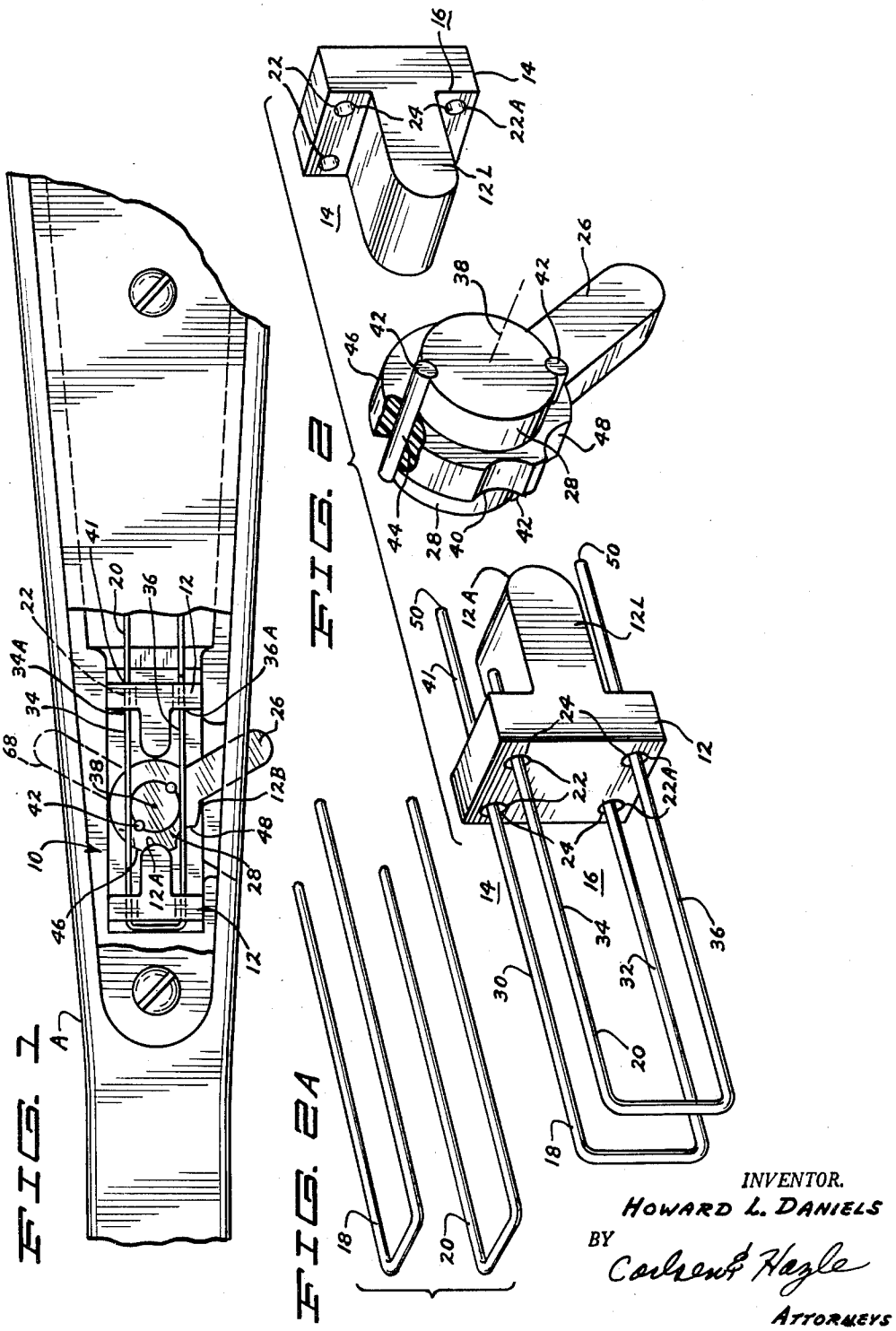
Jan. 30, 1962 H. L. DANIELS 3,019,323

ELECTRICAL SWITCH

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ELECTRICAL SWITCH

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FIG. 3

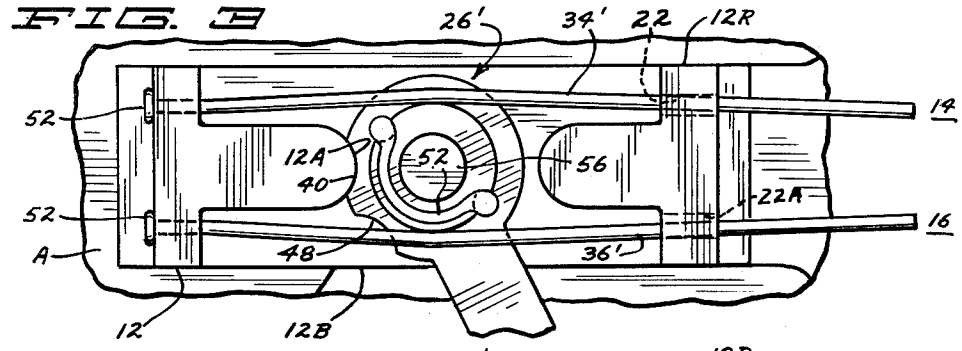


FIG. 4

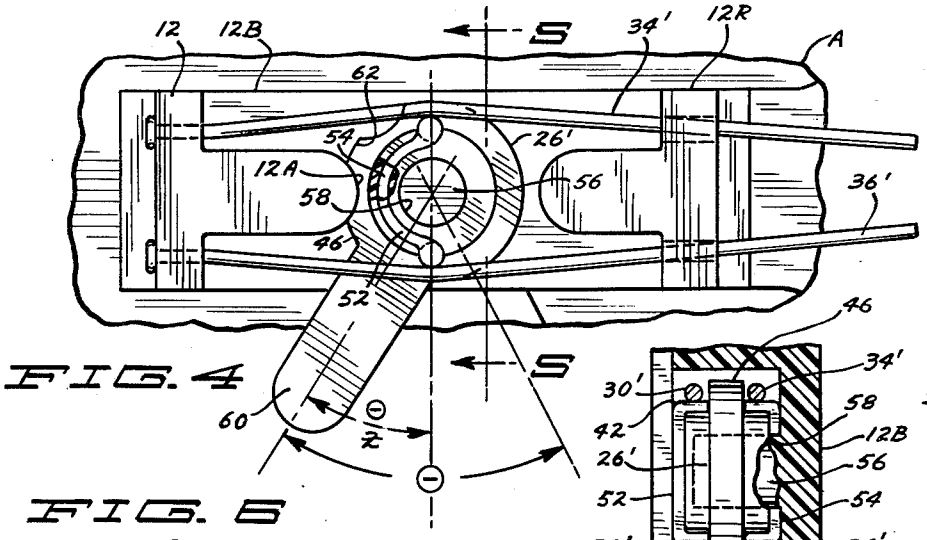
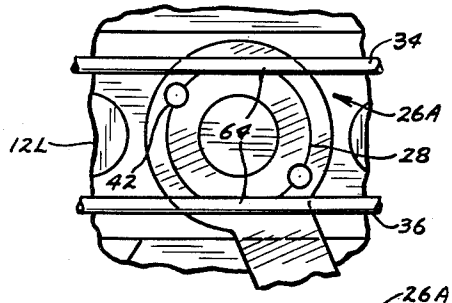


FIG. 6



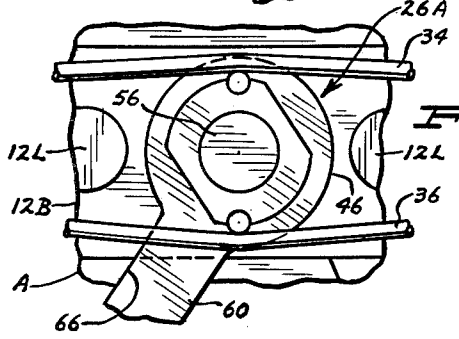


FIG. 7

FIG. 5

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ELECTRICAL SWITCH

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20 Claims. (Cl. 200—155)

This invention relates to electrical switches wherein the stationary contacts or conductors are suspended between two insulating supports with the movable contacting member being interposed between the conductors to force same further apart during electrical contact making engagement.

The present invention is particularly adaptable to construction of miniature and sub-miniature manually actuated electrical switches. The herein illustrated embodiment of the present invention contemplates two somewhat parallel elongated and resilient spaced apart stationary contact or conductor members having their respective end portions supported in suitable insulation. The support is such that limited end portion movement along the conductor length is permitted to provide transverse flexing of the conductors. A rotor having diametrically opposed conductive portions is pivotably disposed about an axis between the stationary members. The rotor is pivotable between an open electrical position and a closed electrical position wherein the stationary members are forced further apart and their resiliencies yieldably urge the stationary members into pivotal supporting engagement with the rotor.

Accordingly it is an object of the present invention to provide an electrical switch of the rotor type having a large angle of rotation between a fully open and a fully closed position.

It is another object to provide an electrical switch of the rotor type having a relatively large angle wherein the rotor conductors engage the stationary conductors in a burnishing manner.

It is still another object to provide an electrical switch wherein the stationary conductors movably support a contact member to provide two positions through their combined resilient yieldable urging on the member.

It is a further object to provide an electrical switch which is held together only by its stationary contact members.

It is a still further object to provide an electrical switch having its component parts arranged to facilitate mechanized and manual assembly.

It is still another object to provide a rotor type electrical switch having parallel stationary members pivotably supporting the rotor and spaced apart such that in an open position there are no stresses in any member due to switch action and in a closed circuit position all forces are tangential to the component members.

It is a further object to provide an electrical switch of the rotor type having parallel spaced apart elongated stationary conductors each supported at their respective ends and limitedly movable along their respective lengths at one supported end for permitting increased flexing thereof.

These and other more detailed and specific objects will be disclosed in the course of the following specification, reference being had to the accompanying drawings, in which—

FIG. 1 is a greatly enlarged cutaway side elevational view of an early embodiment of the present invention as installed in an eyeglass templar member.

FIG. 2 is an enlarged exploded perspective view of a modified FIG. 1 switch for showing the assembly of the component parts.

FIG. 2A is a perspective view of an alternate switch stationary conductor arrangement for installation in the FIG. 2 switch.

FIG. 3 is an enlarged side elevational view of a switch constructed according to the teachings of the present invention when in an Off position.

FIG. 4 is a side elevational view of the FIG. 3 switch in an On position.

FIG. 5 is a vertical sectional view taken along the line 5—5 in FIG. 4 for showing the engagement of the switch rotor conductive portions with the stationary conductors.

FIG. 6 is an enlarged side elevational view of an alternate rotor construction for use with the present invention and shown in an Off position with respect to the stationary conductors.

FIG. 7 is a side elevational view of the FIG. 6 apparatus in an On position.

With more particular reference now to the accompanying drawing, like numerals denote like parts and structural features in the various figures. A sub-miniature switch 10 is inserted into a suitable cavity in an eyeglass templar member A for use with a hearing aid (not shown). The switch includes the two spaced-apart apertured T-shaped molded plastic blocks 12. These blocks are disposed with their respective T-leg ends facing each other in spaced apart relation. Each block 12 has two rows of apertures 14 and 16 respectively on each side of the T-legs 12L. The apertures in each row are respectively aligned for receiving the U-shaped resilient wires 18 and 20. Note that each aperture 22 in the respective row 14 forms an aperture pair 24 with the respective apertures 22A in the row 16 and on the opposite side of the legs 12L; each pair 24 on the respective blocks 12 movably receives one of the wire conductors 18 or 20. A rotor-type contacting member 26 is pivotally disposed between the wires 18—20 with radially reduced sections 28 disposed intermediate in slideably engaging relation to the respective upper and lower wire legs 30, 32, 34 and 36. This slidable engagement pivotably supports the rotor 26 about the pivot axis 38 which lies about midway between the blocks 12 as well as midway between the respective stationary conductor pairs 30—32 and 34—36. The axis 38 extends transversely to the stationary conductor legs and to the plane formed by the aperture pairs 24.

In assembling the switch 10 the U-shaped wire 18 is first threaded through the FIG. 2 left-hand aperture pairs 24 in both blocks 12. The blocks 12 may be joined by a base member 12B as shown in FIG. 1. The rotor 26 is then moved axially between the two blocks 12 until one section 28 engages the parallel wire pair 30—32. The detent groove 40 is engaged with the left hand block end 12A. To complete the assembly the U-shaped wire 20 is inserted through the right hand aperture pair 24 of both blocks 12. When the blocks 12, as shown in FIG. 2, are not joined by a base member 12B one of the stationary wire end portions may be bent, as at 41, after assembly to hold the component parts in the described cooperative relation.

The rotor 26 has four electrically conductive peripheral portions 42 on the radially reduced rotor sections 28, each portion being on the same diamenter. In an early embodiment the portions 42 consisted of two wires 44 inserted through an aperture in the rotor radially enlarged section 46 to form a pair of bridging rotor conductor portions for interconnecting the wires 18 and 20 by parallel contact engagement as will become apparent. To make such engagement the rotor 26 is pivoted clockwise as viewed in FIG. 1 until the detent groove 48 engages the left-hand block 12 as will be fully described.

In the above described switching action there is limited relative momentary longitudinal movement between the rotor 26 and the left-hand block 12 for permitting the end 12A to ride over the section 46 periphery between the detent grooves 40 and 48. To yieldably urge said end 12A into the grooves the stationary conductors are bent, as at 41, such that the block ends 12A both yieldably bear against the rotor 26 section 46. In this manner there is no spindle or axle for the rotor 26, all support for same being caused by the resilient urging of the conductors and the section 46 extending between the parallel conductor pairs whereby axial movement of the rotor is prevented. A flexible spindle may be provided as will be later fully described.

As shown in FIG. 3 the outwardly bowed, but somewhat parallel, conductors 34—36 are continuously in tangential engagement with the section 28. In the illustrated Off position the diameter of the section 28 is equal to or slightly greater than the conductors 34—36 spacing to remove strain from the parallel conductors for preventing wire fatigue. The conductive portions 42 on the other hand extend radially outward from the sections 28 for providing good contact pressures with the respective stationary parallel conductors. Keeping the rotor diameter greater than the aperture pair 24 spacing causes the wires to frictionally engage the aperture walls.

As seen in FIGS. 1 and 2 the apertures 22 cross-sectional areas are substantially greater than the wires 18—20 ends 50 cross-sectional areas. This loose support permits the respective parallel wire conductors to easily move at their end portions 30A, 32A, 34A and 36A, which means larger parallel wires may be used without excessive contact burnishing action. During the rotor pivoting the end portions respectively move in the apertures.

A slight variation for the FIGS. 1 and 2 embodiment is shown in FIG. 2A wherein the U-shaped conductors 18 and 20 are positioned horizontally as would be viewed in the former figures. The wire 18 is inserted through the row 14 two apertures while the wire 20 is inserted through the row 16 apertures. A later described rotor must be used with the latter conductor arrangement to form a switch.

A second variation of stationary conductor arrangements is shown in the FIGS. 3, 4 and 5 wherein the parallel conductors 30', 32', 34' and 36', each of which are separate wires and not electrically interconnected. One end of each wire has a radially enlarged head 52 for limiting longitudinal movement thereof. In this version two independent electrical circuits are opened and closed by the switch.

In one case the rotor 26 may be used therewith to independently electrically interconnect the row 14 conductors 30—34 and the row 16 conductors 32—36. The rotor 26' is identical to rotor 26 save for the interconnections of the conductive peripheral portions 42. Two wires 52 and 54 respectively on opposite axial rotor 26' ends interconnect the conductive portions 42. Note the portions 42 do not extend through the radially enlarged insulating portion 46 to provide two circuit making switch sections for the respective parallel conductor pairs 30'—32' and 34'—36'. This rotor is also useful with the FIG. 2A stationary conductor arrangement.

In the latter switch variation a flexible molded plastic

stud 56 is integrally formed on the base member 12B and extends axially of the rotor 26'. The rotor 26' is apertured along its axis, as at 58, for being pivotally disposed on the stud 56. The stud 56 is placed such that the rotor detent grooves 40 and 48 engage the end 12A as respectively shown in FIGS. 3 and 4. The rotor is pivoted about the stud 56 by manually urging the enlarged portion 46 radially-downwardly extending handle 60 clockwise as viewed in these figures. The stud 56 momentarily is moved further away from the detent groove engaging end 12A as the rotor periphery 62 between the grooves 40 and 48 slides over the end 12A. The resiliency of the stud yieldably urges the rotor grooves 40 and 48 into engagement with the detent end 12A. It is understood that the stud 56 is for longitudinally holding the rotor against the end 12A and is spaced such that the rotor portion 46 clears the block 12R.

FIGS. 5 and 6 illustrate an alternate rotor 26A construction for use with any of the illustrated switch versions where it is desired to provide increased flexing of the parallel stationary conductors 34 and 36. As shown, it is pivotable about a stud 56 between the FIG. 6 Off position wherein two flat chord surfaces 64 formed in the radially reduced section 28 respectively engage the unflexed parallel conductors 34 and 36. The handle 60 is used to pivot the rotor 26A to the FIG. 7 On position wherein the portions 42 respectively engage the conductors. The axial wires 44 (refer to FIG. 2) comprise the portions 42 for interconnecting the conductors in the same row 14 or 16 as has been described.

The On position is indicated by the handle 60 engaging the surface 66 of the eyeglass templar member. It is preferred that in the On position the rotor diameter 42' through the portions 42 be perpendicular to lines joining two apertures 22 in the respective blocks 12. Note that all forces on the contacting surfaces are tangential.

With the above described switch constructions the described rotors must be pivoted through a long arc between the Off and On illustrated positions for providing a positive indication to the operator of a sub-miniature switch of the switch position. Note that in each rotor having the conductive portions 42 on one diameter the handle is angularly offset therefrom about one-half the angle θ encompassing the rotor pivoting between the two positions. This particular arrangement provides the two switch positions with the actuating handle 60 being respectively disposed in opposite directions while the portions 42 are pivoted between a perpendicularly conductor-engaging position and a disengaged position.

Since the illustrated rotors are symmetrical the handle 60 may be disposed between the row 14 conductors 30 and 34 as indicated by the dotted lines 68 in FIG. 1. In all respects the switch operation is the same as heretofore described.

It may be further noted that the flexing of the wires 18 and 20 which are supported at their respective end portions provides an increased length 70 along the wires wherein electrical contact with the portions 42 occurs to provide a very positive On position. The long sliding engagement also serves the burnish the contacting surfaces providing reliable operation under adverse environmental conditions.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. In an electrical switch at least, two spaced apart insulating means, paired spaced-apart elongated and resilient conductors each of which extends between and has its respective end portions independently supported in the respective insulating means, the means being such as to permit movement of the respective supported conductors along their lengths as independent units, a movable contacting member interposed between the conduc-

tor members intermediate the means, two electrically conductive portions respectively on opposite sides of the movable member for being respectively juxtaposed to the conductor members whereby as the movable member is moved in a first direction the portions respectively engage the two members causing same to move along their respective lengths in one of the means.

2. Apparatus as in the claim 1 wherein the insulating means respectively are apertured blocks and each of the conductor member respective end portions are movably disposed in one of the apertures.

3. Apparatus as in the claim 2 wherein the apertures have a greater transverse cross-section than said conductor ends.

4. Apparatus as in the claim 2 wherein each conductor member is outwardly bowed by the engagement with the movable member such that there is substantial frictional engagement between the said end portions and the respective blocks.

5. Apparatus as in the claim 2 wherein said two conductor members are formed by a single piece of U-shaped resilient wire.

6. In an electrical switch, two spaced-apart apertured insulating blocks, at least two parallel resilient wires disposed loosely through the respective apertures and extending between the blocks, a contacting member interposed between the wires intermediate the blocks and having oppositely and outwardly extending electrically conductive portions which are spaced apart greater than said parallel wire spacing, the member being movable between the conductors such that the portions are selectively slidably engageable with the respective conductors whereby the conductors are flexed to move in the apertures.

7. Apparatus as in the claim 6 wherein the portions are wires disposed transversely to the parallel wires and respectively engage same approximately midway between the blocks.

8. Apparatus as in the claim 7 wherein the member is a rotor pivotally disposed between the two first mentioned wires and the second mentioned wires extend radially outwardly of the rotor.

9. An electrical switch including at least two spaced-apart and resilient stationary conductors each having independently axially movable support means at each of their respective ends, a rotor having two conductive portions on one rotor diameter and each portion extending radially outwardly, and the rotor being disposed between the conductors and being pivotable about an axis intermediate the conductors whereby as the rotor is pivoted the conductive portions respectively slidably engage the conductors for flexing same further apart.

10. Apparatus as in the claim 9 wherein a radially extending handle is on the rotor and disposed at an angle with respect to the one diameter which is approximately one-half the angle through which the rotor is pivoted between arbitrarily defined ON and OFF switch contacting positions.

11. In an electrical switch, a plurality of elongated resilient stationary conductors forming conductor pairs in parallel planes, a rotor pivotably disposed between the paired conductors and being pivotable about an axis transverse to said planes, a radially enlarged rotor section extending between two conductor pairs for limiting axial rotor movements, apertured insulating support means adjacent each conductor end for receiving the respective conductor end portions, and contact portions on the rotor respectively between the conductors in each pair.

12. Apparatus as in the claim 11 wherein one of the conductor pairs consists of a single wire, the rotor portions juxtaposed therewith extending along the rotor axis to another conductor pair, and the portions so juxtaposed being on one rotor diameter.

13. In an electrical switch, spaced-apart elongated and resilient conductors, insulating means engaging the conductor respective end portions for slidably supporting same, a contacting rotor interposed between the conductors and having radially enlarged and reduced portions, a reduced portion being between the conductors and having one diameter greater in length than the conductor spacing, two electrical conductors on the respective diameter ends, a radially enlarged portion extending outwardly adjacent the resilient conductors whereby as the rotor is pivoted between the conductors the diameter end conductors slidably engage the resilient conductors to force same further apart.

14. In an electrical switch, two spaced-apart elongated and resilient conductors, a base having an upstanding apertured member at each longitudinal end and an upstanding resilient stud intermediate the members, a rotor pivotally disposed about the stud through which a rotor pivot axis extends, the members having an aperture on each transverse side of the axis and the apertures on like sides in the respective members being aligned, the conductors respectively having their end portions inserted in said aligned apertures and each extending between the members respectively on opposite sides of the rotor, detent engaging means on the rotor periphery, detent means on the base and engaging the rotor detent engaging means such that there is relative movement between the stud and detent means as the rotor is pivoted, and electrically conductive portions on the rotor periphery for respectively engaging the conductors.

15. In an electrical switch, two rows of stationary and elongated resilient conductors, support means engaging each of the conductor end portions for respectively independently supporting same for axial movement of at least one end portion thereof, a rotor pivoted about an axis between the said rows and extending transverse to said conductors, radial means on the rotor extending between two conductors in each row for limiting axial movement thereof and conductive portions on the rotor extending away therefrom whereby as the rotor is pivoted about its axis the portions slidably engage the resilient conductors flexing same such that at least one of the end portions are respectively moved in said support means.

16. In an electrical switch, two insulating means one of which is T-shaped and each having a row of apertures on the respective sides of the T-formed leg, the one means being disposed with the leg end facing the other means in spaced apart relation and the aperture rows being respectively aligned, two rows of elongated resilient conductors extending between the means and through an aperture in each means on the same side of the leg, a rotor disposed between the conductor rows in contacting relation therewith and having a radially enlarged portion extending between two conductors in each of the two rows, and a plurality of electrically conductive means on the rotor extending outwardly therefrom whereby as the rotor is pivoted on an axis transverse to the conductors the conductive means respectively slidably engage the conductors to flex same urging the respective conductor end portions to move in the apertures.

17. Apparatus as in the claim 16 wherein the rotor radially enlarged portion periphery is adjacent the T-formed leg end and the rotor and the leg end each having corporating detent means.

18. An electrical switch comprising U-shaped resilient electrical conductors, two spaced-apart insulating means having two rows of apertures which respectively movably receive the respective ends of each of the U-shaped conductor leg ends with each conductor extending between two apertures in one of the means, a rotor member disposed between the conductors in the respective rows in engaging relation therewith, the rotor having electrically conductive portions interconnected in a predetermined manner, a pivot axis extending between the conductor rows and about which the rotor is pivotable, and a radially enlarged portion on the rotor and which extends radially beyond one conductor in each of the rows where-

by the rotor is movable only in a rotational manner about said pivot axis.

19. Apparatus as in the claim 18 wherein a base joins the insulating means adjacent one axial end of the rotor, one stud means on the base extending along the axis, the rotor having an aperture for receiving the stud such that the rotor is pivotable thereabouts, detent means on the rotor adjacent to and removably engaging one of the insulating means, and one of the said one means being resilient and flexible for serving to yieldably urge the interengagement of the detent means and one insulating means.

20. In an electrical switch, a plurality of spaced-apart

elongated and resilient conductors, insulating means supporting the ends of said conductors so that at least one end of said conductors may be axially slidable with respect to insulating means, and a contacting member interposed between said conductors, said contacting member having oppositely and outwardly extending electrically conductive portions which are spaced apart greater than said conductors and rotatable about an axis extending normal to said conductors.

References Cited in the file of this patent

UNITED STATES PATENTS

1,675,185 Lofgren ---------- June 26, 1928