

Oct. 24, 1939.

A HALL

2,177,481

SWITCH

Filed Oct. 5, 1934

4 Sheets-Sheet 1

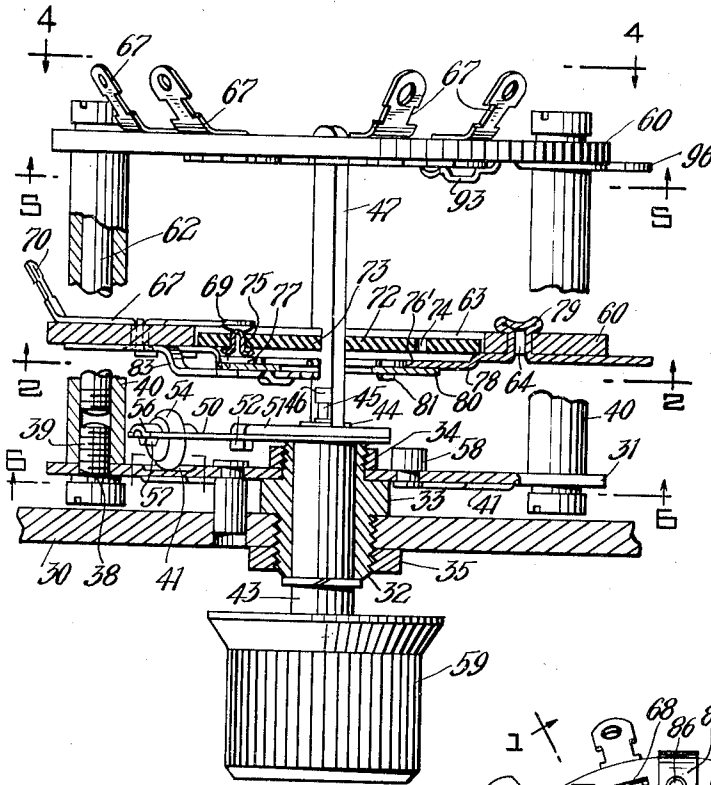


Fig. 1.

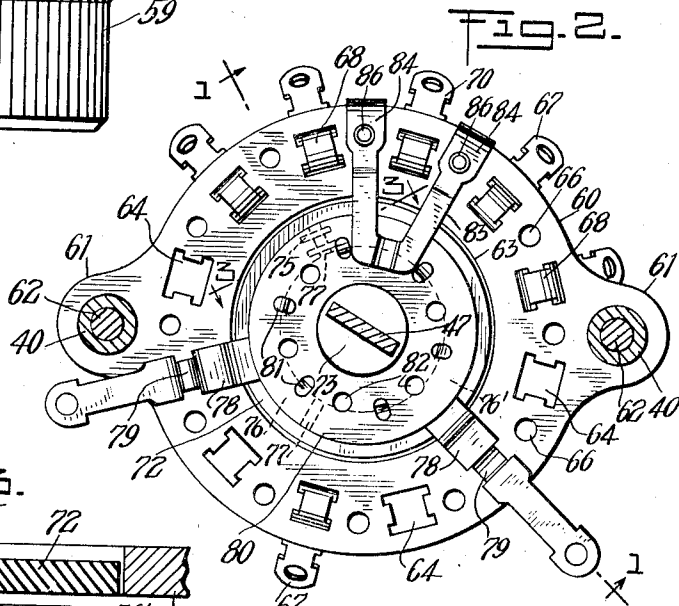


Fig. 2.

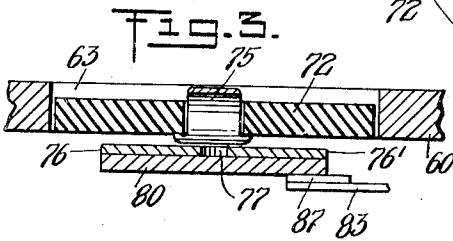


Fig. 3.

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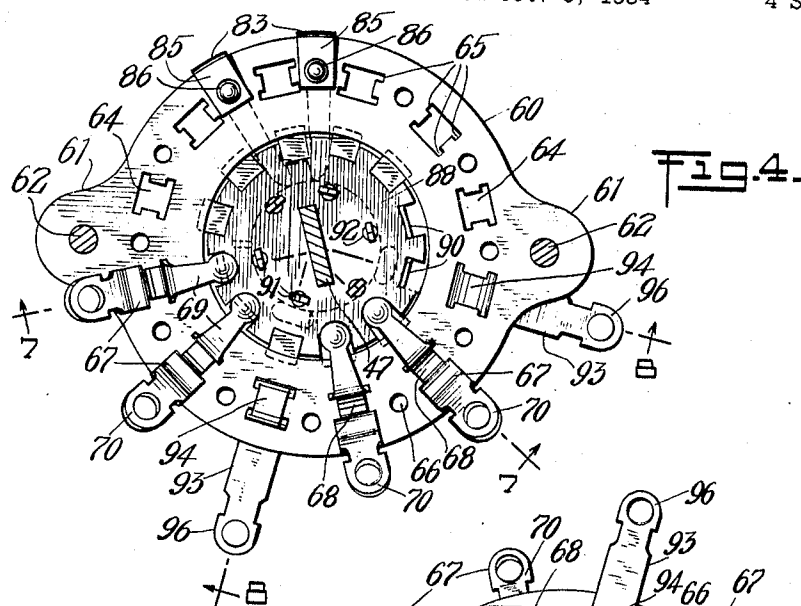


Fig. 5.

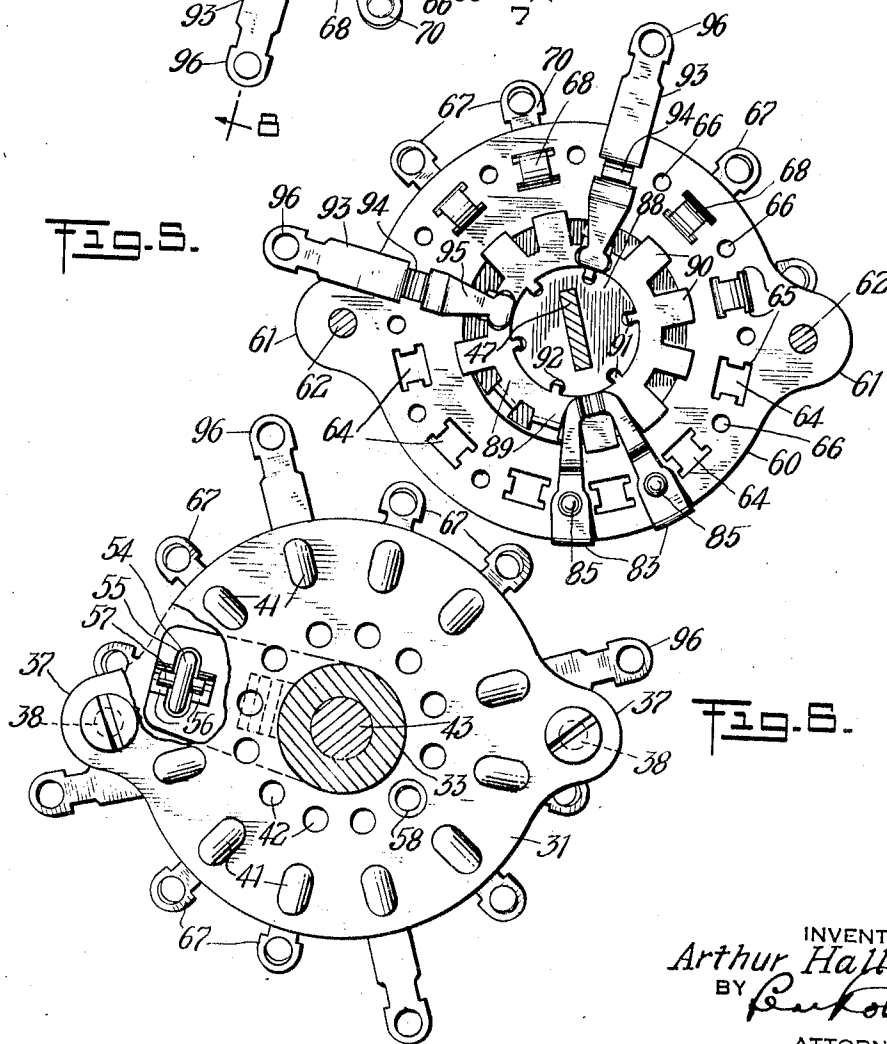


Fig. 6.

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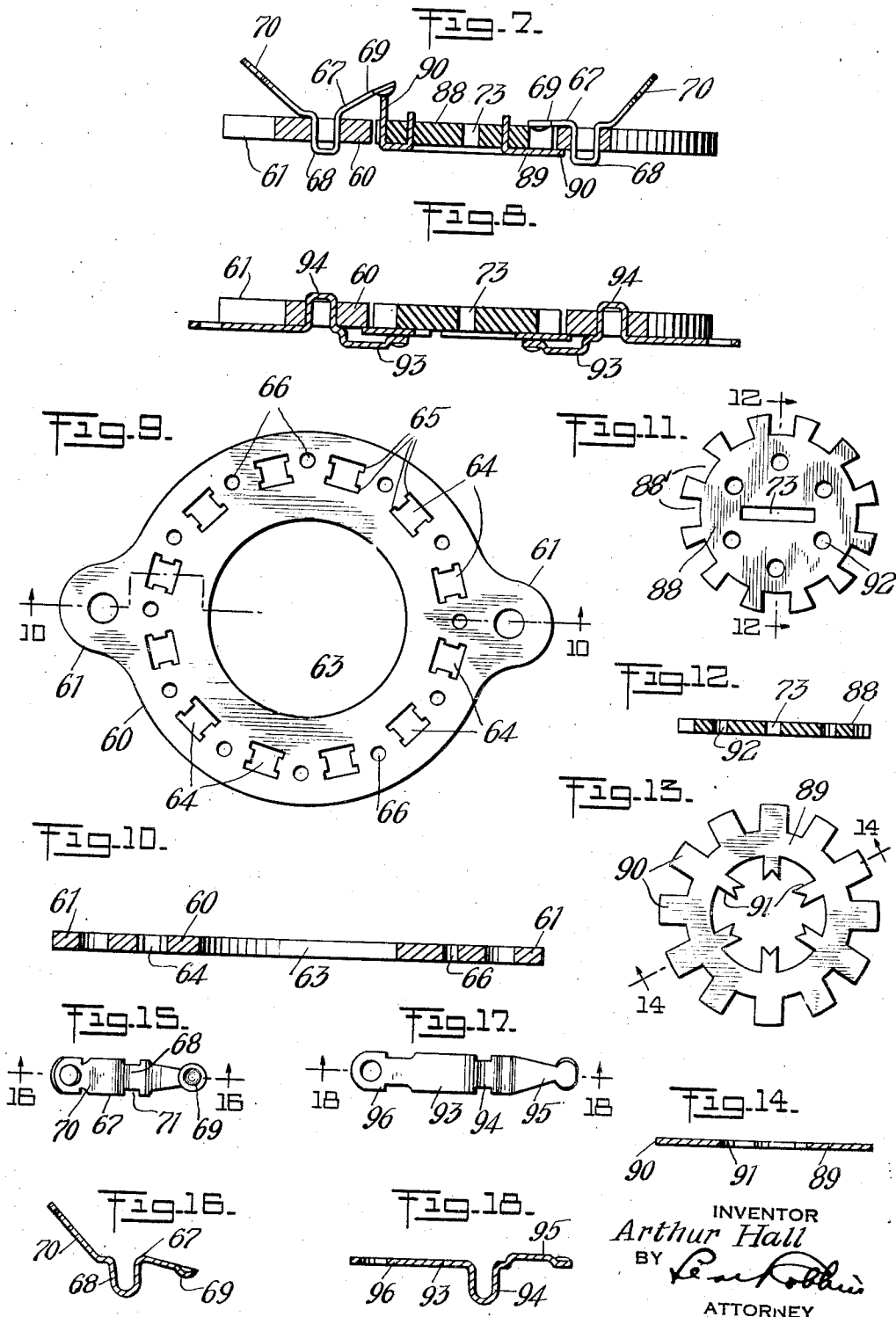
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Fig. 18.

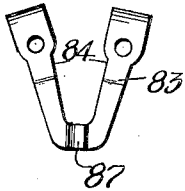


Fig. 20.

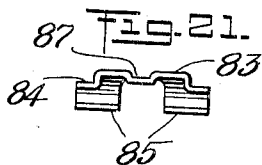
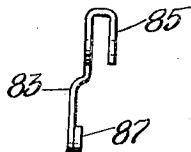


Fig. 22.

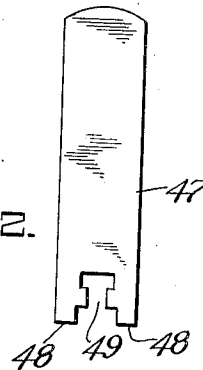


Fig. 24.

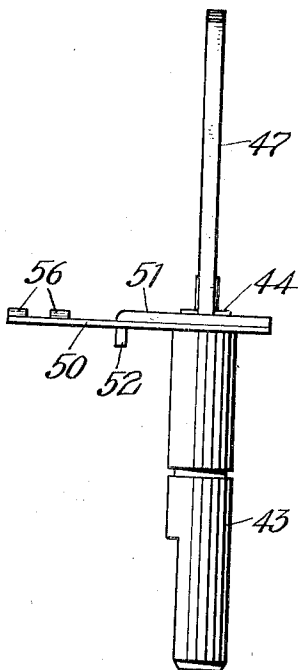


Fig. 25.

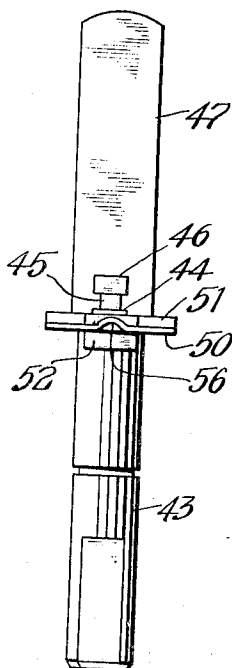


Fig. 23.

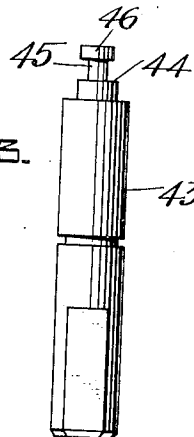
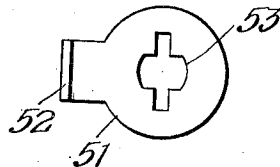


Fig. 26.



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UNITED STATES PATENT OFFICE

2,177,481

SWITCH

Arthur Hall, Indianapolis, Ind., assignor, by
mesne assignments, to P. R. Mallory & Co.,
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aware

Application October 5, 1934, Serial No. 746,950

3 Claims. (Cl. 200—11)

This invention relates to electric switches and has for a general object the provision of such a device which is compact in structure, efficient in operation and can be economically manufactured and readily assembled into a plurality of desired forms from standard parts.

The invention further contemplates the provision of an improved electric switch for radio use capable of effective circuit selection, with the switch assembly made from standard parts arranged to meet the particular requirements of the radio set in which used, particular objects of the invention being the provision of combinations and sub-combinations of elements useful both effectively to obtain this general end and to perform certain subsidiary steps, operations and functions involved therein.

Another object of the invention is the provision in such a switch of improved and novel bridging pieces or "slugs" for establishing electrical connection between certain terminals.

A further object of the invention is the provision in such a device of a standard switch base part of insulating material provided with a central aperture to receive a rotatable contactor member and having improved types of apertures for receiving, without requiring tools, terminal contacts to be arranged in such of said apertures as circuit requirements necessitate.

A still further object of the invention is directed to the novel and ingenious connection made between aligned cylindrical and flat shafts by which one may cause a corresponding rotation of itself in the other.

The invention presents a further object of improving upon the rotor construction and obtaining a universal rotor wherein the contact points may be selected from an ever present series thereof, at only the places where needed in the particular instance of use, the rotor being further improved in strength and in mounting.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth and the scope of the invention of which will be indicated in the appended claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a view partly in elevation and partly

in section showing a two-bank switch in accordance with the present invention, the section of the first switch bank being taken upon line 1—1 of Figure 2;

Figure 2 is a face view of the first switch bank looking from a plane indicated by line 2—2 of Figure 1;

Figure 3 is a sectional view on line 3—3 of Figure 2 showing a part of the rotor and base piece and a certain "slug" mounted in the rotor.

Figures 4 and 5 are opposite face views of the second switch bank looking from planes indicated by lines 4—4 and 5—5 respectively of Figure 1;

Figure 6 is a sectional view on line 6—6 of Figure 1, looking at the face of the index base;

Figures 7 and 8 are cross-sectional views on lines 7—7 and 8—8 respectively of Figure 4;

Figure 9 is a face view of the switch-bank base;

Figure 10 is a cross-sectional view thereof on line 10—10;

Figure 11 is a face view of the insulatory backing of the rotor for the upper switch bank of Figure 1;

Figure 12 is a cross sectional view thereof on line 12—12;

Figure 13 is a face view of the rotor contact shoe with contact ears and attaching tabs as used in the upper switch bank of Figure 1;

Figure 14 is a cross-sectional view thereof on line 14—14;

Figures 15 and 17 are face views of the spring contacts and terminal connections; and

Figures 16 and 18 are sections thereof on lines 16—16 and 18—18 respectively.

Figure 19 is a face view of a rotor support.

Figures 20 and 21 are edge views looking at the same from what may be termed the side and end respectively;

Figure 22 is a face view of the non-cylindrical extension shaft;

Figure 23 is an elevation of the cylindrical shaft;

Figures 24 and 25 are elevations taken at right angles to each other of the non-cylindrical and cylindrical shafts assembled with the index arm and means by which the same are caused to rotate together; and

Figure 26 is a face view of a certain interlocking arm forming part of the assembly shown in Figures 24 and 25.

Referring to the drawings, like numerals of reference indicate similar parts throughout, and in the specific embodiment thereof, there is shown next to panel 30 of the radio set, an index

base 31 provided at its middle with a hollow collar or sleeve 32 having a flange 33 adapted to seat at one side against the index base and at the other side against said panel. The sleeve 32 is secured to both the index base, as by a nut 34, and to the panel, as by a nut 35, both of which are shown threaded upon the sleeve at opposite ends thereof from flange 33. By this, or other suitable mounting, the index base is made fast with respect to the panel, and suitably prevented from rotating with respect thereto. It will be understood that the outer end of said sleeve 32 projects at the front of the panel and that the sleeve passes through both the panel and the index base so as to have the inner end of the sleeve at the inside of said index base.

The index base 31 is substantially in the form of a disc as shown in Figures 1 and 6 and is preferably provided with a pair of opposed ears 37, 37 apertured at 38, 38 to receive anchoring means such as screws 39 for switch bank supports. As illustrated in Figure 1, said screws 39 enter internally threaded sleeves 40, 40 which form the supports for a switch bank. The index base 31 is additionally provided with spaced indentations 41 arranged in a circular series near the outer circumference of the said index base and is further provided with a plurality of holes 42 arranged in a circular series closer to the center of the index base than the indentations and yet radially outward from sleeve 32.

Within the sleeve 32 is rotatably mounted a cylindrical shaft 45 (see Figures 1 and 23 to 25) for rotating within said sleeve and having a reduced end 44 with flattened side faces projecting from the inner end of said sleeve. This reduced end furthermore terminates in a still smaller neck 45 and therebeyond a head 46 of approximately the diameter of said reduced end 44. An extension shaft 47, which is preferably a strip of flat material, is provided next the cylindrical shaft 43 with forked ends 48 providing therebetween a cut-out or opening 49 corresponding in shape to the reduced end, neck and head of said cylindrical shaft 43. By virtue of this shape of cut-out, the extension shaft 47 may be applied, by a lateral movement, upon the end of shaft 43 to form an aligned continuation thereof. At the interlocking engagement of shaft 43 and extension 47 is mounted a transverse or laterally extending index arm 50, suitably apertured to receive the reduced end 44 of shaft 43 therein. The aperture may be shaped to fit the flattened faces of reduced end 44. Positioned flatwise against said index arm 50 is an interlocking arm 51 (Figure 26) the outer end of which is provided with a lip 52 turned into an appropriate slot in the index arm so that both arms must rotate together. This interlocking arm 51 likewise is apertured, as at 53, to overlie reduced end 44 with the aperture shaped to fit both the flattened sides of said reduced end 44 and also to receive the forked ends 48, 48 of the shaft extension 47. When this assembly is completed, a lateral pressure, normal to the flat face of the extension, is applied to head 46. This pressure has a tendency to flatten the head causing it to tightly fit within the corresponding part of cut out 49 and tending to spread ends 48, 48. This obtains a tight fit of said ends within the slot-like aperture in which they project in the interlocking arm 51. As a result of this structure, the two shafts are held rigidly against longitudinal displacement and are interlocked by the two arms for insuring simultaneous rotation of all of said parts.

At the outer end of index arm 50 is provided means for mounting a registration or index device, such as a wheel or roller 54, (see Figures 1 and 6). As here shown, this structure may conveniently include a transverse slot 55 near the outer end of the index arm, sufficient to receive the roller 54 therethrough (see Figure 6). Normal to the slot, on opposite sides thereof midway of its length are a pair of partially circular impressions 56, 56 concave at the side of the arm next the index base to form bearings for axial pintles 57, 57 on the roller. Said roller is adapted to ride upon the face of the index base and at every station drop into the one of the series of indentations 41 for locating the arm at that station. One or more stop pins 58 may be mounted in an appropriate hole or holes of the inner series 42, said pin projecting preferably into path of movement of lip 52 to prevent further rotation of the shaft assembly. The provision of the series of holes 42 enables the pin or pins 58 to be selectively applied to meet the requirements of any particular radio set or switch.

Rotation of the shafts 43, 47 and associated parts is effected by a suitable knob 59 on the outside of panel 30 and made fast in a suitable manner to shaft 43. Shaft 47 passes through one or more switch bases and for each switch base there is provided a rotor having a slot fitting said shaft for rotation in unison therewith.

Next above the indexing structure heretofore described and as shown in Figure 1, is a switch bank having a base and rotor, illustrated also in Figures 2 and 3. The base is the same as utilized with the upper switch bank and is illustrated in detail in Figures 9 and 10. The switch bases identified accordingly by numeral 60 throughout, are shown in the several instances as formed from insulating material, preferably in the form substantially of discs. Each base is provided with a pair of ears 61, 61 apertured to receive securing means, such as bolts 62 threaded into collars 40, which space the switch base from the index base in parallel relationship.

The switch base is provided with a central circular opening 63 within which the rotor, hereinafter described, is located. Between the outer and inner circumferences of the switch base is a circular series of finger-receiving sockets 64. These sockets are arranged in the same placement in a circular direction as the indentations 41 of the index base so there will be one such socket in the switch base for each indentation of the index base. The shape of these sockets 64 preferably is substantially rectangular with notches 65 arranged in pairs at the four corners, said notches being cut into the base from the socket in circumferential directions, for purposes to be later described. Between sockets 64 may be conveniently positioned a series of holes 66 for mounting a rotor support in any desired adjusted position as more fully explained below. The switch base as thus constructed, is a standard part for the various switch banks, and as many thereof as desired may be utilized to make up a complete switch assembly, depending upon the combinations of circuits desired and the particular set within which the switch is to be used.

In order to render the switch universal for any desired combination, I provide a plurality of resilient switch fingers 67, shown in assembled position in Figures 1, 2 and 4 to 7 and shown in detail in Figures 15 and 16. Furthermore each said switch finger is formed into a U-shaped loop in its middle or intermediate portion 68. From one

leg of this U-shaped loop extends the contact portion 69 of the finger and from the other leg extends a wire attaching portion 70. The material of which this finger is made is preferably a resilient metal which enables the finger to conduct current and also will enable the finger to resiliently retain itself in position and also to provide a resilient contact to cooperate with the rotor. The width of the finger where it is looped for introduction into socket 64 is substantially equal to the width of said socket plus the notches 65. The bottom of the loop is notched as at 71 (see Figure 15) thereby enabling it to pass through said socket. The fact that the margins of the finger where passing through the socket engage within notches 65 obtains a substantially rigid support for the finger, preventing it from turning sidewise and yet affording opportunity for the resiliency of the finger to function as above outlined. For obtaining permanent mounting of the fingers, the protruding loop portion of the U-shaped loop is preferably deformed, after assembling, as by crushing or spreading, thereby preventing its removal.

A rotor is provided, as indicated above, to occupy a position within circular opening 63 of the switch base and to be rotated by shaft 47. As indicated in Figure 1, the first switch bank next the index base provides a rotor, the rim of which appears in the underneath plan of Figure 2. Said rotor is preferably a disc 72 of insulatory material. This disc has a central slit 73 for receiving shaft 47 so as to be rotated thereby. The said rotor disc likewise is provided with a plurality of apertures 74 arranged in a circular series for receiving slugs or contact members 75 (see Figure 3). These slugs are preferably of resilient material bent in hair pin form so as to resiliently support themselves within apertures 74 with the upper doubled end thereof forming a contact to be engaged by the spring fingers 67 the contact 69 of which projects over the rotor as far as the said circular series of apertures 74. The lower ends of the slugs 75 are flared outwardly to prevent upward displacement and rest upon a bus bar which is here shown as in two segments thereby providing one bus bar segment 76 and another bus bar segment 76 separated by gaps 77 between the otherwise abutting ends thereof. As many segments for the bus bar may be provided as desired and as many slugs or contacts 75 may be utilized as the particular circuit arrangement requires.

The bus bar described may, if desired, be formed with each section thereof integral with a radially outwardly extending arm 78 having a looped portion 79 introduced into one of the rectangular notched openings 64 of the switch base. This affords means whereby the switch base may have more or less segments applied thereto, affords appropriate support for the bus bar and the arm furthermore enables a wire to be connected thereto for completing the circuit to the radio set. If so desired, the loop 79 may be crushed as shown in Figure 1 for permanently retaining the bus bar section mounted with respect to the switch base. This operation is similar to the crushing or deformation previously described with respect to the loops of the contact fingers. The bus bar segments may be made of a standard length if desired, adjacent segments may then be connected to provide longer segments where required.

Preferably a supporting insulatory annular ring 80 lies immediately beneath the bus bar sections

for giving them additional support. If so desired, the bus bar sections may have tabs 81 depending therefrom through holes 82 in this annular insulatory ring 80 thereby affording a much more rigid support for the bus bar sections. An auxiliary support 83 may be provided for this annular insulatory supporting ring, the present showing of this auxiliary support being illustrated in Figures 1, 2 and 19 to 21. This support may conveniently comprise a pair of diverging arms 84 the outer ends of which extend over the edge of the switch base and return on the other side of the base, as at 85, so that a rivet 86 may be applied through the parallel portions of each arm and through the intervening switch base for obtaining rigid attachment. The meeting ends of the arms 84 provide a rib 87 which underlies the said insulatory ring and supports the same. As shown in Figure 2, the assembled bus bar and insulatory ring have a three point support, one point being by the auxiliary support 83, and the other two supports being by the radial arms 78. It will be understood that the middle of both of the insulatory ring 80 and the bus bar are circularly open so as to permit rotation of the shaft 47 freely therein.

In the switch bank shown at the top of Figure 1 and also shown in Figures 4, 5, 7 and 8, the rotor preferably comprises an insulatory disc 88 which carries the metallic rotor contact shoe 89. These parts of the rotor are shown in detail in Figures 11 to 14. In this construction, the rotor is provided, as before, with a slot 73 through the insulatory part thereof so as to receive shaft 47 therein to be rotated thereby. The periphery of the insulatory plate or part 88 of the rotor is provided with a plurality of notches 88 and the metallic part or rotor shoe 89 is provided with a plurality of corresponding projections or contacts 90 which can be bent upwardly through notches 88 and project from the top surface of the rotor insulatory plate 88 normal to the plane thereof, as shown at the left of the rotor in Figure 7. As many of these contact projections 90 as desired may be turned up in order to effect the circuit combinations required of the switch. Those not required for contact purposes may remain flat as shown at the underside of the rotor at the right of Figure 7. At the middle part of the rotor shoe are provided a plurality of forked tabs 91 which are upturned and project through appropriate holes 92 in the insulatory plate 88. These forked tabs may be wedged outward or flared at their ends by an appropriate tool for effecting a permanent assembly of the rotor shoe with the insulatory plate.

It will be understood that appropriate spring contact fingers 67 are inserted in the rectangular sockets of switch base 61 such that the contact portion 69 of said finger projects over the rotor in the path of movement of upturned contacts 90 as shown in Figure 7. Connection to the rotor shoe may be secured by a similar contact finger 93 shown particularly in Figures 1, 8, 17 and 18. This finger 93 provides a middle looped mounting portion 94 from one leg of which extends a contact portion 95 to underlie and engage the rotor shoe and from the other leg of which extends a portion 96 for having a wire attached thereto from the radio circuit. The rotor may be supported by an adequate number of these contact members 93 or by a supporting member 83 such as already described. In the showing of Figure 8, I have indicated the rotor shoe as in sections, whereas in Figures 13 and 14 I have shown

the rotor shoe as one complete section. It will be understood that the structure of Figure 8 would require a pair of contact members 93, one for each section shown, whereas a single contact member 93 for contact purposes is all that would be required when using rotor shoe shown in Figure 13.

10 In operation, the angular rotation of shafts 43 and 47 obtained by twisting knob 59 is controlled by index arm 50 which will most readily come to rest when roller 54 seats in one of the indentations 41. All of the switch banks are arranged to have the contact arms, at this point of rest, overlying the positions of contact effected by either slugs 75 or projections 90 heretofore described as constituting the cooperating contact members from the bus bar or rotor contact shoe as the case may be. Intermediate positions throughout the angular travel of the shaft and rotors are indicated and controlled by the index arm, as will be understood.

25 Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, when construed in the light of the prior art, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative only, and not in a limiting sense.

30 Having thus described my invention, I claim:

1. An electric switch structure comprising in combination with an insulatory switch base, said base having an annular series of openings there-

through, a bus bar, a radial arm from said bus bar having a resilient loop, said loop being insertable at will in one of said openings for mounting the bus bar in desired position upon the base, and an auxiliary support for said bus bar from the said switch base.

2. An electric switch comprising in combination with a switch base having a central opening, a rotor within said opening comprising an insulatory disc having edge notches therein, a rotor contact shoe having projections registering with said notches and adapted to be selectively bent into said notches to project from the opposite face of the said disc normal thereto for providing contacts from the rotor shoe.

3. A switch assembly comprising a stator disc of insulatory sheet material, an aperture therein, a rotor disc of insulatory material mounted so as to turn in said aperture, control means for turning said rotor disc, an arcuate row of stator contacts mounted on one face of said stator along the periphery of said rotor disc, a common stator contact mounted on the opposite face of said stator, a rotor contact shoe mounted on one face of said rotor disc so as to turn therewith, said contact shoe being adapted to make contact with said common stator contact, a plurality of rotor contacts located on the opposite face of said rotor and adapted selectively to make contact with contacts of said row of stator contacts, and means passing through said rotor and conductively joining said rotor contacts to said rotor contact shoe.

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