Nov. 30, 1948. G. R. PENNINGTON 2,455,137

RADIO CIRCUIT SELECTOR SWITCH

Original Filed May 25, 1942

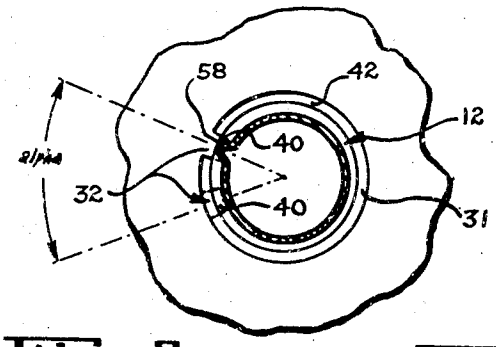


Fig. 2.

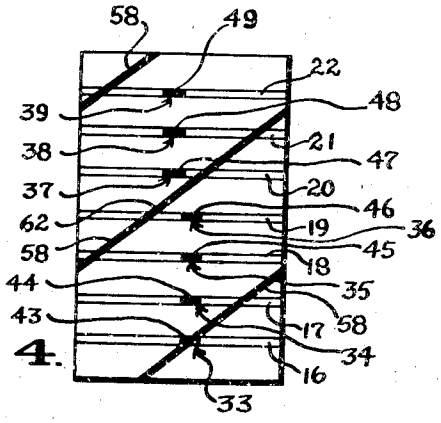


Fig. 4.

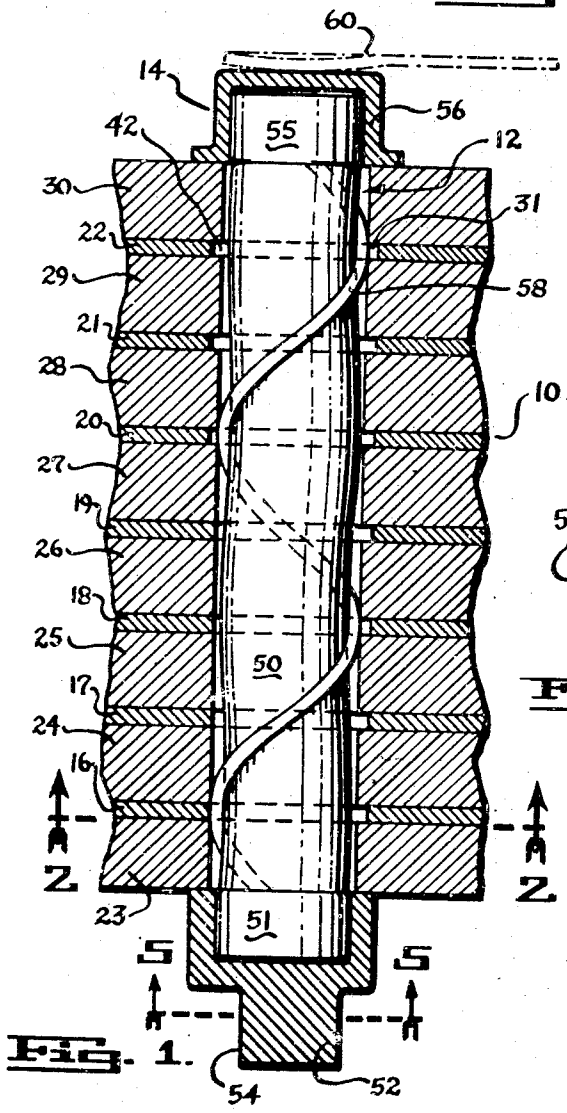


Fig. 1.

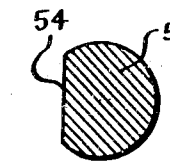


Fig. 5.

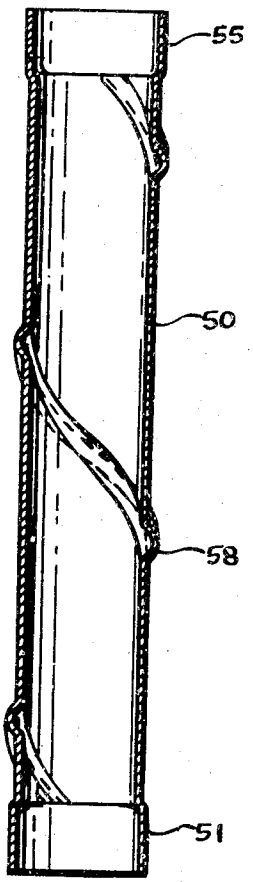


Fig. 3.

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RADIO CIRCUIT SELECTOR SWITCH

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Original application May 25, 1942, Serial No. 444,331, now Patent No. 2,422,253, dated June 17, 1947. Divided and this application April 24, 1947, Serial No. 743,711

14 Claims. (Cl. 200—8)

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This invention relates to an electrical circuit selector switch, and especially to a selector switch for use in connection with automatic program selectors for radio receiving sets.

The present application is a division of my co-pending application, Serial No. 444,331, filed May 25, 1942, now Patent No. 2,422,253, issued June 17, 1947.

The object of my invention is to provide an electrical selector switch which is of simple construction, adapted to low cost, quantity production and which is highly efficient for the use intended.

A further object is to provide a compact electrical selector switch adapted to select a plurality of selector circuits one at a time.

Another object is to provide a selector switch in which the rotatable contact plug thereof is so constructed as to accommodate substantially wide manufacturing tolerances in the bore of the switch panel and of the plug and yet obtain a good pressure contact and fit when the plug is assembled in the panel.

A more specific object is to provide a selector switch in which the contact plug thereof comprises a stem having a hollow thin walled construction including a projecting contact making bead, the portions of which are disposed in a generally spiral arrangement about said stem, the stem being distortable at each section under the bead so that the plug may be assembled for rotation in a switch panel bore smaller than the free diameter of the plug whereby to facilitate proper fitting of the plug in the panel and the obtaining of good electrical contact at each rotative position of the plug where a circuit connection is to be made.

Another object is to provide a selector switch in which the bore of the switch panel is of slightly smaller size than the normal free size of the plug therein, the said plug comprising a hollow resilient structure adapted to accommodate itself to the switch bore by distortion from its normal shape lengthwise of the plug so as to exert a radial pressure against the wall of the bore for obtaining good electrical contact, yet be readily rotatable to different positions.

A still further object is to provide a selector switch including a contact panel and a selector plug in which the plug obtains at least a three point contact with the bore of the contact panel in any plane through the axis of the plug.

Other objects and novel features of my invention will be apparent from the following description and from the drawing which illustrates my

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invention as applied to an eight position switch for an automatic program selector described and shown in my said co-pending application.

In the drawing in which similar numerals designate similar parts of the construction,

Figure 1 is a cross-sectional view of a switch embodying my invention, portions of the switch panel being broken away.

Figure 2 is a cross-sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a cross-sectional view of a portion of the switch rotor or plug.

Figure 4 is a developed view of the cylindrical surface shown in Figure 1 illustrating the contact area of the plug in the position shown in Figure 1 superimposed on the contact areas on the surface of the bore in the switch panel.

Figure 5 is a sectional view of the selector head taken at 5—5 of Figure 1.

Referring to Figures 1 to 5, the numeral 10 generally designates a switch contact body, block, or panel having a cylindrical bore or hole 12 in which is positioned the electrical conducting or contact plug, or rotor generally designated by numeral 14 and adapted for relative rotation with respect to the switch panel 10. The panel 10, in the form illustrated, preferably comprises a laminated structure built up of a plurality of thin metallic sheets (one for each of the broadcasting stations from among whose programs selection is to be offered) 16 to 22 inclusive of electrical conducting metal such as hard copper or brass alternating with and cemented between sheets 23 to 30 inclusive, of plastic or other (relatively) electrically nonconducting material.

Each of the metallic sheets is pierced prior to assembly by a hole 31 which is circular in shape except for a radially inwardly projecting tab generally referred to by the numeral 32. (See Figure 2.)

As seen in Figures 2 and 4, the tabs 33, 34, 35 and 36 of conductor sheets 16, 17 and 18 and 19, respectively, in the switch illustrated, are preferably arranged in alignment axially of the plug; and the tabs 37, 38 and 39 of the conductor sheets 20, 21 and 22, respectively, are also arranged in alignment with each other axially with the plug but are, as a group, angularly offset by the angle alpha (see Figure 2) from the group of tabs 33 to 36, inclusive, this angle alpha being substantially 45°.

After assembly, the plastic sheets are drilled through the hole in the metallic sheets to provide the cylindrical hole or bore 12. It is to be observed that, when the bore 12 is drilled through

the panel 10, it is so located, and of such a diameter, as to cut off a portion 40 (see Figure 2) of each of the tabs 33 to 39 inclusive, but does not otherwise cut through or intersect the metal sheets 16 to 22 inclusive, by being of slightly less diameter than the holes in the metal sheets so as to leave an annular clearance 42 (see Figure 2) between the bore 12 and the periphery of the hole 31 in the metal sheets which may be and preferably, are filled with electrically non-conducting plastic during the cementing operation, except where the tabs are located, thus providing electrical contact surfaces at and only at the tab locations.

The amount of clearance 42 is pre-set to be sufficient to allow for expected variations in hole locations in production when a switch panel having a plurality of plugs is provided. The tabs 32 are preferably made of sufficient length to make sure that they will be trimmed during the drilling operation of the panel to form contact areas 43 to 49 inclusive on the tabs 33 to 39 inclusive respectively of Figure 4 flush with the surface of the bore 12 as seen in Figure 2. Each of the metal sheets 16 to 22 will be provided with a connection tab (not shown) projected beyond the plastic sheets to which circuit connections may be made.

The rotatable plug 14 comprises a thin walled tubular member or stem 50 of resilient character preferably of hard drawn brass and tinned on the outside, having an expanded portion 51 at one end which is press fitted into and/or soldered to a head piece, or knob, 52 whereby the rotor may be manually rotated. The head 52 may be provided with a suitable pointer or indicating means, for example a flat 54, for indicating angular position of the plug with respect to the horizontal or vertical or to some markings or other indices not shown, which may be on the plastic sheet 23.

The opposite end of the rotor 14 also has an expanded portion 55 to receive a metallic contact cap 56, preferably of brass, which is press fitted, and preferably soldered to the tube 50 after assembly of the rotor in the panel 10.

The tubular member 50 has a raised spiral ridge which is preferably raised .007" to .010" on all except the ends of the tube, for example, as by a radial coining operation. In the switch illustrated the helix angle of this ridge is such as to produce a quarter of a revolution (90°) of the ridge around the rotor in the distance between any two adjacent conductor sheets 16 to 22 inclusive.

It will be understood that the flat 54 must, of course, be accurately positioned angularly with respect to the spiral 58. This positioning can readily be accomplished in an automatic machine by machining the flat while the assembly of the head 52 and the tube 50 (soldered at an earlier operation) is gripped in the die which forms the ridge 58. This die is machined so as to make the top of the ridge 58 project a few thousands of an inch outside of a cylinder which would just fit easily into the drilled hole of bore 12 and which would substantially coincide with the cylindrical surface of the expanded portions 51 to 55 of the tube or stem 50.

Thus, when a rotor whose free diameter is greater than the diameter of the bore 12 is inserted in the bore, the stem or tube 50 is, in order to be fitted therein, distorted slightly from its normal shape, as in Figure 3 to that somewhat exaggeratedly shown in Figure 1, from which it will be evident that the tube distorts or bends immediately under each point of contact of the

spiral with the wall of the bore in the panel, giving the plug stem 50 a twist effect. This distortion, in combination with the resiliency of the tube, which, as stated previously, is preferably of hard drawn brass, assures positive pressure between the top of the spiral ridge 58 and the contact areas 43 to 49 inclusive which are, as previously stated, flush with the walls of the drilled hole 12. After the rotor 14 is inserted in the bore 12 a contact cap 56 is firmly pressed on the cylindrical raised portion 55 to hold the rotor endwise in the bore 12 of the panel and also to provide an electrical contact surface for contact with a circuit completing contacting finger 60 shown in phantom in Figure 1.

As seen in Figures 1 and 4 the rotor 14 is in a position in which the spiral ridge 58 contacts the conductor sheet 16 through the contact area 43 of the tab 33 so as to create an electrical circuit path between conductor sheet 16 and the spring contact 60 through the tube 50 and cap 56, the contact 60 and the conductor sheet 16, being connected with, for example, a radio broadcast circuit in the manner set forth in my copending application aforesaid.

If the rotor is turned 45° counterclockwise (as seen from the front of the panel), the raised ridge 58 will contact the conductor sheet 20 through the contact area 47 of the tab 37. Further rotation in the same direction will establish contacts at 45° intervals with the conductor sheets in the order 17, 21, 18, 22 and 19, respectively, through their contact areas 44, 48, 45, 49, and 46 respectively. An additional rotation of 45° in the same direction (or 45° clockwise rotation from the position shown in the drawing) after making contact with the contact area 46 will establish no contact and is therefore the "off" position of the switch.

It will be observed as stated above, that the contact areas 47, 48 and 45 are angularly offset by the angle alpha from the contact areas 43 to 46 inclusive. This arrangement is preferred so that the portion 62 of the spiral ridge 58 in Figure 4 will not make contact with the contact area 47 at the same time as contact is made with contact area 43 and similarly as to other contact positions. It will also be noted that the sheets 16, 17, 18 and 19, alone, would provide a 4 pole switch in which these separate sheets would be contacted successively by 90° rotational steps of the rotor.

It will be seen from Figure 1 that the spiral ridge 58 is of such length as to enable selective contact of each of the conductor sheets 16 to 22 inclusive to be made during a complete revolution of the plug 14. Preferably this length will, in the preferred embodiment be approximately one and one-half turns, such having the advantage that any plane passed through the rotational axis of the spiral ridge will intersect the latter at at least three points in contact wtih the wall of the bore 12 so as to obtain a good fit and good operation in either direction of rotation, and good electrical contact at the time the spiral 58 engages one of the conductor sheets, all this being facilitated by the nature of the contact ridge and the slight distortion of the rotor tube, or stem heretofore referred to.

Although I do not desire to be precise as to the number of turns of the spiral ridge it will be manifest that when less than the one and one-half turns is employed the advantageous three point contact will be lost in some planes and when one and one-half turns are exceeded there will be

more than three points of contact in some planes resulting in unnecessary thickness, and therefore cost, of the panel 10.

While the particular selector switch structure hereon described is well adapted for carrying out the objects of the present invention it will be understood that various modifications, changes, and substitutions may be made without departing from the spirit thereof. For example, although not preferred, the spiral ridge may be in the form of an interrupted spiral. Moreover, the invention may be applied to other uses than radio program selectors. The present invention is therefore to be construed to include all such modifications, changes, substitutions and applications as may come within the scope of the following claims.

I claim:

1. A circuit selector switch comprising in combination, a rotatable plug having a thin-walled resilient metallic stem the surface of which is provided with a projecting bead extending spirally about said stem, and a panel having a generally cylindrical bore adapted to receive the stem of said plug, said bore being of slightly smaller diameter than the free diameter of said stem outside said bead whereby the section of said stem under said bead is slightly distorted to provide a spring-like pressure fit with said bore when said plug is assembled therein.

2. A circuit selector switch as claimed in claim 1, wherein the said bead projects sufficiently from the surface of said stem to accommodate said distortion.

3. A circuit selector switch as claimed in claim 1, wherein said bead extends in a spiral of approximately one and one-half turns.

4. A circuit selector switch comprising in combination a rotatable plug having a normally straight thin-walled tubular stem resilient in character, the surface of which is provided with a projecting metallic contacting ridge extending generally spirally about the axis of said stem, and a contact panel having a generally cylindrical bore of slightly smaller diameter than the free diameter of said stem outside said ridge, said stem being adapted to resiliently assume a wavy character when assembled in said panel, to facilitate pressure contact of said ridge with said bore.

5. A circuit selector switch comprising in combination, a rotatable contact plug having a cylindrical stem presenting a resilient metallic contact ridge extending in a spiral about the axis of said stem and projecting above the adjacent surface of said stem, and a contact panel of insulation material having in the body thereof a metallic contact, said panel having a bore for receiving said stem and said contact presenting a contact surface of limited area substantially flush with the surface of said bore; said stem having a free diameter outside said spiral ridge slightly greater than that of said bore and said spiral ridge being resiliently contractable when said plug is assembled in said panel whereby to exert outward pressure against said metallic contact when in radial alinement therewith.

6. A circuit selector switch comprising in combination, a rotatable contact plug having a hollow thin-walled resilient metallic stem the surface of which is provided with a projecting contacting bead extending generally spirally about the axis of said stem, and a contact panel having a generally cylindrical bore of slightly smaller diameter than the free diameter of said stem outside said bead, and having a plurality of metallic

contacts axially and circumferentially spaced in the said bore and substantially flush with the surface of said bore, said stem when assembled in said bore being resiliently contractable therein whereby said bead exerts outward pressure against the said metallic contacts when in radial juxtaposition thereto.

7. A selector switch comprising in combination, a rotatable contact plug having a hollow thin-walled metallic stem provided with a circuit making ridge extending spirally about the axis of said stem, and a contact panel having a bore adapted to receive said stem for rotation therein, said panel comprising alternate layers of metallic sheets and insulating material, said metallic sheets each adapted to form a part of an electrical circuit and each said metallic sheet having a tab thereof exposed in said bore for making contact with said spiral ridge at a predetermined rotational position of said plug.

8. A selector switch comprising in combination, a rotatable contact plug having a resilient hollow thin-walled metallic stem provided with a circuit making ridge extending spirally about the axis of said stem, and a contact panel having a bore in which said stem is mounted for rotation, said panel comprising spaced apart metallic members adapted to form part of electrical circuits and each member having a portion thereof exposed in said bore for making contact with said ridge at predetermined rotational positions of said plug; the stem of said plug prior to assembly in said bore having a free diameter outside said ridge slightly in excess of said bore whereby a reduction in the stem shape occurs in assembly to facilitate pressure contact between said ridge and exposed portions of said members at said predetermined positions.

9. A selector switch comprising in combination, a contact panel comprising insulation material having a cylindrical bore therein, a plurality of metallic contacts presenting areas of limited extent flush with the wall of said bore, a hollow rotatable plug in said bore presenting a spiral metallic ridge adapted to bear upon a limited area of the wall of said bore and adapted to make contact with said areas of said metallic contacts in accordance with predetermined rotational positioning of said plug, said spiral ridge having a free diameter greater than said bore when disassembled from said bore and said spiral ridge being of resilient character and adapted to resist reduction in the free diameter thereof such that when said plug is in assembled relation with said bore said ridge may effect a pressure contact with said metallic contacts at said predetermined positions of said plug.

10. A selector switch comprising in combination, a rotatable contact plug having a resilient, hollow, thin-walled metallic stem presenting a circuit making ridge extending in the form of a spiral about the axis of said stem, an insulated contact panel having a cylindrical bore in which said plug is rotatably mounted, said panel comprising a plurality of metallic contact members separated by insulation material, said members each having a portion thereof exposed in said bore and said portions being arranged in a plurality of groups with the said portions in each group in series and intersecting a plane passing through said axis, each group being positioned at a different rotational position of said plug such that during rotation of said plug said ridge will make contact successively with said portions of said groups in accordance with their axial position and

make contact with only a single one of said portions at any one position of said plug.

11. A selector switch comprising in combination, a laminated panel having alternate layers of metallic sheet material and insulation material, an opening in said panel having a wall formed by said insulation material and presenting limited spaced edge areas of said sheets flush with said wall, and a contact plug in said opening having a resilient hollow thin-walled stem providing a resilient contact ridge in pressure contact with said wall and adapted to make contact with said edge areas of said metallic sheets at predetermined rotational positions of said plug.

12. A selector switch as claimed in claim 11, wherein the plug has an indexing means at one end and circuit contact means at the other end.

13. A rotatable contact plug for a selector switch comprising a resilient hollow thin walled cylindrical stem having a narrow raised contact ridge extending spirally about the axis of said stem the said ridge being adapted to be slightly distorted to provide a spring-like pressure fit with a bore of lesser diameter than the free diameter of the stem.

14. A slector switch comprising in combination, a panel comprising a plurality of metallic elements each adapted to form part of an electrical circuit, sandwiched and cemented between elements of non-conducting material, a cylindical hole through said panel presenting contact areas of limited arc at the surface thereof of each of said metallic elements, a rotatable plug in said hole provided with aproximately one and one-half turns of a spiral ridge whose free diameter exceeds that of said hole bearing on a limited arc of said surface in the plane of each element and adapted to contact said metallic elements singly in succession as the said plug is rotated and means for limiting the axial movement of said plug.

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The following references are of record in the file of this patent:

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