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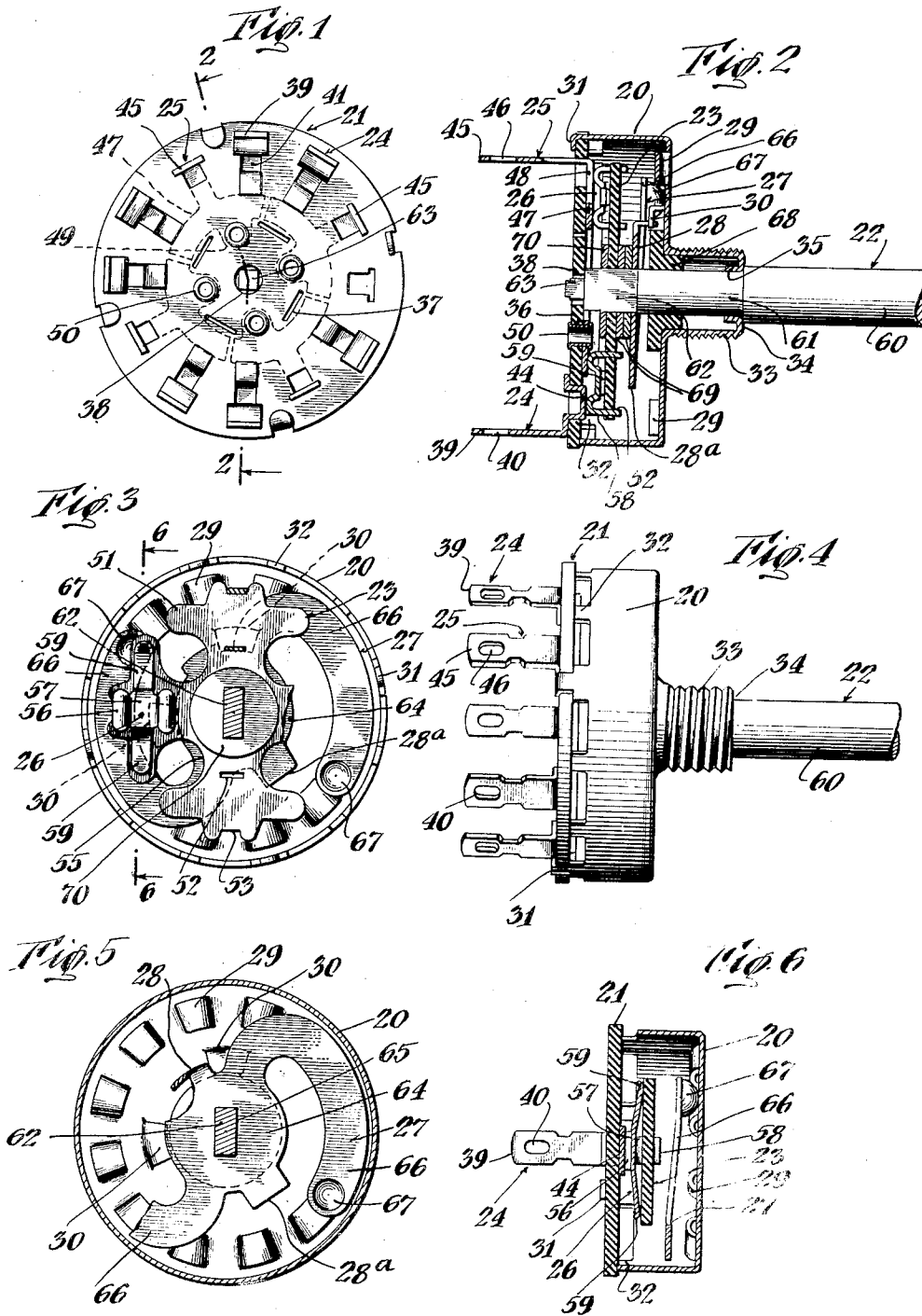
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SWITCH CONTACT

Filed May 13, 1936

2 Sheets-Sheet 1



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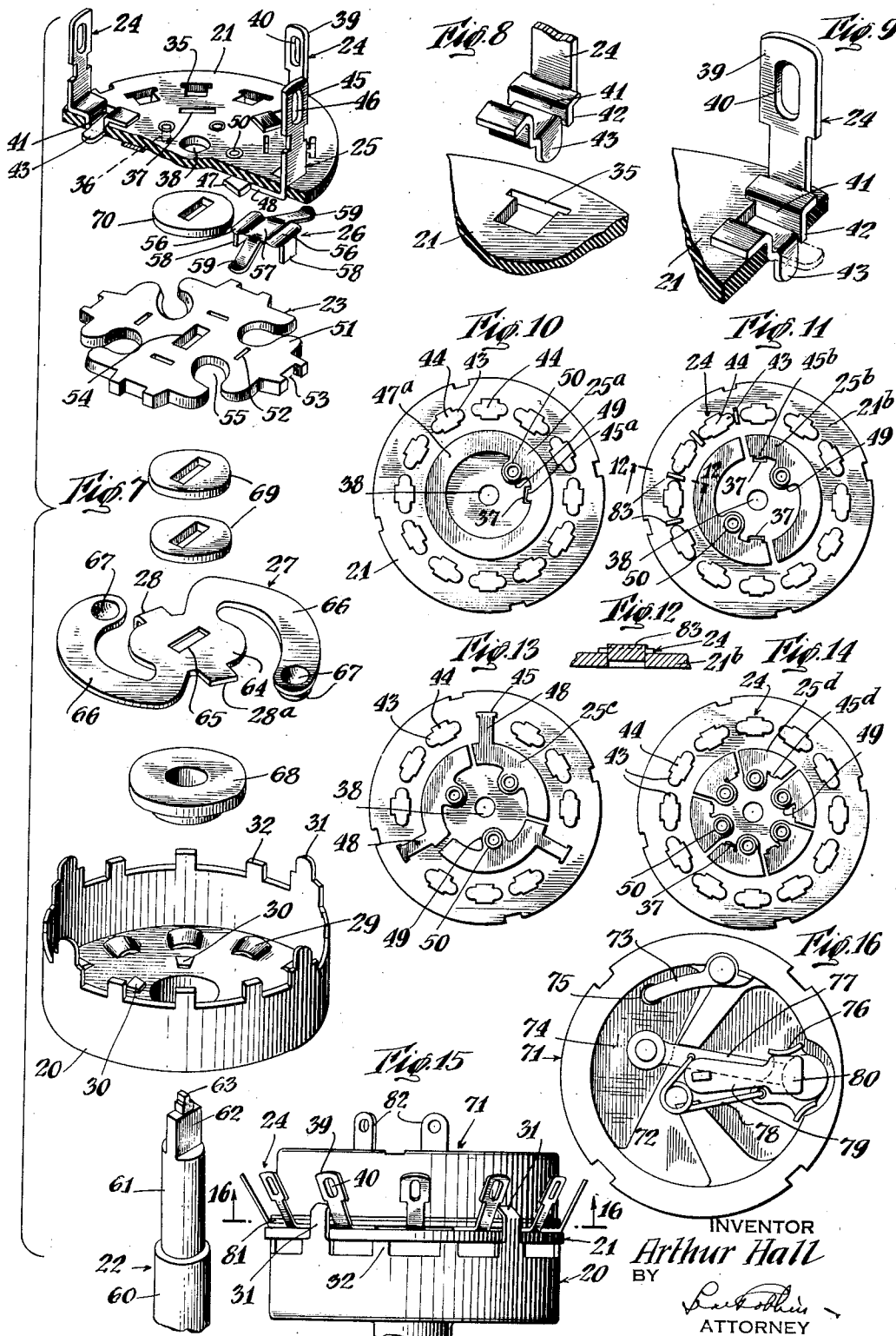
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UNITED STATES PATENT OFFICE

2,186,638

SWITCH CONTACT

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Application May 13, 1936, Serial No. 79,465

4 Claims. (Cl. 200—171)

This invention relates to electric switches.

An object of the invention is to improve electric switches, particularly those of the multi-circuit variety.

5 Other objects of the invention will be apparent from the following description and accompanying drawings taken in connection with the appended claims.

10 The invention comprises the features of construction, combination of elements, arrangement of parts, and methods of manufacture and operation referred to above or which will be brought out and exemplified in the disclosure hereinafter set forth, including the illustrations in the drawings, the scope of the invention being indicated in the appended claims.

15 For a fuller understanding of the nature and objects of the invention as well as for specific fulfillment thereof, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a face view of an electric switch embodying the present invention;

25 Figure 2 is a section on the line 2—2 of Figure 1;

Figure 3 is a face view of the switch with parts removed to show the rotor assembly;

Figure 4 is a side view of the switch;

30 Figure 5 is a face section of the switch showing the indexing means;

Figure 6 is a section on the line 6—6 of Figure 3;

35 Figure 7 is an exploded view of the entire switch;

Figures 8 and 9 indicate the means of mounting the stator contacts;

40 Figure 10 is a face view of a stator of a 12 position single pole switch having a modified form of pole terminal;

Figure 11 is a face view of a stator of a 6 position 2 pole non-shorting switch;

Figure 12 is a section on the line 12—12 of Figure 11;

45 Figure 13 is a face view of the stator of a 3 position 3 pole switch;

Figure 14 is a face view of the stator of a 2 position 6 pole switch;

50 Figure 15 is a side elevation of the switch with an AC snap switch mounted thereon; and

Figure 16 is a section on the line 16—16 of Figure 15.

While a preferred embodiment of the invention is described herein, it is contemplated that considerable variation may be made in the method

of procedure and the construction of parts without departing from the spirit of the invention. In the following description and in the claims, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

5 The present invention provides a switch which can be of small size and still control a large number of circuits. This makes it particularly well adapted for use as a short wave, tone control or tap switch in radio work and for a multi-circuit control switch in many other applications. The construction of the switch makes it possible to control an exceedingly large number of circuits in a small unit without undue capacity effects when used with alternating currents such as are encountered in radio circuits.

10 Referring to the drawings, the switch comprises a metal case 20 having a stator disk 21 of insulating material mounted thereon and a rotatable shaft 22 having an insulating rotor 23 mounted thereon. The stator disk 21 has a plurality of individual contacts 24 mounted thereon and one or more poles or common contacts 25 also mounted thereon. The rotor 23 carries a plurality of bridging contacts 26 adapted to co-operate with stator contacts 24 and 25 to connect them in a predetermined variety of ways. A rotor indexing member 27 having an integral rotor stop arm 28 is also mounted on shaft 22 and cooperates with indexing projections 29 and stop projections 30, in the bottom of case 20 for indexing and limiting the rotation of the rotor assembly.

35 Case 20 is formed of a single piece of metal, such as steel, iron, brass or aluminum, by suitable spinning and drawing operations so as to provide a single integral unit, as shown particularly in Figures 2, 4 and 7. It will be noted that case 20 has a plurality of integral ears or lugs 31 spaced around the free edge thereof and adapted to be bent over the stator disk to hold the same in position. Case 20 is also cut away around its periphery so as to provide a plurality of upstanding teeth 32 upon which the stator disk rests. These teeth serve to space the main body of the case away from the stator disk and thereby increase the air path between the stator contacts and the case 20. This reduces the electrostatic capacity between the case and the contacts by a considerable amount since the electrostatic capacity of air is considerable below that of the Bakelite or other insulating material from which the stator is made. A circular series of

spaced indexing projections 29 is formed in the end wall of the case 20 to provide indexing positions for the switch rotor. Projections 29 are rounded metal loops stamped up from the base of case 20 and are angularly spaced by the same amount as the individual stator contacts 24 so as to locate and center the rotor contacts on the stator contacts in the various switch positions. A pair of projecting lugs 30 are also stamped up from the base of case 20 and are so positioned as to confine the rotational motion of the rotor to the number of positions for which the switch is designed.

An integral tubular bushing 33 is provided in the center of the end of case 20 for receiving the control shaft 22. The outside of bushing 33 may preferably be threaded, as indicated, to provide for mounting of the switch in a panel or on a mounting bracket with a suitable retaining nut.

The end of bushing 33 is turned in as indicated to provide a shoulder portion 34 and a bearing portion 35 in which the shaft 22 is adapted to rotate.

It will be noted that a portion of shaft 22 is of reduced diameter to produce a shoulder on the shaft abutted against shoulder portion 34 to limit the lateral motion of the shaft.

Stator 21 is formed of insulating material such as Bakelite, resin impregnated fibre, ceramic or the like. It is punched with a circular series of T-shaped openings 35 near its outer periphery for receiving the individual contacts 24. Several rivet holes 36 are provided nearer the center of disk 21 for receiving the mounting rivets for the common contacts 25. Likewise, a series of elongated rectangular holes 37 are provided for the terminals on the modified form of common contacts to be described later in connection with Figures 10, 11 and 14. Likewise, in some instances, an opening 38 may be provided in the center of stator disk 21 for a purpose to be described.

The method of mounting stator contacts 24 in stator 21 is illustrated in Figures 8 and 9. The contacts 24 may be stamped from sheet metal, such as brass or steel, into the form shown in these figures, comprising a soldering lug terminal 39 having a hole 40 therein and a U-shaped mounting portion 41 adapted to fit into the T-shaped openings 35 in the stator. It will be noted that one side of the U-shaped portion is provided with a pair of edges 42 which fit into the cross arm of the T-shaped opening in the stator disk so as to securely hold the contact against turning or lateral movement. The center of the U-shaped portion is provided with a pair of spaced parallel, downwardly extending ears 43. After the terminal has been set in place in the stator disk 21, ears 43 are spread out against the face of the disk so as to provide an extended flat area 44 (see Figure 10) to serve as the contact face. The contact face 44, or the entire terminal, if desired, is preferably plated with silver or some other contact metal adapted to provide improved electrical contact.

The form of the common contact 25 will depend upon the number of contact positions which are to be provided in each individual switch. In a four pole switch, such as that illustrated in Figures 1 to 7, inclusive, the common contacts 25 may each comprise a metal stamping having a soldering terminal 45 having a hole 46 therein and a segment portion 47 (indicated in dotted lines in Figure 1) covering slightly less than 90° of a circular arc. Portion 47 is connected to the

soldering terminal 45 by a shank 48 which is bent at right angles and passes through one of the T-shaped openings in the stator, the terminal fitting into the cross arm of the T. A riveting ear 49 is provided at the inside edge of the segment whereby the terminal may be secured to stator disk 21 by rivet 50 which passes through disk 21 and ear 49. It will be noted that four similar terminals 25 are provided in spaced relation so as to provide four segments of a circular arc. With this type of terminal four of the individual contact positions are required for bringing out the terminals 45. If the stator 21 is provided with twelve T-shaped openings each sector of the switch will have two individual contacts 24 and one common contact 25.

It will be apparent that a greater or lesser number of common contacts 25 will be provided depending on the number of poles desired, the arc-shaped portions 47 each extending through a greater or lesser angle, as required. Figure 10, for example, shows a stator arrangement in which a single common contact 25a is provided for all twelve positions. This might be termed a single-pole 12-position switch.

Figure 11 shows a stator having two semi-circular common terminals 25b to provide a 2-pole 6-position switch. Figure 11 also illustrates a modified form of stator disk 21b provided with stamped-up bosses 83 between the individual contacts 24. Bosses 83 are slightly higher than the contact faces of contacts 24 so that when the rotor contacts are moved from one stator contact to the next the contact is broken momentarily between the two positions. A cross-section of a portion of disk 21b is shown in Figure 12. With stator disk 21, illustrated in Figures 1 to 10, 13 and 14, the rotor contacts produce a short-circuit between adjacent stator contacts during change over from one position to the next.

Figures 10 and 11 illustrate a modified arrangement for terminals 45a and 45b which are joined to the contact portion of contacts 25a and 25b, respectively, at their inner edge and extend out through holes 37 in the stator disk. With this form of terminal all the individual contact positions can be occupied by individual contacts 24 since none are required for the common contact terminals. The terminals 25a and 25b extend through holes 37 in stator disk 21 project out from the outer face of the stator.

Figure 13 shows a stator having three common contacts 25c each extending for 60° around the stator. This figure also shows a similar terminal arrangement to that shown in Figures 1 to 7.

Figure 14 shows 6 terminals 25d of slightly less than 30° each. The terminal 45d is of the modified form also illustrated in Figures 10 and 11.

The rotor 23 is formed of sheet material, preferably Bakelite or other resin impregnated fibre. The preferred form of rotor is shown most clearly in Figure 7. It will be noted that the disk is cut away to provide for contact carrying table portions 51 upon which the rotor contacts 26 are mounted, a rectangular slot 52 and a notched portion 53 being provided to receive the side flanges of the contact. A central rectangular opening 54 is provided of such dimensions as to fit over the rectangular portion of the rotor shaft. It will be noted that portions of the rotor are cut away, as at 55, in order to reduce the amount of solid insulating material between the metallic parts of the switch. This serves to reduce undesirable electrical capacity in the switch.

Rotor contact 26 is stamped from a single piece

of sheet metal so as to have a pair of rounded elongate contact surfaces 56 joined by a flat connecting portion 57 and having a pair of downwardly projecting side flanges 58 at the outer edges of the contact faces and a pair of leaf spring portions 59 joined to the two edges of the flat portion 57. Rotor contact 26 rests on the rotor table portion 51 with side flanges 58 received in the slot 52 and notch 53 respectively. The spring portions 59 extend downwardly at such an angle that their rounded ends rest on the two ends of table portion 51 to provide a resilient support for the contact. When the switch is assembled, the rotor contacts are held between the rotor and stator members, the spring pressure produced by spring portions 59 pressing contact faces 56 against the stator contacts 24 and 25 in such manner that one of the rounded contact faces 56 rests on the contacting surface of one of the stator contacts 24 and the other rounded contacting surface 56 rests on the contacting surface of common stator contact 25. Thus the rotor contact acts as a connecting bridge between one of the individual stator contacts and a common stator contact when the rotor contact is moved to a predetermined position. Flanges 58 serve to hold the rotor contact in position on the rotor but, due to their plunger-like action, allow variable depression of the contact under control of spring portions 59 and the contact surfaces.

Shaft 22, preferably of metal, is provided with a body portion 60 of circular cross section and a reduced bearing portion 61 of smaller circular cross section whereby a shoulder is provided which rests against shoulder 34 of case 20. Body portion 60 may be connected in any well-known and standard manner to a control means for governing its rotation. For example, a suitable control knob or handle adapted for manual operation can be secured to the shaft by a set screw. The rotor end of shaft 22 is provided with a flat portion 62 of rectangular cross section for mounting the rotor 23, indexing member 27 and other rotor parts. In cases where it is required to mount an A. C. switch on the back of the present switch an additional short extension 65 may be provided on the end of the shaft (see Figure 2) to extend through hole 38 in the stator and support an actuating arm for the A. C. switch. In other cases portion 63 and hole 38 may be dispensed with.

Indexing member 27 is a resilient sheet metal part having a central circular portion 64 provided with a rectangular hole 65 for receiving the rotor shaft and a pair of indexing arms 66 connected to the central portion and having their ends disposed in circular arcs on the two opposite sides of the central portion so that the indexing member has the general shape of the letter S. A hemispherical indexing projection 67 is stamped downward at the outer end of each indexing arm. A stop arm 28 also extends from the edge of middle portion 64 of the indexing member and is bent downward at right angles so that it may engage the stop projections 30 on the metal case. As shown in Figure 7 a second arm 28a is also provided opposite arm 28 and may be used in place of arm 28 for certain switch arrangements by bending in the same manner. On some switches stop arm 28 and projection 30 can be eliminated to allow for continuous rotation.

An insulating bushing 68 is fitted inside case 20 with a reduced portion thereof extending into the bearing portion 33 of the case. This bushing provides an additional bearing for shaft 22 and

serves to prevent lateral motion therein. Bushing 68 may suitably be made of a molded synthetic resin or a ceramic material.

In assembling the switch, shaft 22 is inserted in the bearing portion of case 20, and bushing 68 is slipped over the end of the shaft and fitted into position against the end of case 20. Indexing member 27 is then fitted over the end of the shaft so that its central portion rests against the shoulder between circular part 61 and rectangular part 62 of the shaft. A pair of metal washers 69 are then slipped on to the shaft after which the rotor 23 is placed thereon and a third metal washer 70 is finally placed over the top of the rotor. The end of shaft 22 (or the end of rectangular portion 62 where additional projection 63 is provided) is then peened over or spread so as to firmly unite the rotor parts and hold them securely on rectangular portion 62 of the shaft. Before assembly, spring arms 66 of indexing member 27 are biased so as to press against the bottom of case 20 when the indexing member is placed in position in the switch. It will be apparent from Figure 2 that there is a slight amount of longitudinal play permitting in shaft 22, this being limited by the shoulder 34 and the upper face of the bushing 68. Normally, however, due to the spring pressure of arms 66, the shoulder on shaft 22 is held pressed against the shoulder 34 of the case. Stop projections 30 are formed in the bottom of case 20 to limit the rotation of the rotor to the desired number of switch positions. Thus, stop projections 30 will be spaced to allow rotation through two switch positions for a two position switch, three switch positions for a three position switch, etc.

Figures 15 and 16 indicate how an A. C. snap switch 71 can be mounted on the face of the present switch and actuated by the same control shaft. Switch 71 comprises a molded Bakelite casing having a recessed portion 72 in which are mounted a pair of opposed fixed contacts, connected to terminals 82, and the working faces of which are separated by slide shoe 74 of sheet insulating material carrying the bridging contact button 75 co-operating with the fixed contacts. One of the fixed contacts 73 is shown, the other fixed contact being directly beneath it on the other side of shoe 74. Shoe 74 is controlled by cam member 76 pivoted to the switch case and connected to shoe 74 by an arm 77 and a spring 78. In this arrangement an actuating arm 79 is riveted to the end of shaft 22, by means of projection 63, so as to be turned with the shaft. Arm 79 has a cam portion 80 which controls the A. C. switch 71 by rotating actuating member 76 as the switch shaft is turned from one rotor position to another, resulting in a snap operation of the A. C. switch. A sheet of insulating material 81 may be provided between stator 21 and switch 71 to insure insulation of the two switches from each other. Lugs 31 are bent over the rim of switch 71 to hold it securely against the stator 21. Instead of arm 79 a circular disc of iron or other metal, provided with an actuating lug, 65 can be used in which case the disc may serve as a magnetic and electric shield between the two switches.

It will be noted that the present invention provides a novel switch for short wave, tone control and tap switch applications wherein the switch may be of very small size and still have the advantages of a much larger switch. The present invention allows for great circuit flexibility by rearranging the contacts to form the combination

desired. Thus it is possible to provide, with the switch illustrated, connection between twelve individual circuits and one common circuit. Other combinations include two groups of six circuits each with selective connections to two common circuits. This can be found subdivided, as indicated in Figures 13 and 14, to form further circuit variations. In Figure 14, for example, six pairs of individual circuits can be connected to six common circuits.

The present switch has been found by test to yield a much longer life with quiet performance than any other switch of comparable dimensions. The electrostatic capacity between the contacts and the grounded shaft and metal casing, for a switch of this design and of very small size, has been found to be as small as that ordinarily present in much larger and more expensive switches. Losses caused in a typical radio circuit using this switch are of the same order or less than those found with larger switches.

By suitably positioning the rotor and stator contacts the switch can be arranged to short circuit the connecting circuits, such as short wave coils, when they are cut out of service or they can be left on open circuit if desired.

The contact surfaces are all preferably silver plated and with this design have been found to be practically free from the development of circuit noise after long operation.

Circuit losses are extremely small and the metal case provides an adequate shield so that the switch may be closely spaced to other circuit components without danger of undue interference.

It will be obvious, of course, that this switch may be made in various sizes and with various numbers of contacts, a twelve-contact switch being described herein for purpose of illustration.

While the present invention, as to its objects and advantages, has been described herein as carried out in specific embodiments thereof, it is not desired to be limited thereby but it is intended to cover the invention broadly within the spirit and scope of the appended claims.

What is claimed is:

1. An electric switch contact comprising an integral sheet metal member comprising a flat,

generally rectangular portion, a pair of spring arms extending out from two opposite edges thereof, a pair of contact face portions joined to the other two edges of said rectangular portion and a pair of parallel plunger arms extending rearwardly from said respective contact face portions.

2. An electric switch contact comprising an integral sheet metal member comprising a flat, generally rectangular portion, a pair of leaf spring arms extending outwardly and rearwardly from two opposite edges thereof so as to form obtuse dihedral angles therewith, a pair of convex contact face portions joined to the other two edges of said rectangular portion and a pair of parallel plunger arms extending rearwardly from the outer edges of said respective contact face portions, said plunger arms thereby extending substantially perpendicularly to the plane of said rectangular portion.

3. An electric switch contact formed of a single sheet metal stamping, said stamping comprising a generally rectangular flat area, a pair of integral spring arms extending diagonally back from two opposite edges thereof, a pair of raised contact bosses integral with the other two opposite edges thereof, and a pair of plunger arms extending rearwardly from the outer edges of said bosses in a direction perpendicular to the plane of said rectangular flat area.

4. An electric switch sub-assembly comprising a base of sheet insulating material having a pair of spaced guideways cut therethrough and a contact formed of a single sheet-metal stamping supported by said base, said contact comprising a generally rectangular flat area, a pair of integral spring arms extending diagonally back from two opposite edges thereof, the ends of said arms resting on the face of said base, a pair of raised contact bosses integral with the other two opposed edges of said rectangular flat area, and a pair of plunger arms extending rearwardly from the outer edges of said bosses in a direction perpendicular to the plane of said rectangular flat area and respectively slidably positioned in said guideways.

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