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3,370,259

MULTIPLE CONTACT ROTARY SWITCH

Original Filed Oct. 3, 1958

3 Sheets-Sheet 1

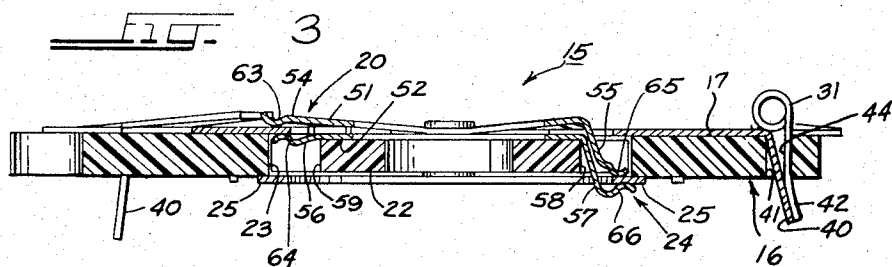
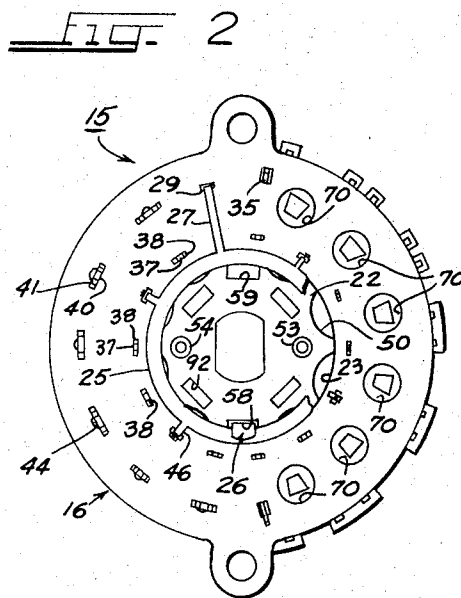
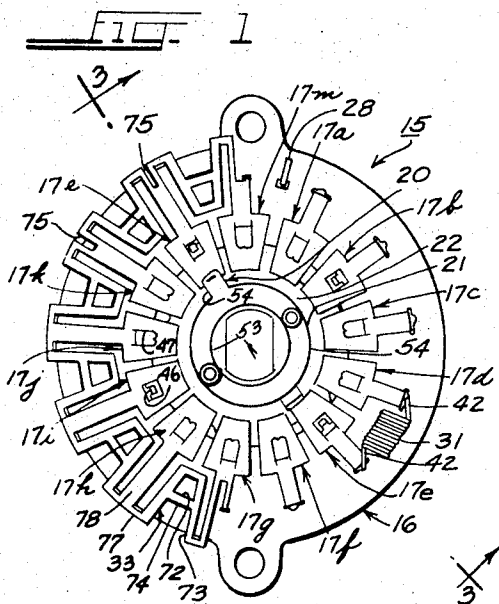
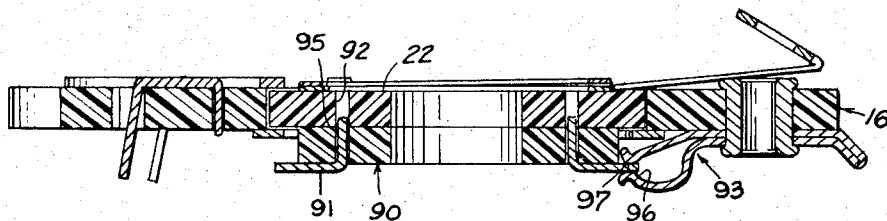


FIG. 5



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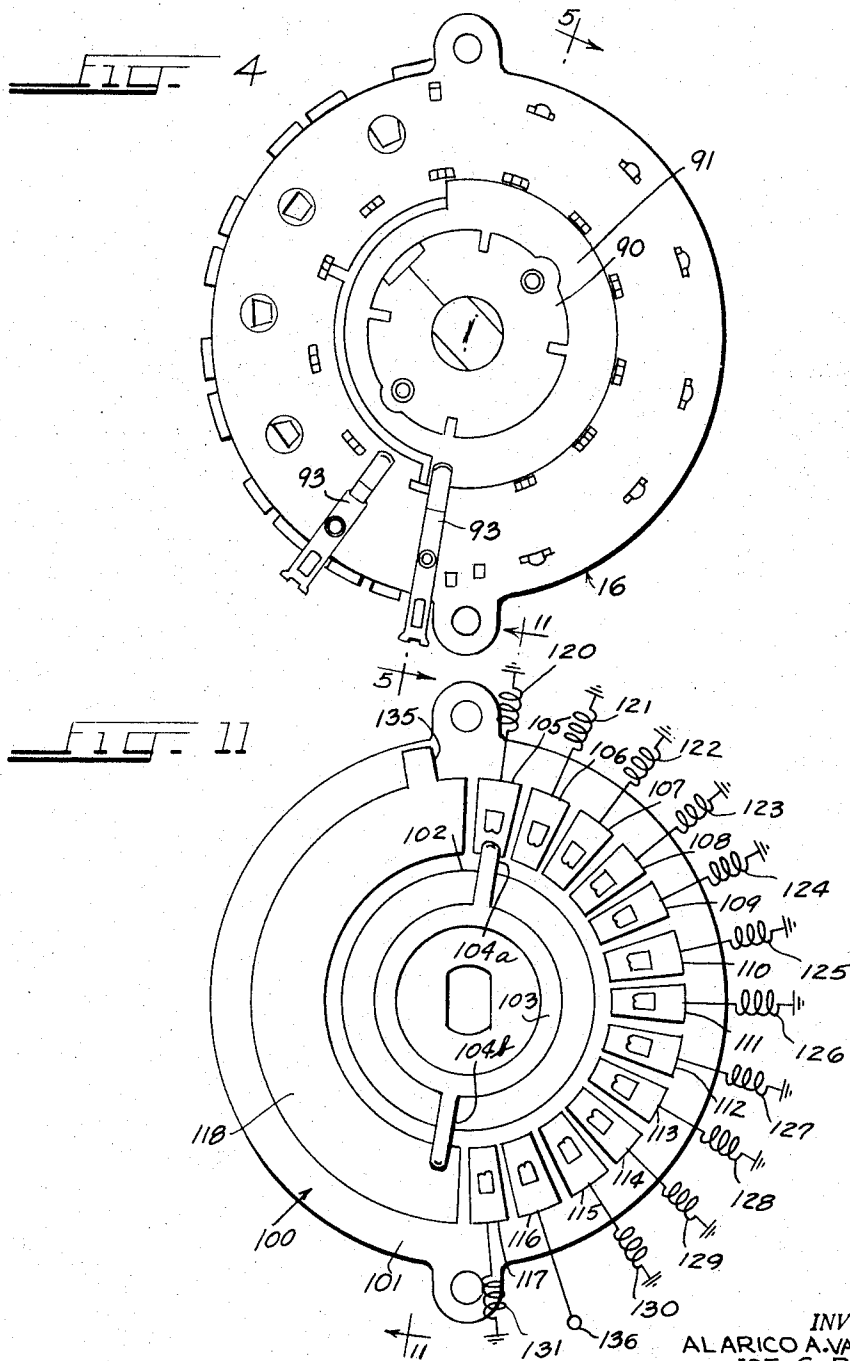
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FIG. 6

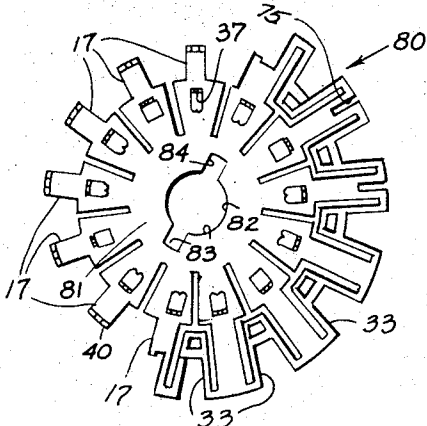


FIG. 7

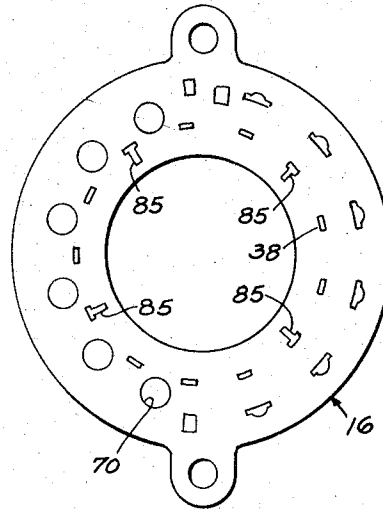


FIG. 8

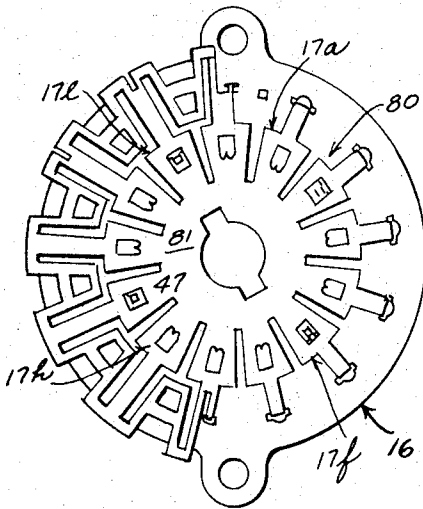


FIG. 9

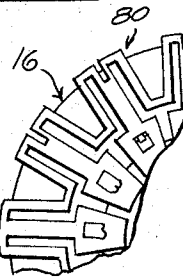
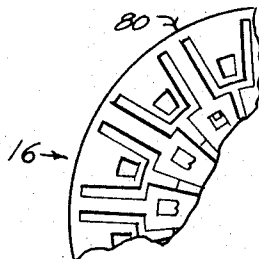


FIG. 10



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3,370,259

MULTIPLE CONTACT ROTARY SWITCH

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Continuation of application Ser. No. 765,138, Oct. 3, 1958. This application Jan. 10, 1964, Ser. No. 337,038
5 Claims. (Cl. 336-20)

This application is a continuation of our prior application Ser. No. 765,138, now abandoned, filed Oct. 3, 1958, assigned to the same assignee as the present invention.

The present invention relates to electrical switches and it more particularly relates to multiple contact rotary switches in which a common rotary contact member selectively engages each of a plurality of circumferentially disposed contact segments.

Multiple contact rotary switches are commonly used in television tuners for selectively switching each of a plurality of incremental inductances into the various stages thereof. Because of the current emphasis which is being placed on the portability of radio and television receivers, it is important that the rotary switches used in television or other high frequency tuners be small and compact. However, such a requirement ordinarily increases the assembly cost of the switch, and therefore, it would be desirable to provide a rotary switch which is particularly suited for use in television tuners, which is small in size and reliable in operation, and which can be readily assembled by automatic or semiautomatic machinery to minimize the assembly time and cost thereof.

Therefore, an object of the present invention is to provide a new and improved rotary switch.

Another object of the present invention is to provide a new and improved multiple contact rotary switch which is suitable for use in television tuners.

A further object of the present invention is to provide a new and improved rotary switch which employs a minimum of parts requiring individual assembly.

Another object of the present invention is to provide a new and improved rotary switch which is so constructed as to insure reliable operation thereof with a minimum of maintenance.

Another object of the present invention is to provide a new and improved method of assembling a multiple contact rotary switch.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a front view of a multiple contact rotary switch embodying the present invention;

FIG. 2 is a rear view of the switch shown in FIG. 1;

FIG. 3 is a sectional view of the device of FIG. 1 taken along the line 3-3 thereof;

FIG. 4 is a rear view of an alternative embodiment of the switch shown in FIGS. 1 and 2;

FIG. 5 is a cross sectional view taken along the line 5-5 of FIG. 4;

FIG. 6 is a rear view of a contact stamping used in the switch shown in FIG. 1;

FIG. 7 is a stator wafer;

FIG. 8 is a front view showing the stamping of FIG. 5 assembled to the wafer of FIG. 6;

FIG. 9 is a fragmentary view of a contact stamping;

FIG. 10 is a fragmentary view of another contact stamping; and

FIG. 11 is a front view of another switch embodying certain features of the present invention.

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Referring now to the drawings and particularly to FIGS. 1-3 thereof, there is shown a multiple contact rotary switch 15 comprising a stator wafer 16 having a central aperture 23 in which a rotor 22 is rotatably mounted. The wafer 16 is formed of any suitable insulating material such as a phenolic resin, and a plurality of contact segments 17, respectively designated 17a, 17b, 17c, 17d, 17e, 17f, 17g, 17h, 17i, 17j, 17k, 17l, 17m, are secured to the front face thereof in equally spaced positions about the aperture 23. The rotor 22 is held in the aperture 23 by means of the inner portions of the contact segments 17 and a conductive ring 25 mounted on the back face of the wafer 16. The ring 25 is secured to the wafer 16 by a plurality of radially extending fingers 46 having off-turned ends which are staked in slots 38 disposed opposite the locations of the apertures 47 formed in the segments 17 when the tongues 37 are struck out. The contact segments 17 are radially disposed on the stator 16, and as best shown in FIG. 3, partially extend over the front face of the rotor 22. Similarly, the ring 25 partially extends over the rear face of the rotor 22.

The ring 25 provides the common terminal for the switch 15 and is selectively connected to the contact segments 17 by means of a rotor contact 21 which includes a first set of wiper contacts 20 and a second set of wiper contacts 24. The contacts 20 selectively engage the segments 17 and the contacts 24 continuously engage the ring 25 as the rotor 22 is rotated with respect to the stator 16 thereby to selectively connect a plurality of low channel inductance coils 31 and high channel inductance loops 33 into the tuner circuit incorporating the switch 15.

The contact segments 17 are staked in place on the stator wafer 16 by respective struck-out tongues 37 which extend through slotted aperture 38 in the wafer. The ends of tongues 37 are bifurcated and the bifurcations are bent over the rear face of the wafer 16 thereby to prevent spurious removal of the segments 17 from the wafer 16. Connection of the coils 31 to the segments 17b-17g is facilitated by off-turned tabs 40 which extend through slotted apertures 41 in the wafer 16. The apertures 41 each include an arcuate portion 44 through which the leads 42 on the inductances extend, and a good contact between the leads 42 and the tabs 40 is assured by the angular disposition of the tabs 40 over the hole portion 44 so that, as best shown in FIG. 3, as the leads 42 are inserted into the slots 41 they necessarily press against the tabs 40. More permanent connections between the coils 31 and the contact segments 17 are, of course, provided by thereafter soldering the leads 42 to the tabs 40, this being preferably effected in a dip-soldering process.

In order to insure a low ohmic connection between the ring 25 and the selected one of the contact segments 17, the rotor contact 21 comprises a pair of conductive spring plates 51 and 52 (FIG. 3) which each respectively comprises a pair of radially extending wiper contact elements 54, 55 and 56, 57. The contact elements 54, 56 respectively include arcuate end portions 63 and 64 which press against opposite sides of the segments 17, and the contact elements 55, 57 respectively include arcuate end portions 65 and 66 which press against opposite sides of the ring 25. As best shown in FIGS. 2 and 3, the rotor 22, which like the wafer 16 may be formed of any suitable insulating material such as a phenolic resin, is provided with a pair of clearance notches 58 and 59 for the wiper contacts 20 and 24. The double action of the wiper contacts 20 and 24 engaging opposite sides of the segments 17 and the ring 25 thus insures the reliable operation of the switch 15 even in a tuner having a misaligned shaft since cocking of the rotor 21 in the aperture 23 does not break the connections to either the segments 17 or the ring 25.

In order to reduce the capacitance value between the ring 25 and the segments 17 as well as to reduce the capacitance value between the segments 17, the rotor 21 is provided with a plurality of arcuate cutouts 50, best shown in FIG. 2. Since the major portion of the ring 25 extends over the rotor 21, and since the dielectric constant of the rotor material exceeds that of air, the removal of the rotor material from between the ring 25 and the segments 17 reduces this undesired capacitance.

The inductance increments 33 each comprise but a single loop and are best formed as integral parts of the contact segments 17g-17m between which they are connected. The inductance increments 33 on any one switch 15 are substantially identical and respectively include end portions 77 which connect the respective increment between radially extending arms 78 on the adjacent ones of the segments 17g-17m. The inductances 33 each further include a loop portion 73 and a cross arm shunting bar 74 coaxing with the intermediate portion of the loop 73 to define an aperture 72, and a plurality of slots 75 may be provided in the outer ends of the contact segments 17g-17m to increase the inductance values of the increments 33. Since the inductances 33 are planar and the arms 78 are planar and constitute a portion of the inductance between adjacent segments 17, a substantial range of inductance adjustment is provided by adjustably pivoting the loop 72 about the end portions 77, and a plurality of apertures 70 are provided in the wafer 16 directly beneath the loops 73 to enable adjustment of the high channel inductance increments from the rear side of the wafer 16.

Referring now to FIGS. 6, 7 and 8, the segments may be formed and assembled to the stator wafer 16 to provide the unit of FIG. 8, and thereafter, the center portion of the unit 80 may be punched out to disconnect the segments 17 from one another. Considered in greater detail, the stamping 80 includes the contact segments 17, and the inductance increments 33 and in addition comprises a center portion 81 which interconnects the inner ends of the segments 17 thereby to render the stamping 80 a unitary member. Alignment of the stamping 80 on an assembly jig for connection to the stator wafer 16, best shown in FIG. 7, may be facilitated by providing the center portion 81 with a central keying aperture 82 including a pair of diametrically opposed notches 83 and 84.

In manufacturing the switch 15, the stamping 80 is punched out of a metal sheet of suitable rigidity and conductivity, and the die which is employed for this purpose includes a plurality of first portions which punch out the apertures 72 and a plurality of second portions which punch out the remainder of the loop 73 to leave the cross arm 74. The second portions of the die are replaceable with portions of varying size to enable the stamping with a single die of a plurality of stampings 80 in which the inductance value of the increments 33 may be one of several substantially different values. Where a maximum value of inductance is required the second portions of the die are so large as to completely eliminate the cross arms 74 from the increments 33 and where the value of inductance required is a minimum the second portions are eliminated from the die so that the cross arms 74 extend from the apertures 72 to the periphery of the stamping 80. The former condition is illustrated in FIG. 9 and the latter condition is illustrated in FIG. 10.

Following the stamping operation, the stamping 80 and the stator wafer 16 are positioned on an assembly fixture and then placed in a press which simultaneously deforms the tongues 37 to stake the stamping 80 to the wafer 16 and bend the loops 73 into substantially the proper positions to provide the desired inductance values. Some slight further adjustment of the loops 72 may be made after the switch 15 has been assembled into a tuner. After the stamping 80 has thus been secured to the wafer 16, the center portion 81 of the stamping 80 is punched

out thereby leaving the contact segments 17 disconnected from one another. The rotor 21 is then positioned in the central aperture 23 in the stator wafer 16 so that the contact set 20 engages opposite sides of the segments 17. Thereafter, the ring 25 is put in place on the wafer 16 with the fingers 46 extending through portions 85 of the appropriate ones of the slots 33 and the contact set 24 engaging opposite sides of the ring 25. The finger portions 46 are then deformed in a press to stake the ring 25 in place. The individual inductance increments 31 may now be added in the manner heretofore described and soldered to the appropriate ones of the segments 17b-17g in a dip-soldering process.

Referring to FIGS. 4 and 5, television tuners ordinarily include an adjustably tuned circuit interconnected between the antenna and the RF amplifier, and in order to reduce any undesired interference between the high and low channel inductance increments which may be selectively connected into this circuit by the selector 15, there is provided in accordance with the present invention an additional set of contact segments 93. The segments 93 are mounted on the rear side of the wafer 16 and an auxiliary rotor 90 is mounted on the rear face of the rotor 22. A common contact ring 91 is mounted on the rear face of the auxiliary rotor 90 by means of a plurality of tabs 95 which are staked in suitable slots in the rotor 90. The ends of the tabs 95 are disposed in clearance slots 92 in the rotor 22. Inasmuch as the ends of the tabs 95 terminate a substantial distance from the upper or forward face of the rotor 92, they are insulated from the wiper ring 21. A plurality of the double-acting contacts 93 are secured to this stator wafer 16 by respective ones of a plurality of eyelets and include oppositely acting contact portions 96 and 97 which bear on opposite sides of the edge portion of the contact ring 91 which extends beyond the periphery of the rotor wafer 90.

Referring now to FIG. 11, there is shown the front view of a switch 100 which embodies the present invention and which has the advantage over the prior art switches of simplicity of construction since all operative portions of the switch are located on one side of an insulating support wafer 101. Since all operative parts of the switch 100 are on one side thereof, two such switches may be stacked back-to-back to minimize the space requirements of the two switches. The switch 100 is adapted for use in a tuner in which the channel selector shaft is movable into an odd number of discrete angular positions such, as in the case of a UHF-VHF tuner, which has thirteen positions, twelve VHF channel selecting positions and a thirteenth UHF selecting position. As shown, it comprises, in addition to the stator 101, a rotor 102 which is rotatably mounted in a central aperture in the stator 100 and which has disposed thereon a conductive wiper ring 103 having a pair of radially extending diametrically opposed contact members 104a and 104b which are adapted to selectively engage a plurality of contact segments 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116 and 117 and a common arcuately shaped contact sector 118, the contact segments 105-117 and the contact sector 118 all being mounted on the front face of the stator wafer 101. Inasmuch as the switch 101 is a thirteen position switch there are thirteen contact segments 105-117 which are disposed at equally spaced intervals throughout about 180 degrees of the stator. Accordingly, as the rotor 103 is rotated through the thirteen equal angular positions, and assuming that the rotor has begun to rotate from the position in which it is shown wherein the contact 104a is in engagement with the contact 105, during the first 180 degrees of rotation the odd numbered ones of the contact segments 105-117 will be engaged by the tab 104a while the tab 104b continuously contacts the common arcuate sector 118. Accordingly, the plurality of inductance coils 120, 122, 124, 126, 128, 130 and 131, which are respectively connected between the odd numbered ones of the contact segments 105-117 and ground

are selectively connected between ground and an output terminal 135 which is connected to the common sector 118. During the second 180 degrees of rotation of the rotor 102, the contact finger 104a continuously rides on the common sector 118 and the contact finger 104b selectively engages the even numbered ones of the contact elements 106-116. Accordingly, the inductance coils 121, 123, 125, 127 and 129 are selectively connected between ground and the output terminal 135 during the second 165 degrees of rotation. In the thirteenth position of the rotor 102, the contact segment 116 is connected by the rotor 103 to the terminal 136 and since this is the UHF position the segment 116 is ordinarily not used for connecting an inductance between ground and the terminal 136 but may be used for some other purpose which depends upon the particular circuitry in which the switch 100 is used.

In constructing the switch 100, a single contact stamping including the contact segments 105-117 and the common sector 118, as shown in FIG. 11, is punched out of a metallic sheet and after the individual radially extending contact segments have been staked to the wafer 100, the center portion is punched out. Since the switch 100 does not require the common contact ring 25 on the back side thereof any of the conventional structures for securing the rotor 102 to the stator wafer 101 may be utilized.

While the present invention has been described in connection with particular embodiments of the invention, it will be understood that various modifications may be made thereon which are within the true spirit and scope of the invention as defined in the appended claims.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A multiple contact rotary switch comprising an insulating stator wafer, an insulating rotor wafer journaled in an aperture in said stator wafer, a plurality of contact segments mounted on one face of said stator wafer around said aperture and partially overlying said rotor wafer, a plurality of flat inductive loops integral with and interconnecting certain adjacent ones of said segments, a conductive ring mounted on the other face of said stator wafer, said ring being concentric with the axis of rotation of said rotor in said stator and partially overlying said rotor wafer, first and second conductive wipers mounted on one face of said rotor, said wipers each including two contacts for respectively engaging said ring and said segments, one of said first wiper contacts engaging said ring on said one face and the other of said first wiper contacts engaging said segments on said other face, one of said second wiper contacts engaging said ring on said one face and the other of said second wiper contacts engaging said segments on said other face, and said rotor including a plurality of notched-out peripheral portions for reducing the capacitance between said ring and said segments.

2. In a rotary switch construction the combination of a stator, a rotor journaled in an aperture in said stator, a plurality of contact segments mounted on said stator and overlying a peripheral portion of one face of said rotor, a conductive member mounted on said stator and overlying a peripheral portion of the opposite face of said rotor, wiper means carried by said rotor for selectively establishing an electrical connection between said conductive member and different ones of said segments, and means defining a plurality of cut-outs in said peripheral portion of said rotor to reduce the capacitance between said conductive member and said segments.

3. In a multiple contact rotary switch of the type having a stator member of insulating material provided with a central opening therein and a rotor member of insulating material rotatably mounted in said central opening and carrying a conductive wiper, an integral, stamped, stator contact and inductance increment assembly in the form a flat metallic member supported by said stator

member and having a plurality of stator contact portions projecting generally radially, said stator contact portions having inner stator blade portions extending into said central opening in said stator member and arranged to be selectively engaged by said wiper as said rotor is rotated, said flat metallic member also having a plurality of inductance increment portions connected to the outer ends of said radially extending stator contact portions by means of flexible hinge portions, whereby said inductance increment portions may be individually adjusted by bending the same out of the plane of said flat metallic member to vary the value of inductance between the corresponding stator contact portions.

4. In a multiple contact rotary switch of the type having a stator member of insulating material provided with a central opening therein and a rotor member of insulating material rotatably mounted in said central opening and carrying a conductive wiper, an integral, stamped, stator contact and inductance increment assembly in the form of a flat metallic member supported by said stator member and having a plurality of stator contact portions projecting generally radially, said stator contact portions having inner stator blade portions extending into said central opening in said stator member and arranged to be selectively engaged by said wiper as said rotor is rotated, said flat metallic member also having a plurality of inductance increment portions, each of said inductance increment portions including a radially inwardly extending loop portion the ends of which are connected to the outer ends of said radially extending stator contact portions by means of flexible hinge portions, whereby said inductance increment portions may be individually adjusted by bending the same out of the plane of said flat, metallic member to vary the value of inductance between the corresponding stator contact portions.

5. In a multiple contact rotary switch of the type having a stator member of insulating material provided with a central opening therein and a rotor member of insulating material rotatably mounted in said central opening and carrying a conductive wiper, an integral stamped stator contact and inductance increment assembly in the form of a flat metallic member supported by said stator member and having a plurality of stator contact portions projecting generally radially, said stator contact portions having inner stator blade portions extending into said central opening in said stator member and arranged to be selectively engaged by said wiper as said rotor is rotated, said flat metallic member also having a plurality of inductance increment portions, each of said inductance increment portions including a loop portion which is connected to the outer ends of said radially extending stator contact portions and extends inwardly in spaced parallel relation to the adjacent edges of said stator contact portions, the connection of said loop portions to the outer ends of said stator contact portions being sufficiently flexible to permit bending said loop portions out of the plane of said flat, metallic member to vary the value of inductance between the corresponding stator contact portions.

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