July 22, 1969 S. R. MEADOWS ET AL 3,457,379

MULTIPLE CONTACT ROTARY SWITCH

Original Filed Oct. 3, 1958 3 Sheets-Sheet 1

FIG. 1

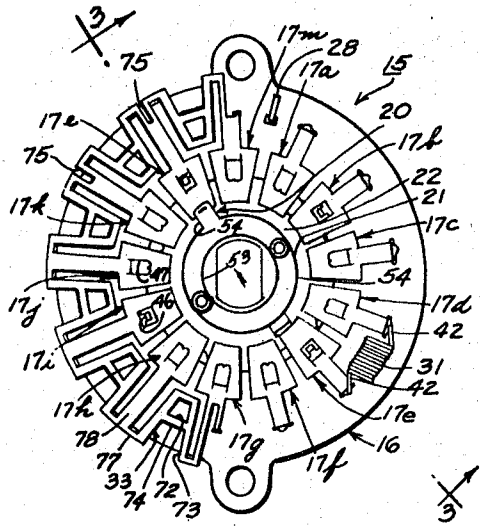


FIG. 2

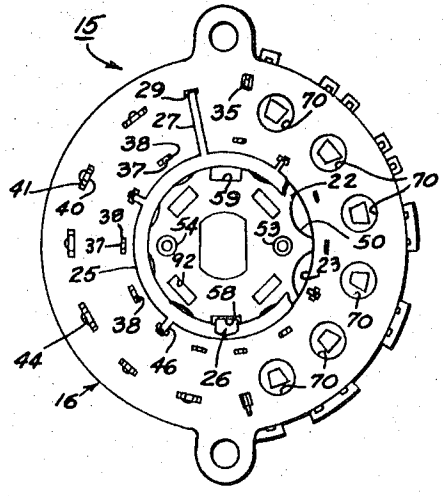


FIG. 3

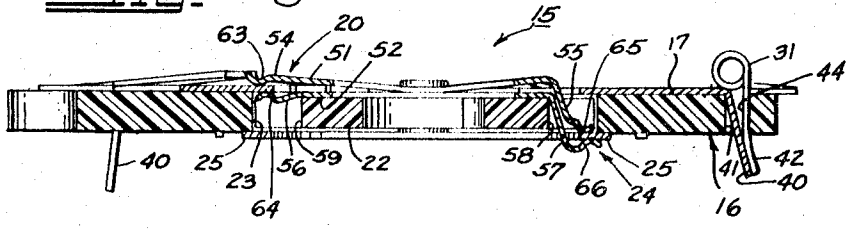
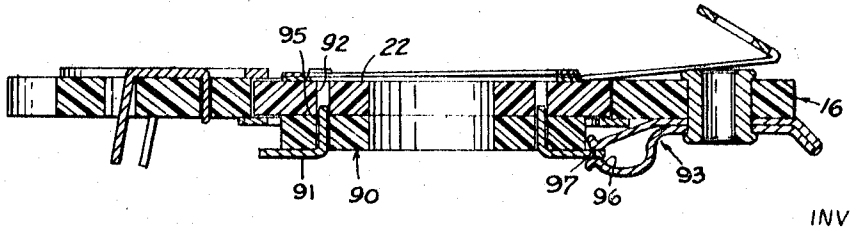


FIG. 5



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FIG. 4

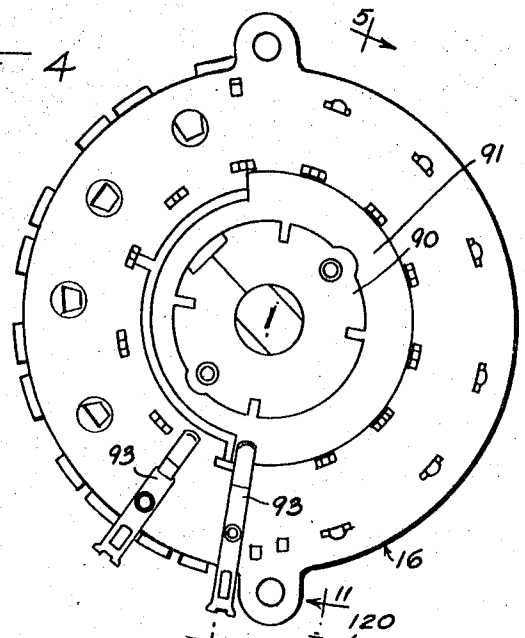


FIG. 11

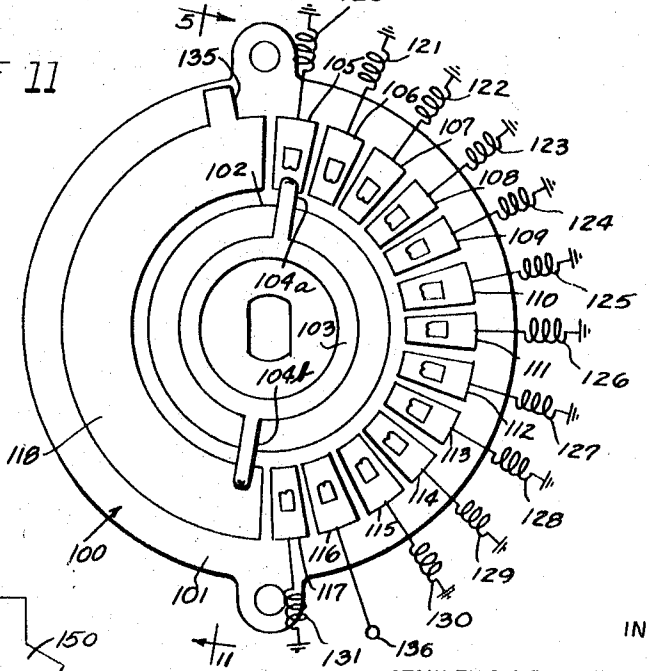
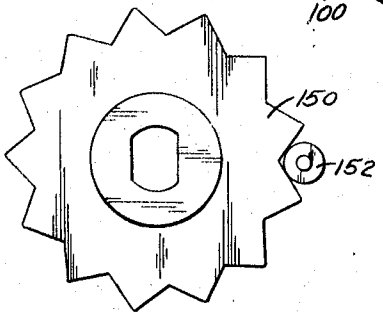


FIG. 12



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FIG. 6

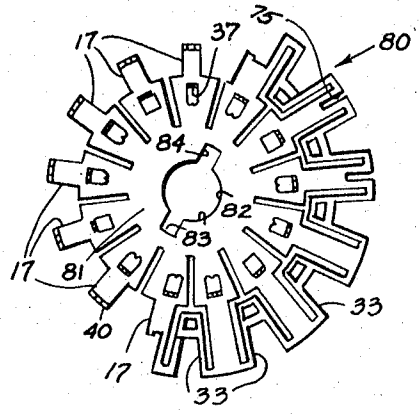


FIG. 7

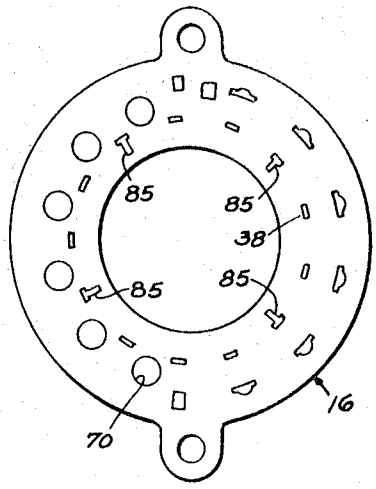


FIG. 8

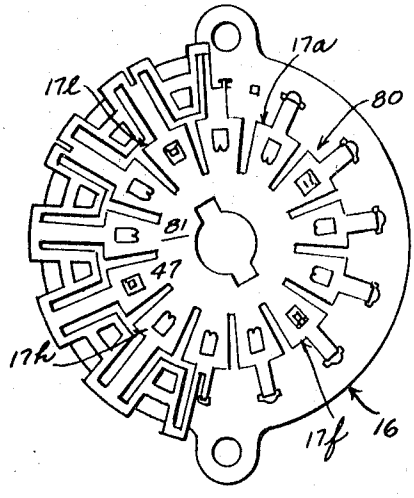


FIG. 9

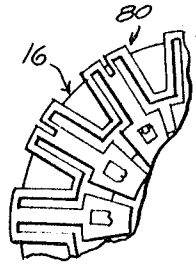
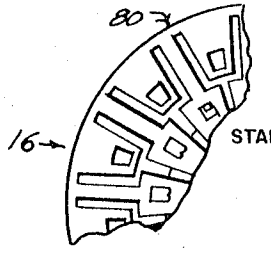


FIG. 10



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3,457,379

MULTIPLE CONTACT ROTARY SWITCH

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Application Jan. 10, 1964, Ser. No. 337,038, now Patent No. 3,370,259, dated Feb. 20, 1968, which is a continuation of application Ser. No. 765,138, Oct. 3, 1958. Divided and this application Feb. 6, 1968, Ser. No. 703,485

Int. Cl. H01h *19/58, 21/78*
U.S. Cl. 200—11 2 Claims

ABSTRACT OF THE DISCLOSURE

An electrical switching arrangement suitable for use in a combination UHF–VHF television tuner is provided wherein the twelve stator contacts for VHF channels are located within an arc of 180° of the switch wafer. The shaft which activates the switch rotor is provided with 13 detent positions which are spaced apart by increments which are twice as large as the VHF stator contacts.

This application is a division of application Ser. No. 337,038, now Patent No. 3,370,259, which is a continuation of application Ser. No. 765,138 filed Oct. 3, 1958, now abandoned, all three applications being assigned to the same assignee.

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 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;

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

FIG. 12 is a front view of an index wheel arrangement suitable for use in the embodiment of FIG. 11.

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 **17***a*, **17***b*, **17***c*, **17***d*, **17***e*, **17***f*, **17***g*, **17***h*, **17***i*, **17***j*, **17***k*, 17L, **17***m* 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 stacked in slots **38** disposed opposite the locations of the apertures **47** formed in the segments **17** when the tongues **37** and 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 **17***b*–**17***g* 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 17*g*–17*m* 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 17*g*–17*m*. The inductances 33 each further include a loop portion 73 and a cross arm shunting bar 74 coacting 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 17*g*–17*m* 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 abut 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 38 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 17*b*–17*g* 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 staged 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 104*a* and 104*b*

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. For example, the channel selector shaft may be detented by means of an index wheel **150** (FIG. 12) which is secured to the selector shaft and a spring biased roller **152** which engages the edge of the wheel **150** and holds the selector shaft in any one of the thirteen index positions of the rotor **102**. 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 **104***a* 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 **104***a* while the tab **104***b* 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 **104***a* continuously rides on the common sector **118** and the contact finger **104***b* 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 180 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 switch, comprising a stator wafer, a rotor rotatably mounted on the principal longitudinal axis of said wafer, an odd number of contacts mounted on said wafer in equal angular increments throughout a first angle of 180 degrees, an arcuate contact member mounted on said wafer throughout a second angle of 180 degrees, said angles being mutually exclusive, and said motor including first and second radially extending contact portions, said contact portions being positioned at 180 degree spaced apart locations, and means for detenting said rotor to stop at a plurality of fixed switching positions equal in number to said odd number of contacts but spaced apart by angular increments which are twice as large as the angular incremental spacing of said odd number of contacts, whereby said rotor selectively connects individual ones of said odd number of contacts to said arcurate contact member during a 360 degree rotation of said rotor.

2. A multiple contact rotary switch of the type provided with a rotor having an odd number of fixed switching positions substantially equally spaced through 360 degrees comprising a plurality of stator contact members equal in number to the number of switching positions, said stator contacts being disposed within a first sector of 180 degrees and being divided into first and second groups, individual members of each group being arranged alternately with respect to members of the other group within said first sector, a continuous stator contact extending through a second sector of 180 degrees, said first and second sectors being mutually exclusive, said rotor having a pair of diametrically opposed contact portions adapted selectively to connect individual members of said first group of stator contacts to said continuous stator contact during a first 180 degree rotation of said rotor and selectively to connect individual members of said second group to said continuous stator contact during the next 180 degree rotation of said rotor.

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U.S. Cl. X.R.

200—166