

April 24, 1962

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3,030,848

ELECTRIC ORGAN TRANSPOSING SWITCH

Filed May 27, 1960

4 Sheets-Sheet 1

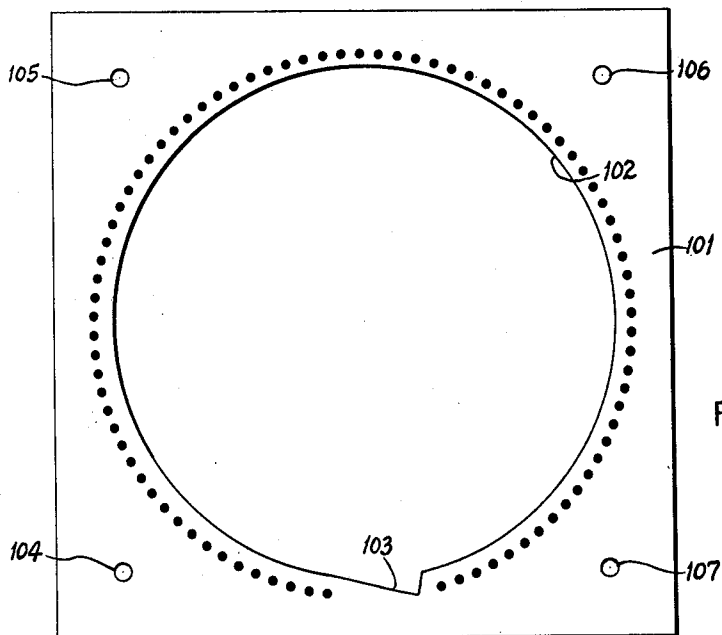


FIG. 1.

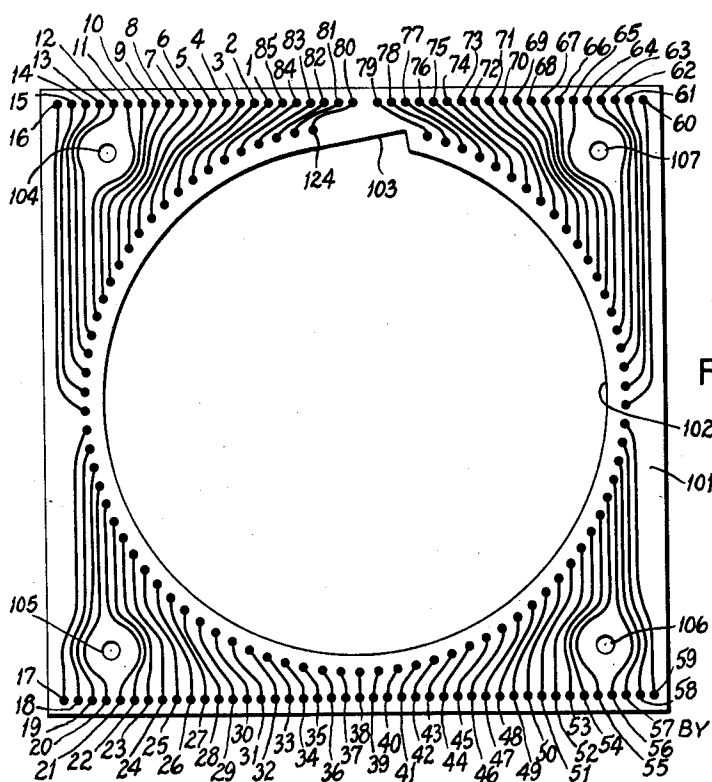


FIG. 2.

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4 Sheets-Sheet 2

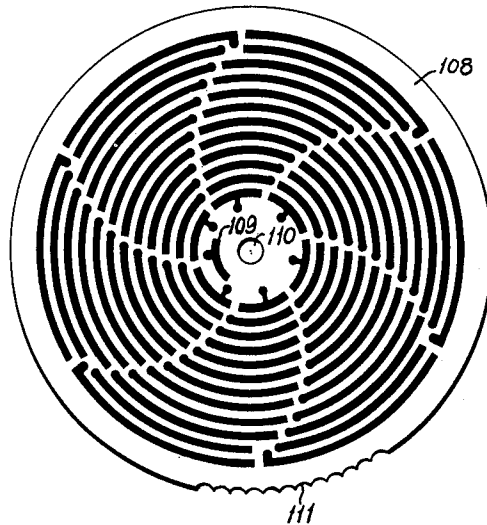


FIG. 3.

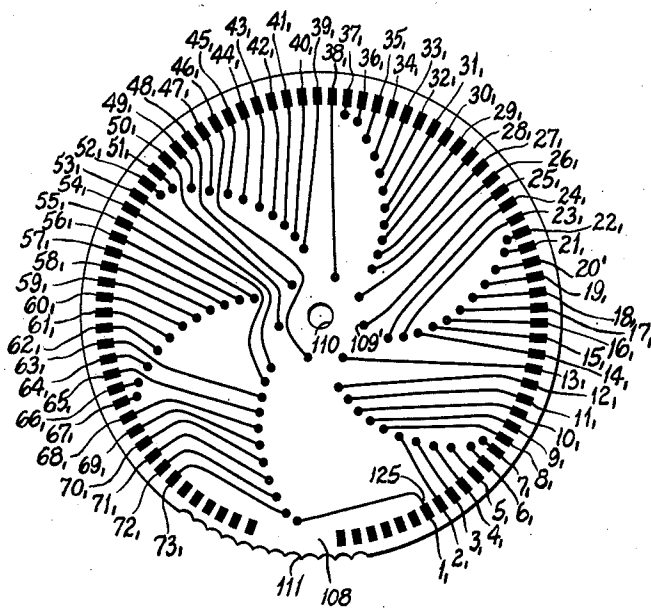


FIG. 4.

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4 Sheets-Sheet 3

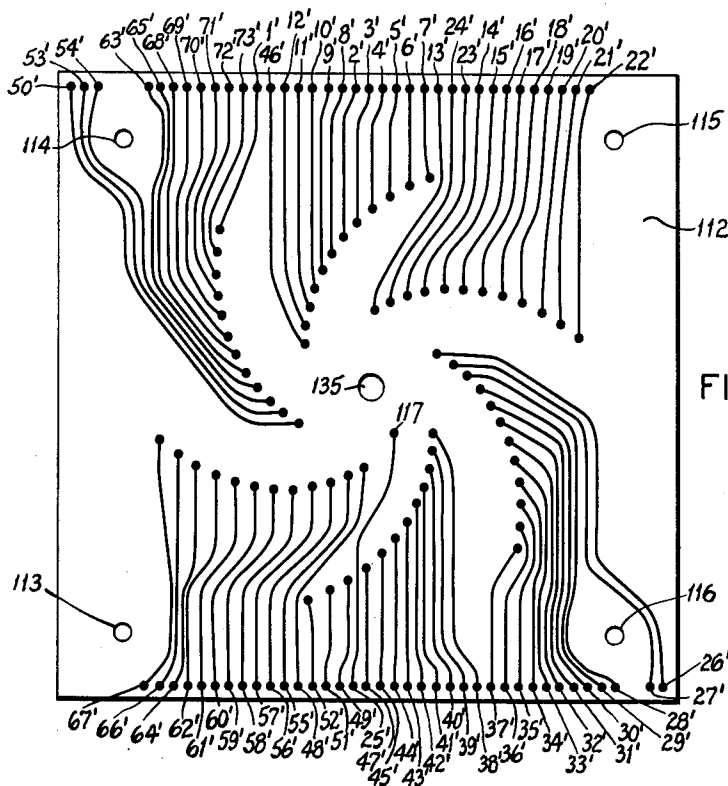


FIG. 5.

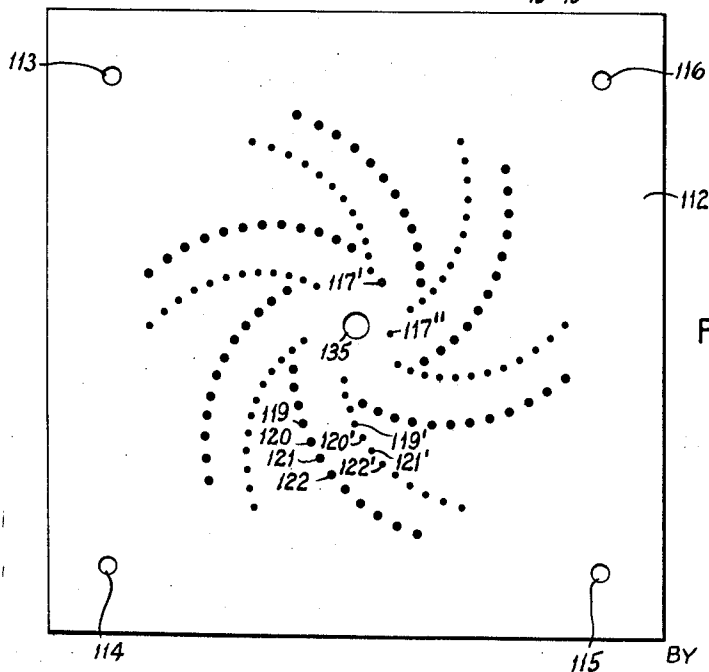


FIG. 6.

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4 Sheets-Sheet 4

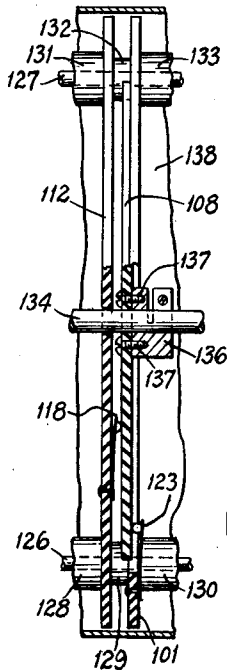


FIG. 7.

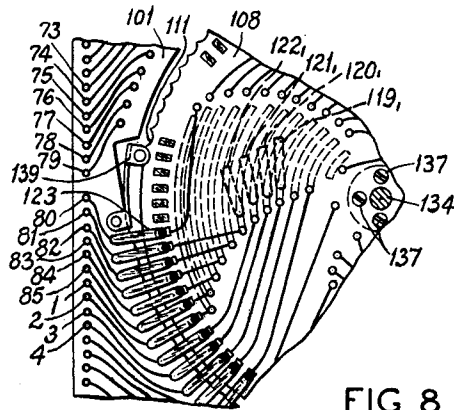


FIG. 8.

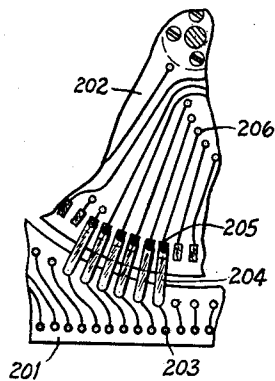


FIG. 9.

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3,030,848

ELECTRIC ORGAN TRANSPOSING SWITCH
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Filed May 27, 1960, Ser. No. 32,227
6 Claims. (Cl. 84-445)

This invention relates to a transposing switch which enables the person playing an electric or electronic organ to change the musical key in which that person is playing with a minimum amount of effort.

One object is to provide a means whereby the instrument may be made to produce music in any key regardless of the key in which the composition is written.

A second object of the invention is to provide an attachment for present electric and electronic organs which is designed to effectuate transposition and which shall be economical to construct, easy to install and simple to operate, while at the same time providing reliable operation over a long period of time without maintenance.

A further object of the invention is to enable the player to render music into any key or pitch desired without a change of fingering of the music as written. This occurs for instance when a singer wishes the accompaniment pitched higher or lower than the music is written, so as to suit the singer's voice better.

A still further object of the invention is to lessen the labor and length of time necessary to enable one to play compositions which are difficult of execution for players of lesser accomplishment due to the fact these compositions have been annotated in keys having many sharps or flats. The object can be accomplished with my invention by playing the compositions from copies annotated in an easier key, and causing the compositions to issue in the more difficult key desired by the simple use of my transposing switch.

There are twelve musical keys of varying degrees of difficulty in mental or digital transposition. With my transposing switch the player can have a composition issue in any key and still avoid the black digitals no matter how many tones up or down the scale he transposed the music. It will be noted that I use the term "digitals" to refer to the actual physical individual "keys" which make up the keyboard. The term digital is in this description employed so that the key or pitch of the music will not be confused with the "key" which the fingers of the player touch. The digitals are the individual parts of the manual keyboard as the pedals are the individual parts of the pedal keyboard.

It is therefore to be understood that any composition whatsoever, written in any key, may be played by means of my transposing switch with the fingering as written, and yet the music heard will be in any one of the twelve keys chosen by the switch.

Music is not usually written in G-flat or B-natural since these keys are too difficult for most players, and this is simply due to the difficulty introduced by the use of a large number of black digitals. There is no other reason why these keys or pitches should not be used as often as C major. With my transposing switch, the composition can be written in the key of C or of F and then the transposition of the music to another key can be accomplished by means of the switch. The piece can thus be played in the key of C or of F, which are simple keys and the switch will transpose the relationships between the keyboard digitals and the musical circuits, whether they be on an electric or an electronic organ, so that the music will issue in whatever pitch has been chosen on the switch. This switch enables the player with less practice in transposing to perform easily in any key and it further enables the accomplished player to obtain many pleasing effects by varying the key of the composition he is play-

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ing continuously during the performance of the composition at will.

An additional object of my invention is to provide a transposing switch connected by wires between the key-boards, both manual and pedal, and the music-generating circuits, with the additional requirement that the wires making the connections shall not be subjected to any movement by the switching action. Any rotational or translational movement of connecting wires would cause flexing of the wires and result inevitably in the breaking of the connections. All switching is accomplished through spring contacts.

With the foregoing and other objects in view, as will appear as the description proceeds, the invention consists in the novel construction, combination and arrangement of cooperating elements as hereinafter more specifically set forth, pointed out in the claims and shown in the accompanying drawings forming a part of the present application, in which:

FIGURE 1 is a plan view of one side of a printed circuit board which is the stator of my transposing switch;

FIGURE 2 is a plan view of the reverse side of the printed circuit board of FIGURE 1;

FIGURE 3 is a plan view of a printed circuit board which is the rotor of my transposing switch;

FIGURE 4 is a plan view of the reverse side of the printed circuit board of FIGURE 3;

FIGURE 5 is a plan view of a printed circuit board which is the manual connection circuit board of the transposing switch;

FIGURE 6 is a plan view of the reverse side of the circuit board of FIGURE 5;

FIGURE 7 is a side view, partly in cross-section of the assembly of the circuit boards of FIGURES 1, 2, 3, 4, 5, and 6, together with a fragment of the case and mounting elements for the assembly;

FIGURE 8 is a fragmentary view of the assembly of the rotor and stator, with some of the spring contacts of the manual connection circuit board shown in dotted line position, to illustrate the assembly of the transposition switch; and

FIGURE 9 is a fragmentary view of an alternative assembly of the circuit boards of FIGURES 2 and 4 which also will serve as a transposing switch.

Referring in more detail to the drawings, in which similar reference characters designate corresponding parts throughout the several views, I shall now describe an embodiment of my transposing switch which is designed for a conventional organ having a manual keyboard with 73 "keys" which I shall refer to as digitals. This embodiment of my switch design will simultaneously switch the entire 73 digitals to any of twelve new positions. For the purposes of this specification I shall illustrate the arrangement whereby the entire keyboard can be transposed downward 12 tones. It will of course be understood that by alternative modes of connection, the transposition could be made to operate upward twelve tones, or by another alternative: down six and up six. Similarly the switch can be made to transpose a total of only 10 or 8 tones or keys, or it can be made to transpose through a range of 14 or 16 keys, in which case there will be repetition of certain keys separated by an octave.

In general a given keyboard, manual or pedal, consists of N number of "keys." In the case chosen for the example, N equals 73. In general the number of keys switched by a transposing switch will be S, the number of switch positions. In the example chosen S will be equal to 12, the number of possible pitches.

Since there are 73 digitals and 12 additional positions required I provide the circuit board 101 of FIGURE 1, that is the stator, with N plus S contacts. These con-

tacts are separated from each other by the switching angle C, that is the angle between the centers of the contacts. These 85 contacts are arranged around the periphery of a central opening 102, which is originally formed from a circular holes. The opening 102 is not entirely circular; it departs from this regular condition by the enlargement of the opening at 103.

Near each corner of the circuit board or stator 101 is a hole, numbered 104, 105, 106, and 107. The group of four holes are used for mounting purposes and are therefore called mounting holes.

In FIGURE 2 the reverse side of the stator 101 is shown formed of a printed circuit. The board itself is of insulating material and the 85 contacts which exist on the other side of the board also exist on the side shown in FIGURE 2. They actually connect from back to front by the well-known techniques of eyelets or by plating through. In FIGURE 2 it will be seen that the 85 electrical contacts around the periphery of the opening 102 are connected through printed conductors to 85 terminals, 42 of which are disposed along the top edge of the circuit board 101, and 43 of which are disposed along the bottom edge of the circuit board 101 in FIGURE 2. The numbers given to the terminals will be referred to in their connection order.

FIGURE 3 shows the printed circuit board in the form of a circle, which comprises the rotor 108. There are shown 73, the number N, conductors in the shape or form of arcs on the surface of the rotor 108 in FIGURE 3. These 73 arcuate conductors correspond to the 73 digitals of the keyboard of the organ. The 73 arcuate conductors are divided into 6 groups of twelve and there is one more, nearest the center of the rotor 108, which is denoted by 109. It will be noted, and this is most important to my construction, that each and every one of the 73 arcuate conductors shown in FIGURE 3, that is each of the twelve in each of the six groups, as well as the extra one denoted by numeral 109, each extends through the same number of degrees. The length in degrees of each is equal to S, the number of switch positions, times C, the switching angle in degrees. This point must be kept in mind through all that follows.

Rotor 108 is provided with a central hole 110 shown in both FIGURES 3 and 4, which is a shaft mounting hole. In FIGURE 4, the reverse side of the rotor, it will be seen that there are here also six groups of twelve conductors disposed on the surface of the rotor and an additional one marked 109'. These six groups of twelve plus the one marked 109' total 73 or N in number. Each of them is connected by a printed conductor on the surface of the rotor in FIGURE 4 to a terminal. The numbers on those terminals are all denoted by subscripted numerals. The subscripted numerals are used in understanding the connection order which will be discussed later.

There are in all 85, N plus S, terminals arranged around the periphery of the rotor in FIGURE 4. They are arranged in the same configuration as the contacts of FIGURE 2, that is they are separated by the same switching angle C. At the bottom portion of FIGURE 4 it will be seen that there are 12, that is S, which are not connected by printed conductors. These twelve lie at the bottom of FIGURE 4 next to twelve indentations cut into the edge of the rotor at 111. These twelve indentations are segments of a circle of small radius and are used for indexing the rotor in its rotative position with respect to the stator. The twelve extra terminals are dummy terminals which will aid in understanding the switching action. They can be dispensed with in an actual construction.

For a full understanding of the function of rotor 108 closer examination of conductor 109' of FIGURE 4 and 109 of FIGURE 3 is required. It will be seen that 109 has near one of its ends a small circle, on one side of its arcuate form. 109' is also a small circle. These two

small circular conductors are electrically connected so that one conducts to the other through the body of the rotor 108. This is accomplished as before by the well-known eyelet techniques or by plating through techniques common in the art of constructing printed circuit boards. Further examination will show that every one of the other 72 arcuate conductors is electrically connected through the insulating body of 108 by a conductor penetrating the insulating body to one of the 72 small circles shown in FIGURE 4, which in turn is electrically connected to one of the 73 or N of the 85 or S terminals disposed around the periphery of rotor 108.

FIGURE 5 shows an arrangement of conductors, N in number, and terminals, N in number connected by printed conductors on one surface of the printed circuit board which I call my connection circuit board 112. This board is provided with mounting holes 113, 114, 115 and 116, corresponding to the mounting holes 104, 105, 106, and 107 of the stator shown in FIGURE 1.

The circuit board 112 is shown in FIGURE 5 to be provided with 73 or N connection terminals in the form of small circles denoted by numbers with primes. These primed numbers will be used in understanding the connection order of these terminals later. These terminals are disposed, 36 along the top edge of board 112 in FIGURE 5 and 37 along the bottom edge of the board. These 73 connection terminals are connected by printed electrical conductors to 73, that is N, other small circles arranged in six groups of twelve with one additional on the surface of board 112 as shown in FIGURE 5. The numeral 117 is given in FIGURE 5 to the additional small circle conductor, that is to the one which is not arranged in one of the six groups of twelve.

In FIGURE 6 it will be seen that there are 146 circular conductors. 73 or N of these are larger; they are the same size as the 73 disposed in six groups of twelve with one additional shown in FIGURE 5. The ones which are the larger size in FIGURE 6 are electrically connected to their counterparts in FIGURE 5. Thus 117 of FIGURE 5 is connected electrically to 117' of FIGURE 6, through the body of connection circuit board 112. This again is accomplished either by eyelet technique or by plating-through technique, through the insulating body of board 112.

There are however 73, that is N, smaller circles on the surface of connection circuit board 112 shown in FIGURE 6. Each one of these 73 smaller circles corresponds to one of the regular circles, that is the larger ones, shown and described before on FIGURE 6. Thus for conductor 117' of FIGURE 6 there is a smaller circle which is numbered 117''. The smaller circle is intended merely as an indicator of angle for mounting a spring contact on 117'.

Such a spring contact is shown at 118 in FIGURE 7 on board 112. The base or fixed end of 118 is soldered in position on board 112 while the other end floats free in space. For example when soldering in position the spring contact, the one end is centered on 117' of FIGURE 6 and the other centered on 117''. The end on 117' is soldered into final position and the other end released. Similarly each of the 72 remaining larger circles has a corresponding contact-angle-determining smaller circle associated with it as shown in FIGURE 6.

As the remaining 72 are divided into six regular groups of twelve, I shall illustrate the positioning of the entire remaining 72 spring contacts by pointing out four near the center of one group. These are 119, 120, 121, and 122. Four spring contacts are soldered at their bases on the four larger circles after positioning the centers of their opposite or free ends respectively on 119', 120', 121', and 122', the smaller circles. Then the ends which lay against the smaller circles are allowed to spring into the released positions. The remaining ones in that group of twelve lie on opposite sides of the four illustrated and are similarly handled in soldered arrangement. The other

groups of twelve each are handled in exactly the same relative arrangements.

After all 73 spring contacts have been soldered on the side of the circuit board 112 shown in FIGURE 6, the next step is to solder in position the spring contacts on circuit board 101. Circuit board 101, the stator, is shown in fragmentary form in FIGURE 8 and in FIGURE 7. Numeral 123 is given to the spring contact which is attached at its base to circuit board 101 in FIGURE 7.

Spring contact 123 is shown in plan view in FIGURE 8. To solder it and its neighbors, I prefer to fix rotor 108 centered in the opening 102 of the stator 101, that is the circuit board 101. When they are mounted center upon center in the position of FIGURE 8, it is a simple matter to determine the angle of mounting of the spring contacts. The base of the spring contact 123 is laid on the small circle of 124, which is obscured but which is shown clearly in FIGURE 2. The opposite or free end is held centered on the nearest terminal, 125, of rotor 108 of FIGURE 4. The base end is soldered to the small circle 124 of FIGURE 2.

In the same manner 85, of N plus S, contact springs are soldered at their bases on the small circle contacts around the periphery of the central opening 102 of the stator 101, in FIGURE 8. This will leave twelve terminals of rotor 108 empty, the twelve with no connecting conductors in FIGURE 4. Of the twelve, eight are shown empty above the contact spring 123 in FIGURE 8; six of these are immediately adjacent to the contact spring 123.

To assemble the switch for one manual keyboard, consisting of 73 or N digitals, I place the stator 101, the rotor 108, and the circuit board 112 in the relationship shown in FIGURE 7. At the rightmost side of FIGURE 7 is placed the stator 101, with the side shown in FIGURE 2 oriented toward the right and the side shown in FIGURE 1 oriented toward the left of FIGURE 7. Thus the contact spring 123 of FIGURE 8 is on the right side of FIGURE 7.

Mounted in the opening 102 of the stator 101 is the rotor 108. The side of the rotor 108 shown in FIGURE 4 is oriented toward the right side of FIGURE 7, and against this side the spring contact 123 lies in sliding contact. The side illustrated in FIGURE 3 of the rotor 108 is oriented to the left of FIGURE 7.

Pressing in sliding contact against the FIGURE 3 side of rotor 108 in FIGURE 7 is the spring contact 118. Spring contact 118 is similar to the many contacts, such as those mounted at 119, 120, 121, and 122 on the side of the connection circuit board 112 shown in FIGURE 6. These four spring contacts are shown in dotted lines in FIGURE 8, as they are there shown to lie on the back side of the rotor 108.

To hold the stator 101 and the connection circuit board 112 in rigid relationship, mounting pins 126, 127 are employed. They are disposed through any adjacent pair of the mounting holes 104, 105, 106, 107 and 113, 114, 115, 116 of the two printed circuit boards shown in FIGURES 1 and 5. The boards themselves are held in fixed spatial relationship by the spacer elements 128, 129, 130, 131, 132, and 133.

The rotor 108 is maintained in rotative position by being mounted on a shaft 134, which is disposed through the hole 110 in rotor 108, and through the central hole 135 of board 112, shown in FIGURES 5 and 6. The shaft 134 is secured to the rotor 108 by the mounting bearing 136 which is fitted to the shaft and the screws 137 which pass through the rotor 108 and into the bearing 136. The entire assembly is disposed in the case 138 which may be of any box-like construction. At opposite ends of the case 138 can be placed two bearings which are not shown, but which have as their function carrying the shaft in rotative relationship. I prefer to have the case 138 sealed tightly and only have the shaft 134 as well as the harnesses of the wire cables come out of the case.

A handle, not shown is mounted on the shaft 134 so that it may be turned by the player.

In order to provide indexing of the rotor with respect to the stator 101, I provide, as shown in FIGURE 8, a pawl or detent 139 which is mounted on the board 101 in the opening 103 of FIGURES 1 and 2. This pawl rests against the indexing indentations 111 on the edge of rotor 108.

To connect the transposing switch, the following procedure is followed. The manual keyboard having 73, or N, digitals or "keys" of an organ has one wire for each digital which ordinarily connects that digital to the electric relay which controls the air circuit to the organ pipe corresponding to that digital in a pipe organ. In an electronic organ that wire leads to a circuit element which corresponds to that digital. Thus there are 73 or N wires from the 73 or N digitals. To connect the transposing switch to the organ the cable consisting of those 73 wires must be cut in half. First I will describe how to connect one-half of the wires resulting from the cutting. I will connect the halves of the wires which are connected to the music-generating circuits, air flow relays in a pipe organ, or electrical circuit elements in an electronic organ. For the sake of clarity I will refer only to the pipe organ.

I have given the numeral 1 to the wire connecting to the lowest note on the pipe organ, that is to the lowest pipe, and the numeral 2 to the next higher pipe wire, and so on up to the numeral 73 which is the wire corresponding to the highest pipe.

This wire 1 I solder on the terminal in position 1 in FIGURE 2. Wire is soldered in position 2 in FIGURE 2, and so on up to the wire numbered 73 which is soldered in position 73. It will be noted that there are twelve or S extra numerals, which are 74 through 85. In order that there will be full continuity in playing and so that transposition of the entire manual keyboard will not result in some blank notes at the ends of the keyboard, I connect position 1 of FIGURE 2 by an extra wire to position 74, similarly with an extra wire I connect 2 to 75, 3 to 76 and so on until 13 is connected to position 85. This procedure completes connecting the music-generating section of the organ to the transposing switch.

Now I must connect the organ manual keyboard wires, which are the other halves of the wire cable which was cut. Starting again with the other half of wire 1, this time taking the half connected to the digital on the keyboard, I connect this in the position 1' in FIGURE 5. The remaining half of wire 2 is connected in position 2' in FIGURE 5 and so on until the 73 or N wires from the digitals are connected to the 73 positions marked as 73 numerals with primes in FIGURE 5.

I have numbered with subscripts the positions on the rotor 108 in FIGURE 4 which correspond to the conductor connections 1, through 73. Thus when rotor 108 is assembled in the position of FIGURE 7, between the stator 101 and the circuit board 112, with all the spring contacts in place, the position of FIGURE 8 is obtained.

In the position of FIGURE 8 terminal 1 on the stator 101 connects through its associated contact spring on the stator to the terminal 1. of the rotor, 2 connects similarly to 2., 3 to 3., and so forth. Through the conductors on the rotor these connections proceed and go through the body of the rotor 108 to the back of the rotor where the long arcuate conductors are. In contact with these long arcuate conductors are the contact springs, such as those at 119, 120 etc. In FIGURE 8 these long arcuate conductors are shown in dotted lines since they are on the back of the rotor 108. Also I show a group of those four contact springs, which are shown in dotted lines also; they are numbered 119., 120., 121., and 122.. These contact springs are soldered in position on the connection circuit board 112. Through their connections through

the body of the connection circuit board 112, they connect to their corresponding terminals along the edges of the circuit board 112 shown in FIGURE 5.

Now referring to FIGURE 8, let us consider rotating the rotor 108 counterclockwise by one indexing position. The pawl 139 moves to the adjacent indexing indentation 111. At the same time all the terminals on the rotor 108 have been switched one position. The terminal which lay under the contact spring corresponding to 2 is now under the contact spring corresponding to 3. The one formerly under 3 is now under the contact corresponding to 4. However the action of the switch is such that the spring contacts 119, 120, that is all 73 of them, still lie in contact with the same long arcuate conductors that they did before.

This is the principle which is necessary to the understanding of the switch action: The contact springs which are represented by 118 in FIGURE 7 remain in contact always, each with its respective associated arcuate conductor on the FIGURE 3 side of the rotor 108. These spring contacts cannot contact any other conductor, throughout the twelve switching positions. The arcuate conductors each terminate by passing through the body of the rotor, in a terminal which lies under the spring contacts on the stator 101. These last-mentioned spring contacts are symbolized by 123 in FIGURE 7. Movement of the rotor relative to the stator exchanges the switch contacts by putting a different terminal on the edge of the rotor 108 under a different spring contact on the stator 101 and thus transposes the entire keyboard with respect to the music-generating circuits.

For the desired twelve or S different switching positions, I have made the angle which the arcuate conductors extend through be twelve times as long as the switching angle, that is the angle between the centers of the terminals on the edge of the rotor 108. Thus when the contact springs on the stator 101 move through that switching angle to a new terminal on the edge of the rotor 108, the other set of contact springs touching the other side of the rotor 108 remain on their identical respective arcuate conductors.

Consequently it is possible with the transposing switch to perform the following illustrative example. Press down any one digital on the keyboard and hold it down. Rotate the transposing switch, through all twelve positions. A scale of twelve notes will be played by the action of the transposition. The spring contact 118 of FIGURE 7 remains in contact with its long arcuate conductor, but the switching action has moved twelve different spring contact springs 123 into active position over the terminal on the other side of the rotor 108 which corresponds to the arcuate conductor on which 118 rests in rotative sliding contact.

It will be seen that an immediate advantage of this construction is that there are no wires which flex or bend during the switching action. The construction is extremely compact and provides a truly efficient small switch for electric organs and the like.

Of course the pedal keyboard of the organ requires a similar arrangement, a subassembly of stator, rotor and connection circuit board. I prefer to gang the subassemblies so that a second set for the pedal keyboard is mounted in the same case. After properly connecting them both keyboards can be switched simultaneously from the same handle on the same shaft. In fact I have tested this arrangement by making a two manual keyboard and one pedal keyboard switch.

One set of subassemblies is made for each of the three keyboards. These three are ganged in the same case 138 on the same shaft 134, separated by spacer elements, and all operated simultaneously by the use of a handle. Of course for a larger keyboard a correspondingly greater number of N terminals and conductors on the switch elements is required to obtain the effect of the switching principle.

In FIGURE 9 I show an alternative arrangement which uses no circuit board corresponding to 112, but accomplishes the switching arrangement by means of two elements, a stator 201 and a rotor 202. The terminal 203 is connected to the music generating circuit as before. The contact 204 is soldered on the stator 201 and lies in spring engagement with the terminal 205 on the rotor 202. The terminal 205 connects to terminal 206 where a wire connecting to the digital on the keyboard is soldered. All the digitals on the keyboard are connected to terminals on the rotor. Similarly all the wires from the music-generating circuits are soldered on the stator 201 terminals. Simple rotation of the rotor 202 relative to the stator 201 transposes each terminal 205 to the neighboring spring contact represented by 204. In this arrangement the wires that are connected to 206 must be able to flex and for such arrangement I form the cable or harness of wires loosely so that they are able to do so.

While the invention is susceptible of various modifications, variations and changes, I have herein described the preferred embodiment in detail, but it is to be understood that I have not thereby intended to limit the invention to the specific forms disclosed but intend to cover all the modifications falling within the scope of the transposing switch as stated by the following claims.

I claim:

1. In a switch for a keyboard of an electric organ having a given number of keys on a keyboard, the given number being denoted by N, and having a given number of switch positions denoted by S, corresponding to the number of pitches, a set of music-generating circuits numbered N and corresponding to the keys of the keyboard, a stator containing N plus S number of terminals, a set of N number wires connecting the N keys of the keyboard to N of the terminals of the stator, a circular-shaped rotor containing conductors and terminals on its two sides, the side of the rotor next the stator containing N number of terminals disposed around the periphery of its circular shape, each of said rotor terminals separated from its closest adjacent neighbors by a switching angle defined as C degrees, spring contacts one of which is mounted on and fixed at one end to each of said stator terminals and its opposite end resting in conducting contact against the aforementioned terminals on said rotor, a series of N number conductors on the other side of said rotor, said second-mentioned conductors communicating through the body of said rotor electrically with the N number terminals on the first-mentioned side of the rotor, said second-mentioned conductors being in the shapes of arcs of circles having radii less than that of the rotor, and the length of each arcuate conductor being equal to an angle in degrees equal to C degrees, the switching angle, multiplied by S, the number of switch positions, a connection board adjacent to said rotor and on the other side from that of the stator, N number of spring contacts fixed on said connection board immediately adjacent to the side of the rotor carrying the arcuate conductors, said spring contacts on said connection board being so positioned that each spring contact is associated with and slidable in contact with one of said arcuate conductors on said rotor, a set of N terminals on the reverse side of said connection board, each of which is electrically connected to one of said spring contacts, a set of N wires connecting said last-mentioned terminals to the respective music-generating circuits, a case in which said switch combination is disposed to seal said switch, and a rotatable shaft on which said rotor is disposed to rotate with respect to said stator and said connection board, and an indexing means on said rotor and said stator to index said rotor with respect to said stator.

2. In a switch for a keyboard of an electric organ having a given number of keys on a keyboard, the given number being denoted by N, and having a given number of switch positions denoted by S, corresponding to the number of pitches, a set of music-generating circuits N in

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number and corresponding to the keys of the keyboard, a stator in the form of a printed circuit containing N plus S number of terminals, a set of N number wires connecting the N keys of the keyboard to N of the terminals of the stator, a rotor in the form of a printed circuit, containing conductors and terminals on two sides, the side of the rotor next the stator containing N number of terminals disposed around the periphery of its form, each of said rotor terminals separated from its closest adjacent neighbors by a switching angle defined as C degrees, spring contacts soldered on and fixed to each of said stator terminals and resting in conducting contact against the terminals on said rotor, a set of N number conductors on the other side of said rotor, said second-mentioned conductors communicating through the body of said rotor electrically with the N number terminals on the first-mentioned side of the rotor, said second-mentioned conductors being in the shape of arcs of circles having radii less than that of the rotor, and the length of each arcuate conductor being S times the switching angle expressed in radians, a connection board in the form of a printed circuit board disposed adjacent to said rotor and on the other side from that of the stator, a number of spring contacts soldered on and fixed to said connection board immediately adjacent to the side of the rotor carrying the arcuate conductors, said spring contacts on said connection board being N in number and so positioned that each spring contact is associated with and slidably in contact with one of said arcuate conductors on said rotor, a set of N terminals on the reverse side of said connection board, each of which is conductively connected to one of said spring contacts through the insulating body of the connection board, a set of N wires connecting said last-mentioned terminals to the respective music-generating circuits, a rotatable shaft on which said rotor is disposed to rotate with respect to said stator and said connection board, an indexing means between said stator and said rotor to index the position of said rotor with respect to said stator and a case in which said switch combination is disposed.

3. In a switch for a keyboard of an organ having a given number of keys on said keyboard, the given number being denoted by N, and having a given number of switch positions denoted by S, corresponding to the number of switches, a set of music-generating circuits N in number and corresponding to the keys of the keyboard, a stator in the form of a square printed circuit board, a set of N spring contacts mounted on and fixed to said stator, a set of N number wires connecting the N keys of the keyboard to N of the terminals of the stator, a rotor in the form of a two-sided circular printed circuit board, a set of N terminals disposed around the periphery of the rotor on one side and oriented so that the aforementioned set of spring contacts lie in conductive engagement with said terminals, a set of N numbered arcuate-shaped conductors disposed on the other side of said rotor, said arcuate-shaped conductors having a common center which is the center of said rotor, and all of said arcuate-shaped conductors having the same length in radians, said length being equal to S times the angle between switch positions, the set of arcuate-shaped conductors connected conductively to the terminals on the other side of said rotor by conductors through the body of said rotor, a connection board in the form of a square printed circuit board disposed on the other side of said rotor from said stator, a set of N spring contacts on said circuit board disposed so that each spring contact is associated with and slidably in contact with one of said arcuate conductors on said rotor, a set of N wires connecting said spring contacts on said connection board to the respective music-generating circuits, and indexing means on said rotor and stator associated with said switch positions, a shaft on which said rotor rotates with respect to said stator and said connection board, and a case in which said switch combination is disposed.

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4. In a switch for a keyboard of an organ having a given number of keys on said keyboard, the given number being denoted by N, and having a given number of switch positions denoted by S, corresponding to the number of switches, a set of music-generating circuits N in number and corresponding to the keys of the keyboard, a stator in the form of a square printed circuit board, a set of N spring contacts mounted on said circuit board and connected to the set of music-generating circuits, said spring contacts being disposed in a circle, a set of N number wires connecting the N keys of the keyboard to N of the terminals of the stator, a rotor in the form of a two-sided circular printed circuit board, a set of N contacts disposed around the periphery of the rotor on one side, and lying in conductive contact with said spring contacts, a set of N numbered arcuate-shaped conductors disposed on the other side of said rotor, said arcuate-shaped conductors having a common center and all of said conductors having the same length in radians, said length being equal to S times the distance between switching positions, the set of arcuate-shaped conductors being connected electrically to the set of N contacts disposed on the other side of the rotor, a connection board in the form of a square printed circuit board disposed adjacent to said rotor, a set of N spring contacts on said circuit board disposed so that each spring contact is associated with and slidably in contact with one of said arcuate conductors on said rotor, a shaft on which said rotor is rotatable with respect to said stator and said connection board, an indexing means which indexes said rotor in said switching positions, and a case in which said switch is disposed.

5. In a switch for a keyboard of an organ having a given number of keys on said keyboard, the given number being denoted by N, and having a given number of switch positions denoted by S, corresponding to the number of pitches which are subject to switching, a set of music generating circuits N in number and corresponding to the keys of the keyboard, a stator in the form of a square printed circuit board, a set of N spring contacts mounted on said circuit board in regular disposition around a circle, said spring contacts being connected to said music-generating circuits, a rotor in the form of a printed circuit board, a set of N contacts disposed on one side of the rotor in a circle and oriented to lie under and against the aforementioned spring contacts on said stator, a set of N numbered arcuate-shaped conductors disposed on the other side of said rotor, said arcuate-shaped conductors being provided with a common center and length in radians, the set of arcuate-shaped conductors being connected electrically to the set of contacts disposed on the other side of the rotor by conductors passing through the body of the rotor, a connection board in the form of a square printed circuit board disposed adjacent to said rotor, a set of N spring contacts on said circuit board disposed so that each spring contact is associated with and slidably contact with one of said arcuate conductors on said rotor, said last-mentioned spring contacts corresponding to said keys on said keyboard, a shaft on which said rotor is rotatable with respect to said stator and said connection board, and indexing means disposed on said stator and against the edge of said rotor to index said rotor in said switching positions, and a case in which said switch is disposed.

6. In a switch for a keyboard for an organ having N number of keys on the keyboard, and having S number of switch positions corresponding to pitches, a set of music-generating circuits N in number and corresponding to the keys of the keyboard, a stator in the form of a square printed circuit board, a set of N spring contacts mounted on the stator in regular disposition around a circle, each of said spring contacts separated from its immediate neighbors by an angle equal to C degrees which is the switching angle, and each of said spring contacts connected to said music-generating circuits, a rotor in the form of a printed circuit board, a set of N contacts dis-

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posed on one side of the rotor in a circle and oriented to lie under and against the aforementioned spring contacts on said stator, a set of N numbered arcuate-shaped conductors disposed on the other side of said rotor, said arcuate-shaped conductors being provided with a common center, and having the same length in radians, said length being defined by their being S times C, the set of arcuate-shaped conductors being connected electrically to the set of contacts disposed on the other side of the rotor by a set of conductors passing through the body of the rotor, a connection board in the form of a square printed circuit board disposed adjacent to said rotor, a set of N spring contacts on said circuit board disposed so that each of said last-mentioned spring contacts is associated with and slidably contacts with one of said arcuate conductors on

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said rotor, said last-mentioned spring contacts connected to said keys on said keyboard, a shaft on which said rotor is rotatable with respect to said stator and said connection board, and indexing means disposed on said stator and against the edge of said rotor to index said rotor in said switching positions, and a case in which said switch is disposed.

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