

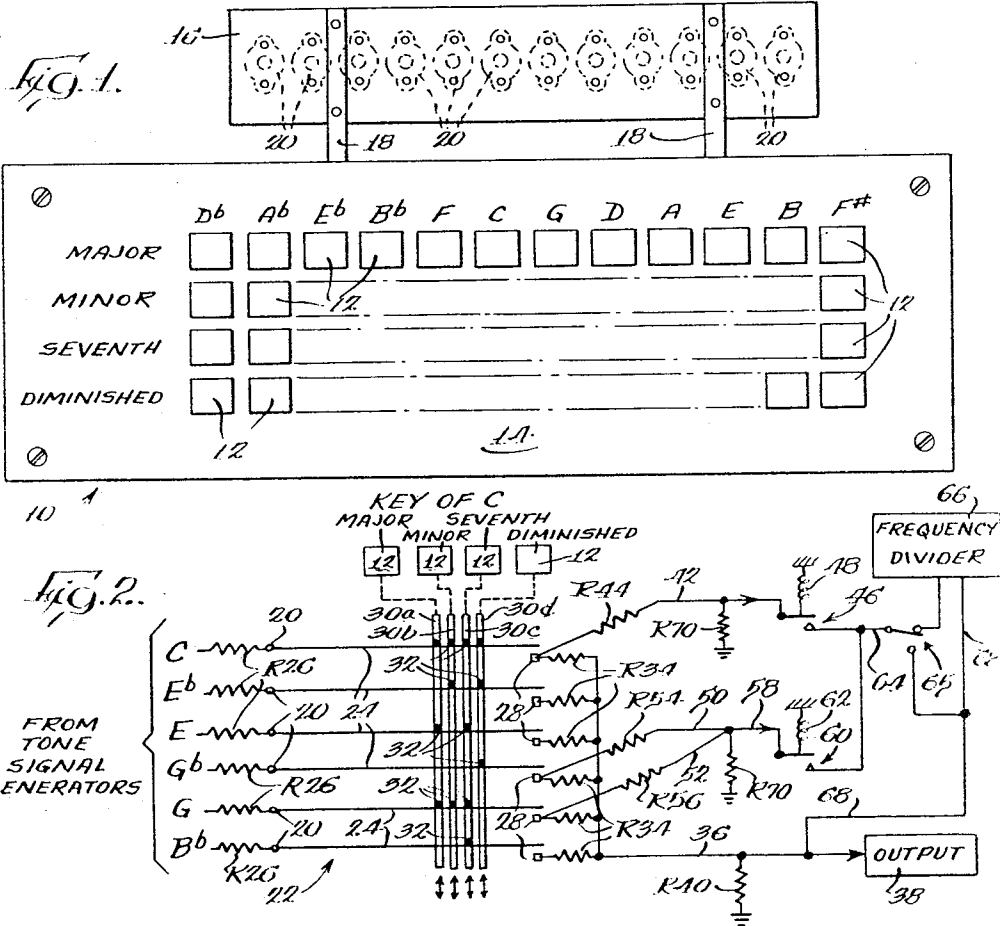
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ORGAN CHORD SWITCHING MECHANISM

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**CHORD BUTTON DESIGNATION**

BUS BAR	NOTE OF CHORD	D <sup>b</sup>	A <sup>b</sup>	E <sup>b</sup>	B <sup>b</sup>	F	C	G	D	A	E	B	F <sup>#</sup>
TOP	"ROOT"	C <sup>#</sup>	G <sup>#</sup>	D <sup>#</sup>	A <sup>#</sup>	F	C	G	D	A	E	B	F <sup>#</sup>
2	MINOR (FLATTED) "THIRD"	E	B	F <sup>#</sup>	C <sup>#</sup>	G <sup>#</sup>	D <sup>#</sup>	A <sup>#</sup>	F	C	G	D	A
3	"THIRD"	F	C	G	D	A	E	B	F <sup>#</sup>	C <sup>#</sup>	G <sup>#</sup>	D <sup>#</sup>	A <sup>#</sup>
4	FLATTED "FIFTH"	G	D	A	E	B	F <sup>#</sup>	C <sup>#</sup>	G <sup>#</sup>	D <sup>#</sup>	A <sup>#</sup>	F	C
5	"FIFTH"	G <sup>#</sup>	D <sup>#</sup>	A <sup>#</sup>	F	C	G	D	A	E	B	F <sup>#</sup>	C <sup>#</sup>
BOTTOM	DOMINANT (FLATTED) "SEVENTH"	B	F <sup>#</sup>	C <sup>#</sup>	G <sup>#</sup>	D <sup>#</sup>	A <sup>#</sup>	F	C	G	D	A	E

Fig. 3.

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**ORGAN CHORD SWITCHING MECHANISM**

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This invention relates generally to electrical musical instruments having generating systems for producing electrical tone signals, and relates more particularly to improved electrical circuitry and controls associated therewith wherein a plurality of electrical tone signals from different sources may be combined additively by the selective manipulation, one at a time, of a group of actuator members, to produce chords of preselected tones.

In certain electrical musical instruments, such as the well known electric chord organs, it is known to provide an electrical switching mechanism including a number of switch actuators operable by the left hand for selectively and simultaneously closing switch contacts between conductors carrying electrical tone signals and a corresponding number of bus bars connected to an electroacoustical translating means, whereby electrical tone signals of preselected frequencies may be combined by manipulation of a single actuator, thus producing for accompaniment complete chords of preselected tones. Such electrical musical instruments of the prior art are also commonly provided with means for playing, simultaneously with tre chords but in the lower register, the "root" or "fifth" notes of certain chords (or, in the case of the diminished chord, the "root" and flatted "fifth" notes) for bass accompaniment of the chord played by operation of a given switch actuator.

One known way of accomplishing this has been through the provision of a pedal keyboard providing a pedal and corresponding switching mechanism for coupling each of the tone signal generators for the twelve tones of the even tempered musical scale with an electroacoustical translator through a conventional frequency divider. In such instruments twelve pedals, and the switching means actuated thereby, are required for playing the above mentioned bass accompaniment notes, which arrangement is not only expensive but substantially reduces consumer appeal because of the difficulty inherent in operating a pedal keyboard.

If multiple-contact switches were used in a conventional way to collect the "root" and "fifth" notes of the chords on two bus bars, thus permitting the reduction of the number of pedal switches to two, it would be necessary to provide not only the two bus bars in addition to the number required for combining the chord tone signal frequencies, but also three extra sets of electrical contacts (over the number engaged by the switch actuators in chord selection) for each of such actuators in the instrument. Accordingly, when the instrument is designed, for example, to play as accompaniment the major, minor, seventh and diminished chords (and therefore has four manually operable switch actuators for each key letter in the musical scale) 144 additional complete sets of contacts, and the mechanism for working them, must be provided. Such extra parts and the labor necessary to install and test them are quite expensive, and would account for a significant proportion of the total cost of the instrument.

It is an object of the invention to provide, in an electrical musical instrument of the organ type having generating systems for producing electrical tone signals, a novel electrical circuit having branches operatively connected to the several tone signal sources, and switching means in such branches selectively operable by the player for com-

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binning additively a plurality of such electrical tone signals in different combinations to produce chords therefrom, and, in addition, to make available for bass accompaniment or reinforcement at the will of the player the "root" note and the "fifth" note (or flatted "fifth" note, as the case may be) of the chord being played.

It is a further object to provide chord selecting and bass accompaniment means in accordance with the foregoing object, wherein the output of the "root" bass and "fifth" bass tone signals of all chords is controlled by two pedal switches, and wherein a relatively small number of bus bars is provided for collecting selected electrical tone signals from a large number of conductors connected to the several tone signal sources, such bus bars being utilized not only for combining electrical tone signals for chord production, but also as sources of the isolated "root" and "fifth" tone signals of the several chords, whereby the number of sets of electrical contacts used in the instrument is significantly minimized, thus greatly reducing the cost of such instruments, when compared with instruments of the prior art capable of producing similar musical effects, while permitting retention of simplicity of operation thereof by the player.

Other objects and advantages of this invention will be apparent from the following description of a presently preferred embodiment thereof, taken in conjunction with the accompanying drawing wherein like numerals refer to the same or identical parts in all of the figures, and in which:

FIG. 1 is a top plan view of a keyboard of chord selecting buttons used for manipulating switch actuators for actuating switches for controlling a circuit in accordance with the present invention capable of producing the major, minor, seventh and diminished chords of all keys;

FIG. 2 is a wiring diagram of a representative portion of the improved circuit of the invention of the type described in the foregoing object, including schematically shown manually operable switch actuators for controlling the chord producing part of such circuit portion; and

FIG. 3 is a chart showing the electrical tone signal generator output connections to each of the contact members adapted to be engaged by the switch actuators for effecting production of the major, minor, seventh and diminished chords of each key letter. The chart of this figure also shows the relative positions of the bus bars of FIG. 2 adapted to be engaged by each of the manually actuable contact members, as well as the tone signal components of the various chords adapted to be impressed on each of said bus bars.

Generally speaking, in carrying out the present invention, twelve banks of movable electrical contacting members are provided, the banks preferably being arranged side by side, each such bank corresponding to one of the key letters comprising the twelve tones of the even tempered musical scale, and each such bank including the number of such contacting members corresponding to the number of notes necessary for making up all of the chords, in a given key, adapted to be produced by the musical instrument in which the invention is used. Such movable contacting members are electrically connected respectively to tone signal sources (not shown) used in conventional electric or electronic organs for producing alternating currents having frequencies corresponding to such notes.

A bus bar is associated with all of such movable contacting members which are disposed in a particular position in all of such banks (i.e., a single bus bar is associated with all of the movable contacting members comprising the top layer of such banks, a second bus bar is associated with all of the movable contacting members occupying positions second from the tops of said banks, and so on). The bus bars are disposed in spaced rela-

tion to the movable contacting members with which they are respectively associated, and are adapted to be engaged by contact elements carried by such contacting members, whereby electrical tone signals carried by said contacting members may be selectively impressed on the corresponding bus bar.

Associated with each bank of contacting members is a group of switch actuators, preferably manipulated respectively by buttons arranged in a row in an accordion type keyboard conveniently placed in the console of the instrument, each of such actuators being arranged to engage preselected ones of said contacting members and move them into engagement with their respective bus bars, whence the several electrical tone signals carried by such contacting members are combined and conducted to an electroacoustical translating means to produce a chord in the key letter assigned to that row of buttons. Additionally, the bus bar adapted to be engaged by the layer of contacting members connected with the tone signal generators for producing the "root" note frequencies of the respective chords is connected to a pedal switch, and the bus bars adapted to be engaged by the two layers of contacting members connected respectively to the tone signal generators for producing the "fifth" and flatted "fifth" note frequencies of the respective chords are connected to a second pedal switch, both pedal switches being in the circuit of a conventional frequency divider which, if desired, may comprise more than one dividing stage. The signals of lowered frequency from the frequency divider are conducted to the electroacoustical translating means, whereby the suitable bass "root" note or bass "fifth" note may be combined with the chord notes, as accompaniment, by actuation of one of the pedal switches.

In the embodiment of the invention shown and described herein, the circuit and associated switch actuators are adapted to provide only the major, minor, seventh, and diminished chords in each key, and for such purpose it is necessary to use only six movable contacting members in each of the twelve banks thereof, since only six notes are needed to produce all of such chords in a given key. It is to be understood, however, that if it is desired to produce a different number of chords and bass accompaniment notes in a chord organ of the type referred to above, a different number of movable contacting members, switch actuators, and pedal switches may be used, and the pedal switch connections to the bus bars may be changed in position and number in accordance with the bass accompaniment desired, without departing from the spirit of the invention.

Referring now to the drawing, there is shown in FIG. 1 an accordion type button keyboard 10 suitable for use in controlling the circuit of the invention. The keyboard includes forty-eight chord buttons 12 which are operated in the manner of accordion chord buttons, and the keyboard is adapted to be fitted into and attached to an organ console to the left of the manual keyboard, in the manner shown for example in U.S. Patent No. 2,645,968 to Hanert. The keyboard 10 includes a molded plastic keyboard plate 14 having 48 openings therein for guiding accommodation of the chord buttons 12, the latter being arranged in four horizontal rows and 12 vertical rows, as viewed in FIG. 1. The horizontal rows of buttons are marked with the chord designations "major," "minor," "seventh," and "diminished." The chord key designations are marked adjacent the rearward ends of the vertical rows of buttons by the legends Db, Ab, Eb, Bb, F, C, G, D, A, E, B, and F#. For convenience, the flatted notes are herein written as the note followed by the letter "b" as in the preceding sentence. Under each of the twelve rows of four key buttons associated with a given key designation, there is positioned a bank of six movable electrical contacting members, preferably in the form of leaf springs of spring bronze, and with each such bank is associated a group of four switch actuator members, each of the latter being adapted to be

operated by one of the four chord buttons in the row above it. One of such banks of contacting members and its associated switch actuators is shown schematically in FIG. 2. Inasmuch as the other eleven banks of contacting members and their associated switch actuators, which are disposed respectively under the remaining eleven rows of four chord buttons, are identical to those shown in FIG. 2, only the representative arrangement of FIG. 2 will be described in detail, such description sufficing for all the other banks and actuators.

Referring again to FIG. 1, the keyboard plate 14 may support a terminal board 16 of electrical insulating material by means of bracket arms 18, the board 16 supporting twelve connectors 20 adapted to be connected respectively to twelve electric tone signal generators (not shown) for generating the signals of the twelve tones of the tempered musical scale. The kind of generators used for producing the tone signals is, of course, not critical, and may be any of the conventional types such as the tone wheel generators described in U.S. Patent No. 1,956,350 to Hammond, or the oscillators described in the above mentioned Hanert patent. The connectors 20 are also adapted to be connected, respectively, to the ones of the spring contacting members in the various banks thereof where the frequency of the particular tone generator is required for producing a desired chord in the key represented by that bank of contacting members, as will be more fully described hereinafter.

The arrangement depicted in FIG. 2 is for the portion of the circuit and associated controls of the invention pertaining to the production of the above designated chords in the key of C, and for isolating the "root" and "fifth" notes of such chords for permissive use thereof in a bass accompaniment. In FIG. 2 there is shown schematically a bank 22 of contacting members, the bank comprising six superposed spaced, movable contacting members 24 which are preferably in the form of leaf springs of spring bronze or other suitable conductive material. The contacting members 24, which may be supported individually adjacent one end, are connected at such supported ends respectively, through impedance elements shown as resistors R26, to the electrical tone signal generators for producing tone signals for the six notes needed for producing all four chords in the designated key (i.e., the key of C). Accordingly, the six contacting members 24 are connected respectively to the ones of the tone signal generators (not shown) for generating electrical tone signals corresponding to the tones C, Eb, E, Gb, G and Bb, the said connections being made through the connectors 20 on the terminal board 16 (FIG. 1), the connectors being depicted as dots 20 in the wiring diagram (FIG. 2). Disposed below the free ends of the contacting members 24, and spaced respectively a short distance therefrom, are a group of six bus bars 28 extending transversely of the bank of contacting members.

A group of four switch actuators 30a, 30b, 30c, and 30d is associated with the bank 22 of contacting members, the actuators being movable vertically relatively to the contacting members 24, as indicated by the double-headed arrows shown under the actuators. The actuators are provided with means, such as lugs of insulating material, for engaging certain of the contacting members 24, such means being represented by the square dots 32 shown on the switch actuators. As shown in FIG. 2, the engaging means 32 are adapted to engage respectively the contacting elements 24 immediately below them, so that when the actuators are moved downwardly they also cause such selected contacting elements to move downwardly and into engagement with the respective bus bars 28 immediately below them. The contacting members 24 are, of course, maintained by any convenient means, such as their natural resilience, out of contact with the bus bars at all times except when they are moved into such engagement by the actuators 30a, 30b, 30c or 30d.

The bus bars 28 are all connected through decoupling

impedance elements, shown as resistors R34, to a common conductor 36 connected to an output 38 comprising conventional amplifying and electroacoustical translating means, the conductor 36 being grounded through a resistor R40. Thus, the tone signal outputs of the bus bars 28 are combined in the conductor 36 and conducted together to the output 38 of the instrument.

The top bus bar 28 is connected by a conductor 42 through a resistor R44 to one terminal of a single pole single throw pedal switch 46 which is normally held in the open position by any convenient means, such as a tension spring 48. The fourth and fifth bus bars 28 are separately connected by means of conductors 50 and 52 through resistors R54 and R56 to a common conductor 58 which in turn is connected to one terminal of a second single pole single throw pedal switch 60 which is biased in the open position by a tension spring 62. The other terminals of the pedal switches 46 and 60 are connected to a common conductor 64 which in turn is connected to the blade of a two-position switch 65. When the blade is in one position, the conductor 64 is connected directly to the conductor 36 leading to the output, and when the blade of switch 65 is in the other position, the conductor 64 is connected to a frequency divider 66 which may comprise as many stages as desired. Signals of lowered frequency from the frequency divider are carried by a conductor 68 to the output 38 for amplification and electroacoustical translation. Each of the conductors 42 and 58 is connected to ground through a resistor R70. The values of the various resistors depend of course on the impedance of the tone signal generators. Generally speaking, the resistance of each of the resistors R26, R34, R44, R54, and R56 should be about five to ten times that of each of the resistors R40 and R70. Typical values (which are not critical) of these resistors, when used with conventional tone frequency sources of the transistor type, are 47,000 ohms for resistors R26, R34, R44, R54 and R56, and 4700 ohms for resistors R40 and R70. The frequency sources are not shown or described in detail since their particular construction is not part of the present invention.

In operation of the system shown in FIG. 2, the several tone signal generators being energized and connected to their respective contacting members 24 as shown, the contacting members 24 being separated from their bus bars, and switches 46 and 60 being in the "open" positions illustrated, the system is in readiness to produce accompaniment chords at the will of the player. Assuming the player wishes to play the C major chord, he depresses the chord button 12 attached to the actuator 39a, thereby moving the top, third, and fifth spring contacting members 24 downwardly, against their natural resilient bias, into contact with the top, third, and fifth bus bars 28, whereby the electrical tone signals from the C, E, and G generators are combined in the conductor 36 and conveyed to the output 38, which sounds the corresponding chord. If the player wishes additionally to sound the "root" note of the chord he will, while the actuator 39a is still depressed, close the pedal switch 46, whereby the tone signal from the top ("root") bus bar is conducted through the conductor 42 and the frequency divider 66 (assuming the blade of the switch 65 is in its illustrated upper position) to the output 38. Similarly, if the "fifth" note of the chord is desired to be sounded in addition to the chord, the player closes the pedal switch 60, while the actuator 39a is still depressed, which then brings the "fifth" note signal from the fifth ("fifth") bus bar 28 through the resistor R56 and conductors 52, 58, and 64 to the frequency divider 66, whence the "fifth" note signal of reduced frequency goes to the output 38.

Since the true "fifth" note is not present in the diminished chord, the actuator for producing the diminished chord is adapted to bring the spring contacting member 24 carrying the flatted "fifth" tone signal (i.e., the fourth contact member 24 from the top of the bank) into contact with the fourth bus bar 28, whereby the flatted "fifth"

tone signal may be conducted through the conductors 50, 58, and 64, and the frequency divider 66, to the output 38, when the actuator 39d for the diminished chord is depressed. Since the "fifth" and flatted "fifth" notes are never played at the same time, the conductors 50 and 52 from the bus bars 28 which are adapted to receive such tone signals are connected through a common conductor 58 to the "fifth" pedal switch 60. The decoupling resistors R34 are effective to prevent any appreciable transmission through the conductors 42, 50, and 52 of tone signals of other frequencies of the chord which are impressed on the common conductor 36 by operation of the several actuators 39a, 39b, 39c and 39d.

As previously noted, the above described arrangement of spring contacting members 24 and actuators 39a, 39b, 39c and 39d is repeated eleven times in the chord producing system of the invention, providing twelve of such arrangements in all, one for each tone of the even tempered scale, and all of such arrangements are identical to that shown in FIG. 2, with the obvious exception that the several spring contacting members 24 in each of the twelve banks will be connected to different tone signal generators, since each bank 22 of spring contacting members is adapted to produce chords in a different key from that produced by any other bank. The bus bars 28 extend transversely of all of such banks 22 of contacting members and occupy the same positions relatively to the respective spring contacting members of each bank as that shown in FIG. 2.

The connections of the various tone signal generators to the several spring contacting members 24 associated with the respective bus bars is shown in FIG. 3, wherein the indicated positions of the bus bars relatively to the banks of contacting members 24 is the same as that shown in FIG. 2. FIG. 3 also identifies each note of the various chords represented by the tone signals adapted to be conveyed to each bus bar. For example, referring to the column for the key of C under the heading "Chord Button Designation" in FIG. 3, it is seen that the tone signal for the "root" note (C) is impressed on the top spring contacting member 24 adapted to engage the top bus bar 28; the tone signal for the minor "third" note (D#) is impressed on the second spring contacting member 24 which is adapted to engage the second bus bar from the top; and so on.

Referring then again to FIG. 2, it will be seen that when the chord button 12 connected to actuator 39b is depressed, to sound the C minor chord, it will bring the top, second, and fifth contact members 24 into engagement with their respective bus bars 28, thereby conveying combined tone signals of the notes C, D#, and G to the output 38 to sound that chord. With the actuator 39b so depressed, and the blade of switch 65 in its illustrated upper position, the "root" pedal switch 46 and the "fifth" pedal switch 60 may also be closed selectively to convey the "root" and "fifth" notes of such chord to output 38 for bass accompaniment.

By way of further illustration, assume the chord button 12 connected to the actuator 39d (for the "diminished" chord) associated with the bank of contacting members 24 for the key of Db is depressed. Referring to FIGS. 2 and 3, it will be seen that in that situation the top, second, and fourth contacting members 24 are brought into engagement with their respective bus bars 28 conveying the combined tone signals respectively for notes C#, E, and G to the conductor 36 and to the output 38. As long as such actuator 39d is so depressed, and switch 65 is in condition to connect conductor 64 to the frequency divider, closing of the "root" pedal switch 46 will add the "root" bass note signal, and closing of the "fifth" pedal switch 60 will add the flatted "fifth" bass note signal to the chord sounded by the output 38.

It will be apparent that when the blade of switch 65 is in its lower position any tone signal in the conductor 64 will be conducted, undivided, to the output 38 to rein-

force the same tone appearing as a component of the chord signals impressed on the conductor 36 by operation of one of the actuators 30a, 30b, 30c or 30d.

Although in the illustrated embodiment of the invention the impedance elements have been shown as resistors, it will be understood that any other suitable impedance element, such as a capacitor, may be used instead, if desired. It will also be understood that, if desired, tone signals of other notes than the "root" and "fifth" of the several chords, such as the "third" note signal, may be isolated from the appropriate bus bar for control by a separate pedal switch, for bass accompaniment or reinforcement in the manner described above in connection with the isolated "root" and "fifth" notes.

Specific switching mechanism for controlling the present circuit does not, per se, constitute part of this invention, a number of switching mechanisms suitable for this purpose being well known in the art. A preferred form of switching mechanism for use in the present invention is that wherein leaf spring contacting members, supported adjacent their ends, are arranged in a plurality of stacks or banks positioned side by side, a bus bar is disposed transversely of the banks adjacent and below each layer of contacting members in such arrangement of banks, and switch actuators in the form of combs (with some of the teeth missing) are used to control engagement of certain combinations of the contacting members with their respective bus bars. In such actuators, the comb teeth may occupy the positions of the square dots 32 of FIG. 2 hereof, and are thus adapted to move certain ones of the spring contacting members into engagement with the bus bars respectively directly beneath them upon depression of chord buttons carried by the actuators.

While there has been shown and described a particular embodiment of the present invention, it will be apparent to those skilled in the art that numerous modifications and variations may be made in the form and construction thereof without departing from the spirit of the invention. It is therefore intended, by the following claims, to include within the scope of the invention all such similar and modified forms of the disclosed invention by which substantially the results of the invention may be obtained by substantially the same or equivalent means.

What is claimed is:

1. In an electrical musical instrument including tone signal generators for generating collectively electrical tone signals corresponding to the twelve tones of the even tempered musical scale, and an output system including electroacoustical translating means, the combination therewith of a multiple-contact switch including a separate movable contact member for each note required to produce a given number of chords of a given key, said contact members being connected respectively to the ones of said tone signal generators for producing electrical tone signals corresponding to such chord notes, a bus bar associated with each of said contact members for permissive engagement therewith, said bus bars being connected in parallel to said translating means through decoupling impedance elements, a plurality of switch actuators associated with said switch, each of said actuators including means for moving a different combination of said contact members into engagement with their respective associated bus bars for conducting tone signals of the different chords in said given key to said translating means, a separate switch, one contact of said separate switch being connected through an impedance element to one of said bus bars, the other of the contacts of said separate switch being connected to said translating means, whereby upon production of any of said chords in said given key including the note produced by the tone signal supplied by said one bus bar, by operation of one of said actuators, reinforcement of the said note in said chord may be obtained by closing said separate switch.

2. In an electrical musical instrument including tone

signal generators for generating collectively electrical tone signals corresponding to the twelve tones of the even tempered musical scale, and an output system including electroacoustical translating means, the combination therewith of a multiple-contact switch including a separate movable contact member for each note required to produce a given number of chords of a given key, said contact members being connected respectively to the ones of said tone signal generators for producing electrical tone signals corresponding to such chord notes, a bus bar associated with each of said contact members for permissive engagement therewith, said bus bars being connected in parallel to said translating means through decoupling impedance elements, a plurality of switch actuators associated with said switch, each of said actuators including means for moving a different combination of said contact members into engagement with their respective associated bus bars for conducting tone signals of the different chords in said given key to said translating means, a separate switch, one contact of said separate switch being connected through an impedance element to one of said bus bars, the other of the contacts of said separate switch being connected to said translating means through a frequency divider, whereby upon production of any of said chords in said given key including the note produced by the tone signal supplied by said bus bar, by operation of one of said actuators, a bass accompaniment for said chord may be added by closing said separate switch.

3. In an electrical musical instrument including tone signal generators for generating collectively electrical tone signals corresponding to the twelve tones of the even tempered musical scale, and an output system including electroacoustical translating means, the combination therewith of a multiple-contact switch including a separate movable contact member for each note required to produce a given number of chords of a given key, said contact members being connected respectively to the ones of said tone signal generators for producing electrical tone signals corresponding to such chord notes, a bus bar associated with each of said contact members for permissive engagement therewith, said bus bars being connected in parallel to said translating means through decoupling impedance elements, a plurality of switch actuators associated with said switch, each of said actuators including means for moving a different combination of said contact members into engagement with their respective associated bus bars for conducting tone signals of the different chords in said given key to said translating means, a separate switch, one contact of said separate switch being connected through an impedance element to the one of said bus bar adapted to be connected through its associated contact member to the tone signal generator for supplying the "root" note signal of the chords in said given key, the other of the contacts of said separate switch being connected through a frequency divider to said translating means, whereby upon production of any of said chords in said given key by operation of one of said actuators a "root" bass accompaniment for said chord may be added by closing said separate switch.

4. In an electrical musical instrument including tone signal generators for generating collectively electrical tone signals corresponding to the twelve tones of the even tempered musical scale, and an output system including electroacoustical translating means, the combination therewith of a multiple-contact switch including a separate movable contact member for each note required to produce a given number of chords of a given key, said contact members being connected respectively to the ones of said tone signal generators for producing electrical tone signals corresponding to such chord notes, a bus bar associated with each of said contacting members for permissive engagement therewith, said bus bars being connected in parallel to said translating means through decoupling impedance elements, a plurality of switch actuators associated with said switch, each of said actuators including means for moving a different combination of said contact

members into engagement with their respective associated bus bars for conveying tone signals of the different chords in said given key to said translating means, a first separate switch, one of the contacts of said first separate switch being connected through an impedance element to the one of said bus bars adapted to be connected through its associated contact member to the generator for supplying the "root" tone signal of said chords in said given key, a second separate switch, one of the contacts of said second separate switch being connected through an impedance element to the one of said bus bars adapted to be connected through its associated contact member to the generator for supplying the "fifth" tone signal of said chords in said given key in which the "fifth" note is a component, the other contacts of said separate switches being connected through a frequency divider to said translating means, whereby upon the production, by operation of one of said actuators, of any of said chords in said given key in which said "fifth" note is a component, a "root" bass accompaniment for such chord may be added by closing the said first separate switch, and a "fifth" bass accompaniment for such chord may be added by closing the said second separate switch.

5. In an electrical musical instrument including tone signal generators for generating collectively electrical tone signals corresponding to the twelve tones of the even tempered musical scale, and an output system including electroacoustical translating means, the combination therewith of a multiple-contact switch including a separate movable contact member for each note required to produce the major, minor, seventh, and diminished chords of a given key, said contact members being connected respectively to the ones of said tone signal generators for producing electrical tone signals corresponding to such chord notes, a bus bar associated with each of said contact members for permissive engagement therewith, said bus bars being connected in parallel to said translating means through decoupling impedance elements, a plurality of switch actuators associated with said switch, each of said actuators including means for moving a different combination of said contact members into engagement with their respective associated bus bars for conveying tone signals of said chords in said given key to said translating means, a first separate switch, one of the contacts of said first separate switch being connected through an impedance element to the one of said bus bars adapted to be connected through its associated contact member to the generator for supplying the "root" tone signal of said chords in said given key, a second separate switch, one of the contacts of said second separate switch being connected through an impedance element to the one of said bus bars adapted to be connected through its associated contact member to the generator for supplying the "fifth" tone signal of the major, minor, and seventh chords in said key, said one contact of said second separate switch also being connected independently through an impedance element to the one of said bus bars adapted to be connected through its associated contact member to the generator for supplying the flattened "fifth" tone signal of the diminished chord of said given key, the other contacts of said separate switches being connected through a frequency divider to said translating means, whereby, upon production of any of said chords in said given key by operation of one of said actuators, a "root" bass accompaniment for such chord may be added by closing the said first separate switch, upon production of any of said major, minor, and seventh chords in said given key by operation of the appropriate ones of said actuators, a "fifth" bass accompaniment therefor may be added by closing said second separate switch, and upon production of said diminished chord in said key upon operation of the actuator therefor a flattened "fifth" bass accompaniment for said diminished chord may be added by closing said second separate switch.

6. In an electrical musical instrument including tone signal generators for generating collectively electrical tone signals corresponding to the twelve tones of the even tempered musical scale, and an output system including electroacoustical translating means, the combination therewith of twelve banks of movable contact members, the number of such contact members in each of said banks corresponding to the number of notes required to produce all of the chords of a given key which the instrument is adapted to produce, a number of bus bars equal to the number of said contact members in each of said banks and respectively associated in common with one of said contact members of each of said banks, said bus bars being positioned respectively adjacent to but normally separated from their associated contact members, said bus bars being connected in parallel to said translating means through decoupling impedance elements, said contact members of each of said banks being connected respectively to the ones of said tone signal generators for producing said chords of a given key, a plurality of switch actuators associated with each of said banks of contact members, each of said actuators including means for moving a different combination of said contact members of its associated bank into engagement with their associated bus bars for conveying tone signals of the different chords of said given key to said translating means, a first separate switch member, one of the contacts of said first separate switch member being connected through an impedance element to the one of said bus bars adapted to be engaged by the said contact members of all said banks connected to the tone signal generators for supplying the "root" tone signals of the said chords of all keys, a second separate switch member, one of the contacts of said second separate switch member being connected through an impedance element to the one of said bus bars adapted to be engaged by the said contact members of all banks connected to the tone signal generators for supplying the "fifth" note signals of the said chords of all keys in which the "fifth" note is a component, the other contacts of said separate switch members being connected through a frequency divider to said translating means.

7. In an electrical musical instrument including tone signal generators for generating collectively electrical tone signals corresponding to the twelve tones of the even tempered musical scale, and an output system including electroacoustical translating means, the combination therewith of twelve banks of movable contact members, each of said banks including six of said contact members, said contact members of each bank being connected respectively to the ones of said tone signal generators for producing the tone signals corresponding to the major, minor, seventh, and diminished chords of a given key, six bus bars respectively associated in common with one of said contact members of each of said banks, said bus bars being positioned respectively adjacent to but normally separated from their associated contact members, one of said bus bars being associated with the said contact member of each of said banks which is connected to the tone signal generator for supplying the "root" tone signal for the major, minor, seventh, and diminished chords of the said given key for such bank, another of said bus bars being associated with the said contact member of each of said banks which is connected to the tone signal generator for supplying the "fifth" tone signal for the major, minor, and seventh chords of said given key for such bank, a third one of said bus bars being associated with the said contact member of each of said banks which is connected to the tone signal generator for supplying the flattened "fifth" tone signal for the diminished chord of said given key for such bank, said bus bars being connected in parallel to said translating means through decoupling impedance elements, four switch actuators associated with each of said banks of contact members, each of said actuators

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including means for moving a different combination of said contact members of its associated bank into engagement with their associated bus bars for conveying tone signals of said chords in said given key for such bank to said translating means, a pair of switch members, one of the contacts of one of said switch members being connected through an impedance element to said one bus bar, one of the contacts of the other of said switch members being connected independently through an im-

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pedance element to each of said other bus bars and said third bus bar, the other contacts of said switch members being connected through a frequency divider to said translating means.

No references cited.

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