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MUSICAL INSTRUMENT

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3 Sheets-Sheet 2

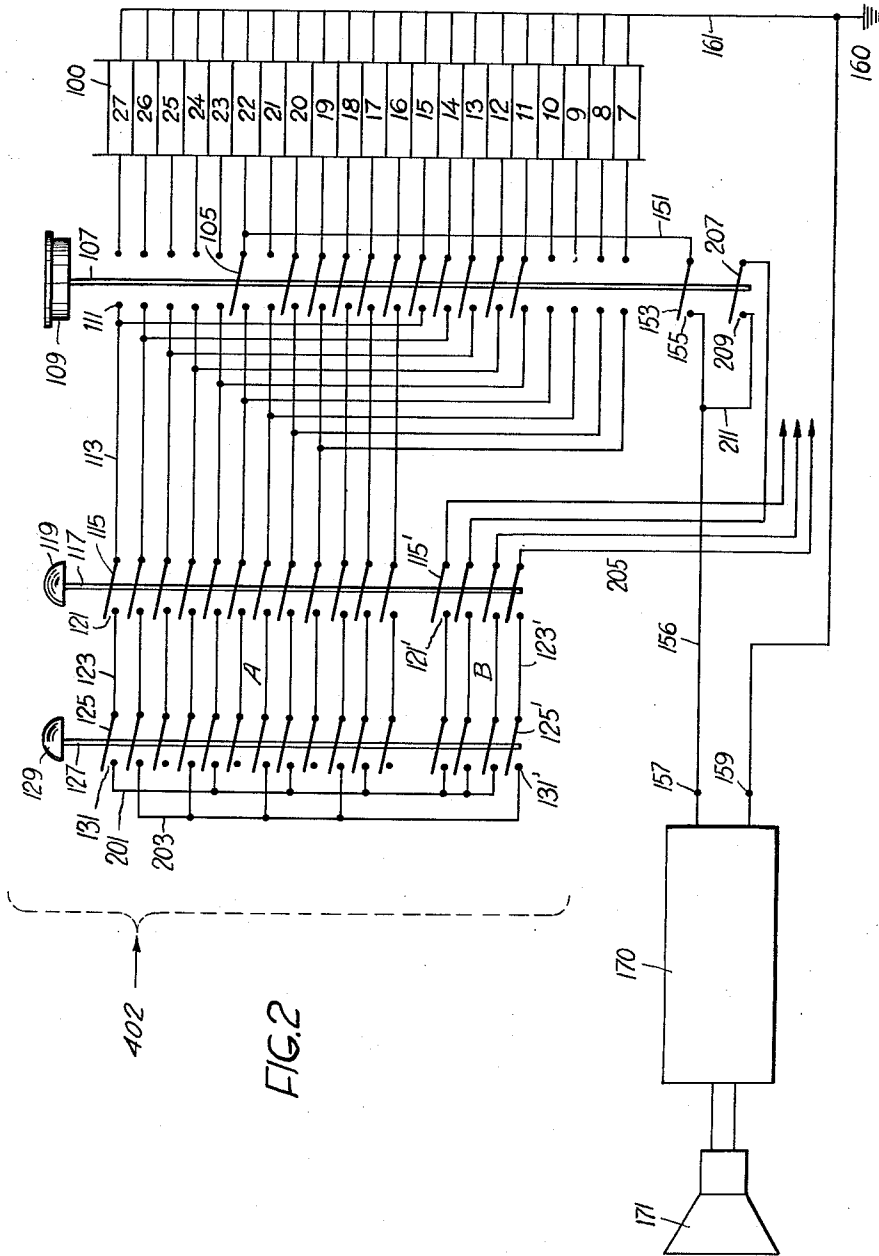


FIG. 2

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3 Sheets-Sheet 3

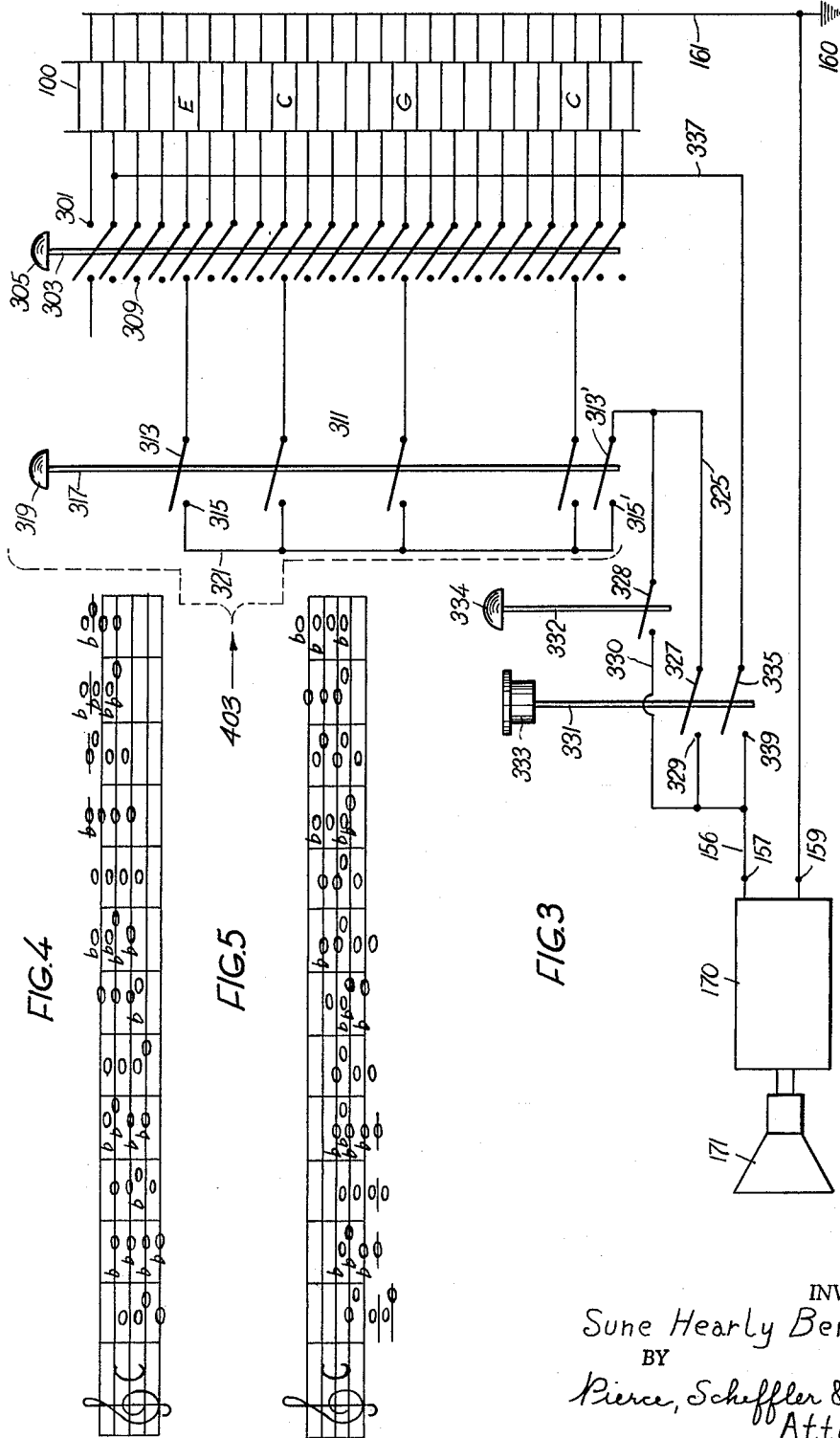


FIG. 4

FIG. 5

FIG. 3

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MUSICAL INSTRUMENT

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The present invention refers to a musical instrument, particularly one wherein tones and harmonies desired to be reproduced are created or at least coupled with the aid of electrical members, although the invention is also applicable to certain musical instruments which are void of electrical circuits, that is to say, which operate mechanically or pneumatically throughout.

This invention is concerned with electro-mechanical means, whereby selected ones of fundamental tone frequencies are modulated through successive stages, by melody and harmony selecting means, to produce a resulting chordal group frequency, which is the desired tone frequency supplied as input to an amplifier.

A musical instrument according to the invention is provided with means for the creation of tone frequencies, such means being constituted either by a conventional mechanical tone creation contrivance, such as organ stops, concertina stops, strings and so forth, the tone frequencies then consisting of audible tones, with an electro-mechanical arrangement, such as voice tongues coupled magnetically to electric scanning coils, or an arrangement for the reproduction of tones preplayed on a recording medium, and so forth, wherein the tone frequencies are constituted by electrical signals, or may finally comprise a purely electronic contrivance, wherein the tone frequencies are likewise created in the form of electrical signals. In these latter cases, an amplifier is generally made use of, which is connected to a loudspeaker for an audible reproduction of the tone frequencies.

Furthermore, the instrument comprises a set of tone-selecting members, that is to say, members for the selection of individual tones from the tone-creating contrivance. This set of members may be constituted by an ordinary keyboard, but the tone-selecting members may also consist of special members, when the musical instrument is adapted automatically to play desired pieces of music on the basis of a corresponding record, such as a hole strip.

Furthermore, the musical instrument comprises a set of harmony-selecting members, that is to say, members for the selection of a desired harmony, which is caused to sound simultaneously with a tone selected by a tone-selecting member. These harmony-selecting members may also be constituted by keys or the like, but may also consist of contacts adapted to be actuated by a record such as a hole strip.

The musical instrument according to the invention is distinguished by a coupling or contrivance such that the harmony adapted to be selected through the harmony-selecting members and pertaining to a tone selected by a tone-selecting member is reproduced simultaneously with the tone in question, when the tone-selecting member corresponding to this tone is actuated.

This involves, in other words, that a desired harmony is caused to sound simultaneously with a certain tone while the latter is struck at the same time, which, however, does

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not exclude that the instrument may be provided with means through which this mode of functioning may be abolished entirely or in part, so that the instrument may be used in a similar manner as an ordinary musical instrument of the kind in consideration, if desired.

In a form of embodiment of the invention, a pre-determined series or pattern of harmonies have been arranged for the keyboard keys for each harmony-selecting member, in which pattern various harmonies are comprised for instance according to schematic arrangements as set forth in the following. According to these arrangements, the pattern of harmonies for the twelve tones of the chromatic scale have been divided into groups, wherein certain harmonies are common to different groups, and wherein the harmonies within each group may be formed in such manner that every harmony contains tones that are not comprised in any one of the other harmonies within the group in consideration. By a suitable selection of such harmonies and by a suitable division of the groups, it will be possible to attain patterns of harmonies which in musical respects are surprisingly well adapted to a number of different melodies, even if the harmony in the performance of an individual piece of music will not always be the most suitable. The harmony sequences in the playing of such a piece of music may obviously also leave much to be desired with respect to counterpoints, at least if comparisons are made with voice arrangements according to the classic school. However, due regard should be taken to the fact that the conceptions as to what should permit of being regarded as acceptable and less acceptable from the point of view of harmonies and voice arrangements highly vary and change, which also depends on what the individual listener has been accustomed to during a long time.

With these reservations it may be established that with a musical instrument according to the invention it will be possible by an adjustment of a harmony-selecting member for the selection of a certain desired harmony pattern to perform a piece of music with a melody and associated harmonies solely by playing the melody on a keyboard, the associated harmonies being then formed automatically and reproduced simultaneously with the tone which is played. Frequently one may then perform a long part of the piece of music with the maintenance of the selected harmony pattern, wherein, if this harmony pattern would not fit any longer, another more suitable harmony pattern may be selected by the adjustment of another harmony-selecting member.

A musical instrument according to the invention may thus be played by a comparatively unpracticed person, inasmuch as he is only called upon to learn the playing of the melody and to know a few individual suitable harmony patterns.

In another form of embodiment of the invention, the harmony-selecting members may be adapted to form, each of them, a harmony function for a given tone, means having then to be provided for the transposition of the harmony-functions into different musical keys. In such a musical instrument, the harmony-selecting members, if constituted by keys, may be arranged in a field, wherein the keys corresponding to the principal harmony functions, such as the tonic, the dominant, the subdominant, the tonic of the parallel key, and so forth, are arranged substantially in the middle of the key field,

whereas the keys for the more peripheral harmonies may be arranged at a greater distance from the center of the field.

When a piece of music is performed with such an instrument, one is only called upon to know what harmony functions are to be arranged for the various tones in the harmony played and then to actuate the corresponding harmony-selecting member. Inasmuch as the harmonies according to the invention shall be caused to co-sound only when the key for the appertaining melody tone is depressed, it may be found suitable in such cases to arrange a member for the neutralization of this function, so that, if required, it shall be possible to repeat a melody tone, without the corresponding harmony being interrupted, that is to say, while this harmony remains.

The invention will be described more closely in the following description in connection with the accompanying drawings, wherein FIGS. 1, 2 and 3 show suitable examples of embodiment, and wherein FIGS. 4 and 5 show chromatic scales which associated harmony patterns according to the invention.

FIG. 1 shows a principal diagram for an embodiment of a musical instrument according to the invention. In this instrument, electrical tone frequency signals are created by a contrivance 100, which may consist for instance of voice tongues corresponding to the desired number of tones, the frequencies of which tongues are scanned by electromagnetic means for instance with the aid of scanning coils in a manner known per se. In the drawing, the arrangement 100 comprises the electrical tone-creating members 7-27, each of them corresponding to a tone. Obviously, the desired tone frequencies may instead be taken out by electrical means for instance from a magnetic sound recording device, on which the tone frequencies have been preplayed.

The musical instrument comprises a keyboard with keys 109 for the selection of individual tones together with harmonies from the tone-creating contrivance 100. Each key is mechanically connected to a rod 107, which is in turn coupled to movable contacts 105 of certain switches, which are individual to each key 109, such switches consisting of the movable contact 105 and a fixed contact 111. Each movable contact 105 is connected or connectible to a voice tongue 7-27 in the arrangement 100, according to FIGS. 1-3 over a contrivance 103, 104 functioning as a sort of transposition device and facilitating recoupling of a key 109 to different tones, which thus makes it possible for instance for an amateur to perform a piece of music in one key, wherein he finds it most easy to play. It is, namely, frequently so that an amateur may very well perform a simple melody on a keyboard, if he is permitted to play the melody in a key he is accustomed to on the keyboard of the instrument in consideration, but experiences difficulties as soon as he is called upon to play the melody in another key. If the piece of music is to be performed in ensemble playing, it may therefore be advantageous, especially for the amateur, to be able to perform a sort of transposition, so that he may recouple the instrument in such a way that different pieces of music may be played in different keys, while the player may at the same time play the piece with the keys with which he is accustomed to operate. Obviously, the arrangement 103, 104 may be readily excluded, if these adjusting facilities are considered to be unnecessary.

The fixed contacts 111 are connected over the lines 113 to the movable contacts 115 in a keynote selector consisting of a button 119 arranged on a rod 117 connected with the movable contacts 115, with the aid of which arrangement the movable contacts 115 may be connected to the corresponding fixed contacts 121. By the fact that various keynote selectors may be adapted to connect different lines 113 with different fixed contacts 121, various adjustments may be made relative to the

tone frequencies that are to be comprised in the cords being played.

The fixed contacts 121 are connected over the lines 123 to the movable contacts 125 of the harmony-selecting members 125-131 according to the invention. In FIG. 1 the components going to make up the chord-forming unit are collectively indicated by the reference numeral 401. The movable contacts 125 are connected here to a rod 127 which is adapted to be actuated by a button 129, through which the movable contact may be closed with the corresponding fixed contact 131. Each one of the fixed contacts 131 is in the embodiment shown connected to other fixed contacts with the aid of a contrivance 133, 135 or 137, which thus, each of them, mutually connect four fixed contacts 131 to means corresponding to a desired chord, which is caused to sound simultaneously with a tone selected by the key 109, in the manner set forth in the following description.

In addition to the movable contacts 105, the rod 107 for the button 109 is connected to a movable contact 153, which is connected to the movable contact 105 for a tone frequency 24, and which cooperates with a fixed contact 155, which is connected to the one input contact 157 of an amplifier 170 with a loudspeaker 171, the other input contact 159 of the amplifier being connected to earth 160. Each one of the tone frequency means 7-27 is likewise connected to earth 160.

The arrangement according to FIG. 1 functions in the following manner.

When the key 109 is depressed, the movable contacts 105 and 153 coupled to the same are closed with their corresponding fixed contacts 111 and 155, respectively. When the contacts 153 and 155 are closed, the amplifier 170 is supplied with the tone frequency from the means 24, so that the latter is reproduced in the loudspeaker. If none of the keys 119 and 129 is depressed, the tone frequency 24 will consequently be the only one that sounds. If the latter keys are depressed, the tone frequencies from the voices 16, 19 and 21 will pass over the corresponding movable contacts 105, 115, 125 of the coupling 135 and back over the movable contacts 125, 115 and 105 corresponding to the voice 24, to the line 151 and further to the amplifier 170, for which reason these frequencies will also be reproduced by the loudspeaker. Obviously, it is possible by different selections of couplings 133, 135, 137 arbitrarily to select the tones that shall sound as harmony tones of the melody tone frequency 24 corresponding to the key 109.

Each key 109 is connected to the movable contact 153 and to a number of movable contacts 105 in correspondence to the melody tone frequency arranged for the key. Because of the varying coupling by means of the couplings 133, 135 and 137, the adjacent keys 109 will attain different co-sounding chords, however. Thus the key for the adjacent lower tone 23 according to the example of this embodiment will be connected with a movable contact 105 corresponding to the voice 23, the co-sounding harmony being thus determined by the coupling 133. For the adjacent upper key 109 of the voice 25, the harmony is determined by the coupling 137. In this example of embodiment there will thus be in principle only three different chords that alternate with one another periodically, inasmuch as the chromatic scale may be regarded as being divided into four groups with three different chords within each group, said chords recurring in the various groups. Thus frequencies 24, 21, 19 and 16 are in chordal group 135.

It also appears from the circuit diagram that the tone frequency (23) located next underneath a depressed key for a melody tone frequency (the voice 24 according to FIG. 1) in the chromatic scale can never co-sound, no matter how the couplings 133-137 are carried out, inasmuch as the rod 107 is not connected to the movable contact 105 for this tone frequency (23). The intention of

this is to avoid too pronounced a discord in a chord, which may be selected at the selector switches 125-137 through a coupling that would in itself permit the tone frequency in question to be comprised in the harmony played. This, however, does not prevent the provision of a special means for connecting this tone frequency as well, if such a case would be considered desirable from a musical point of view.

In FIG. 1, each one of the couplings 133, 135, 137 unites four fixed contacts 131, for which reason the harmony reproduced, including the tone frequency 24 being played, will comprise four tone frequencies. However, the chord need not comprise four tone frequencies only, but may consist of more or fewer tone frequencies, as desired, and with respect to the selection of the harmonizing tone frequencies there are many facilities, as stated above. Thus Table I hereinbelow renders combinations of 2-, 3-, and 4-voiced chords which may be produced by corresponding selections of couplings 133-137.

Table I

Examples of chords in instruments of the type shown in FIG. 1.

Chord pattern No.	Chord No.	Tones of the chord											
		C	D \flat	D	E \flat	E	F	G \flat	G	A \flat	A	B	H
1-----	1a	X									X		
	1b		X									X	
	1c			X									X
	1d				X			X					
	1e					X			X				
	1f						X			X			
2-----	2a	X				X			X				
	2b		X					X		X			
	2c			X					X		X		
	2d				X					X		X	
3-----	3a	X				X			X		X		
	3b		X					X			X		
	3c			X					X			X	
4-----	4a	X				X			X		X		
	4b		X					X				X	
	4c			X					X				X
	4d				X					X			
5-----	5a	X			X			X			X		
	5b		X			X			X			X	
	5c			X			X			X			X
6-----	6a	X			X			X			X		
	6b		X			X			X			X	
	6c			X			X			X			X
7-----	7a	X				X			X		X		
	7b		X				X			X			X
	7c			X			X				X		

The instrument according to FIG. 1 gives the chord pattern No. 3 hereinabove.

In the above table, a few examples are given of polyphonic chords, wherein Example 1 shows how six different two-voiced chords may be provided for as many melody tones being played. For the six remaining melody tones of the chromatic scale, the chords may consist of the same tones as for the corresponding tones among the first six melody tones. The melody tone scale may therefore be regarded as being divided into two groups with six different chords in each group. Consequently, six different couplings will be required in the instrument, corresponding to the couplings 133-137 in FIG. 1. The Examples 2 and 4 show two facilities for providing 3-voiced chords. Here, the chromatic scale is divided into three groups with four different chords in each group, so that four couplings are consequently required, corresponding to 133-137 in FIG. 1. The Examples 3, 5, 6 and 7 show different possibilities for providing 4-voiced chords, wherein the couplings 133, 135 and 137 shown in FIG. 1 correspond to the Example 3.

A common feature in all of the examples in Table I is that the chromatic scale is divided into a number of

groups with corresponding chords within each group, all chords within such a group being mutually different.

Another characteristic feature according to the examples in Table I is that the chords within each such group comprise all of the twelve tones of the chromatic scale, wherein it holds true for each chord within such a group that it does not contain any tone comprised in any one of the remaining chords within the same group.

In the example of embodiment shown in FIG. 1, the chord-forming tones, pertaining to a played tone 24, are selected among the tones which with respect to their frequencies are underneath the played melody tone 24, wherein the chord-forming tones are also selected within an octave below the melody tone. This is not necessary, however, inasmuch as the chord-forming tones may be selected among tones located both above and below the played melody tone 24, and may be selected, furthermore, from tones located at a greater distance from the melody tone than by an octave.

FIG. 4 reproduces a chromatic scale from the 1-marked c to the 1-marked h together with harmonies corresponding to these tones, such as they are formed in the instrument according to the invention according to Example 3 in Table I. Here, the scale is thus divided into four groups with three different chords in each group. For the remaining examples in the table, corresponding scales may be reproduced, which may be studied, so that the player may find it easier to decide which harmony patterns he should use in different situations.

FIG. 2 shows another embodiment of an instrument according to the invention. This instrument agrees with the instrument according to FIG. 1 with respect to the tone-creating unit 109, the buttons 109, 119 and 129 and their associated contacts and connections. In this figure the components making up the chord-forming unit are collectively indicated by the reference numeral 402. The object of the embodiment according to FIG. 2 is to make it possible in various desired chords broadly to insert any tones whatsoever, which was not possible in the arrangement according to FIG. 1. For this reason, an additional field B with corresponding contacts and connections has been arranged in addition to the ordinary field A with contacts and connections for the tone selector 119 and the harmony selector 129, said additional field and their contacts and connections being coupled in a special manner. The group B has for the tone selector 119 the movable contacts 115' and the fixed contacts 121' corresponding to the contacts 115 and 121 of group A, wherein the contacts 115' are connected with the rod 117. This also holds true for the harmony selector, inasmuch as the movable contacts 125' are connected with the rod 127 and the corresponding contacts 125, besides which the contacts 131' correspond to the contacts 131. In the embodiment of FIG. 2, two harmony selector couplings 201, 203 are used. Each one of these connect four contacts 131 in the field A with one or more contacts in the field B. It appears furthermore from FIG. 2 that the fixed contact 131 corresponding to the melody tone 22 of the key 109 in the harmony selector 129 is not connected with any one of the couplings 201, 203, in contradistinction to the case in the arrangement according to FIG. 1. Consequently, the desired harmony tones will not be closed over the line 151 corresponding to the key 109, but will instead be closed over contacts and lines in the field B of the amplifier 170. This is effected by the fact that the lines 205 extending from the movable contacts 115' are each connected to an additional movable contact 207 on the rod 107 of the contact 109, which movable contact 207 cooperates with a fixed contact 209, which is connected to the line 156, which connects the previously mentioned contact 155 with one terminal 157 of the amplifier 170. From FIG. 2 it will be seen furthermore that it will be possible here to select the desired harmonies in any arbitrary way among

the contacts 131 of the harmony selector. Here, it will be possible in a harmony also to comprise such tones as are contained in other harmonies within a group of harmonies according to the description given in connection with FIG. 1. Table II hereinbelow indicates a few suitable chord patterns, that may be provided for in the pattern according to FIG. 2.

Table II

Chord pattern No.	Chord No.	Ordinary tones of the chord											Examples of additional tones					
		C	D \flat	D	E \flat	E	F	G \flat	G	A \flat	A	B	H	C \flat	G \flat	A	C	
11.....	11a	X																
	11b		X															
	11c			X														
	11d																	
	11e					X				X				X				X
	11f						X								X			
12.....	12a			X		X			X			X		X	X	X	X	
	12b		X				X			X			X	X				
13.....	13a	X																
	13b		X															
	13c			X														
14.....	14a	X			X				X									
	14b			X		X				X								
	14c		X			X												
15.....	15a			X			X				X							
	15b				X					X								
	15c		X			X								X			X	

A chromatic scale from G to G \flat with chord patterns according to table II is shown in FIG. 5.

A damping element such as a variable resistor may be connected into the circuit 211 in the arrangement according to FIG. 2, said resistor being adapted to be actuated by means of a key or a pedal. By an increase of the ohmic resistance it is then possible to reduce the sound intensity for the harmony tones pertaining to the melody tones entering over the lines 205. This may sometimes be desirable not in the least from the point of view that certain chords in a chord pattern might be less suitable in a certain connection, in which case an exchange of harmony patterns could possibly be avoided, provided the less suitable chords are made less audible.

In the arrangements according to FIGS. 1 and 2 there may be provided twelve keynote selectors 119, for the fixed contacts 121 of which there may be arranged a number of harmony selectors 129 corresponding to the number of desired harmony patterns. The keynote selectors are adapted upon depression of a corresponding key to remain in the depressed position for instance by a suitable locking mechanism, which on the other hand is obviously not the case with the remaining keys according to the figures.

FIG. 3 shows a further embodiment of an instrument according to the invention. This instrument comprises, like the previously described instruments, a set of tone-frequency-creating members 100 connected each to a movable contact 301 of a keynote selector or transposition device comprising a rod 303 with an actuating button 305 as well as fixed contacts 309 corresponding to the movable contacts. When the transposition device is to have the appearance shown in FIG. 3, twelve of them are provided, but if the transposition device is carried out in a manner corresponding to the arrangement 103 according to FIG. 1, it may be adapted to perform switching between twelve adjacent chromatic tones for each output contact.

The arrangement according to FIG. 3, in which the components going to make up the chord-forming unit are collectively indicated by the reference numeral 403, comprises a number of harmony selectors 311, each of which is adapted to form a certain harmony function for the keynote or tonic which is adjusted through the keynote selector 305. The harmony selector 311 has

movable contacts 313 connected each to a fixed contact 309 of the keynote selector 305, as well as corresponding fixed contacts 315, the movable contacts being mechanically coupled through a rod 317 having an actuating button 319 arranged thereon, whereby all contacts 313 may be closed with the fixed contacts 315 at the same time. The fixed contacts 315 are mutually coupled by

a coupling 321, which is also connected to the fixed contact 315' of a switch, the movable contact 313' of which is secured to the same rod 317 as are the movable contacts 313. The movable contact 313' is connected over the circuit 325 to the movable contact 327 of a switch, the fixed contact 329 of which is connected to the line 156 extending to the amplifier 170 in the manner illustrated in FIGS. 1 and 2. The movable contact 327 is secured to a rod 331, which is adapted to be actuated by means of the key 333 and which also governs the movable contact 335, which is connected over the line 337 to a voice corresponding to the keyboard key 333 in the set of voices 100. The contact 335 cooperates with the fixed contact 339, which is connected to the line 156.

The line 325 is connected to the movable contacts 327 of all keyboard keys, the movable contacts 335 of which are connected each to one of the voices in the set 100 or in another set of members for the creation of tone frequencies such as tone frequencies of a higher frequency than that of the corresponding set of voices, which may be assumed to comprise "bass-voices" among which harmonies are selected by the harmony-selector 319.

The number of harmony selectors may be arbitrary and can in smaller instruments be limited f.i. to 10-15, while larger instruments may comprise substantially more selectors. Here is to be remarked that against a certain harmony principal function harmonies of different types may be necessary, f.i. chords of principal form, of reversed form, fourth-sixth chords, chords with narrow position, chords with spaced position of the including tones and so on, for which reason a large number of harmony selectors may be necessary in instruments which should give wholly satisfactory possibilities of expression.

These harmony selectors may be arranged to remain in contact closing position after the depression and, moreover, may be so arranged that the depression of a harmony selector causes all others to return to resting position. By use of the instrument according to FIG. 3 the harmony selector 319 corresponding to the harmony function is depressed, which is necessary during that part of a piece of music which is just being played, the musical key selector 305 corresponding to said piece of music being then depressed. For playing the piece of

music it may be in many cases necessary to depress another musical key selector, f.i. after a modulation.

By means of a key common to all harmony selectors, the rod 332 of which is connected to a movable contact 328 coupled to the line 325, the corresponding fixed contact 330 of which is coupled to the line 156, a harmony may be established by transmission from different keys 333. This arrangement may also be applied to the formerly described embodiments, f.i. to the arrangement according to FIG. 2.

It is evident that the mutual order of the frequency members in the unit 100 may be arbitrary. It is also of course possible instead of using voices according to the twelve tone system to use voices according to any other system, for instance the quarter tone system.

In an instrument according to FIG. 3 the different harmony selecting keys may preferably be arranged such that the keys of the principal harmony functions, f.i. the tonic, the subdominant, the dominant, the tonic of the parallel musical key and so on are arranged in the middle of the field, which is formed by the different keys of the harmony selectors, while the more peripheral chords have their keys positioned further away from the middle of the field, as they as a rule are not used so often as the above-mentioned keys of the principal harmony functions.

The invention is not restricted to the shown and described embodiments, as they may be altered in many ways within the scope of the invention.

What I claim is:

1. An electrical musical instrument comprising a plurality of electrical fundamental tone-frequency generating devices of different frequencies, each of these devices having an output terminal, sound quality reproducing means including an amplifier and a loud speaker, the output terminals of said devices being selectively connectible to the input terminals of the amplifier, conductor means for completing the input circuit to the amplifier through ground, melody-selecting switch means for transmitting a selected fundamental tone frequency to the input circuit of the amplifier, and for blending therewith a plurality of melody selected fundamental tone frequencies; harmony-selecting switch means to which this plurality of melody selected fundamental tone frequencies are transmitted as input, the output of said harmony-selecting switch means constituting a chordal group frequency, which is transmitted through the melody-selecting switch means and blended with the said selected fundamental tone frequency, thereby forming the resulting melody-blended frequency which constitutes the input frequency transmitted to the amplifier; said chordal group frequency resulting from selected fundamental tone frequencies derived from the tone-frequency generating devices and blended by the melody-selecting switch means.

2. The electrical musical instrument of claim 1, where-

in the melody-selecting switch means and the harmony-selecting switch means each is constituted by banks of fixed and movable switching contacts, these contacts having prearranged connection with selected ones of frequency-transmitting circuits, said banks of movable switching contacts being provided with common rod and push-button operating means.

3. The electrical musical instrument of claim 1 wherein the harmony-selecting switch means includes additional fixed and movable contact switching means, having prearranged connection with selected ones of the various frequency-transmitting circuits, said additional switching means being operated by the rod and push-button operating means for the harmony-selecting switch means, for further modulation of the frequency of the chordal group of frequencies constituting the output frequency of the harmony selecting switch means, which resulting chordal group frequency is blended with the selected fundamental tone frequency by the melody-selecting switch means to provide the input frequency supplied to the amplifier.

4. The electrical musical instrument of claim 1, wherein preselected fundamental tone frequencies from the output terminals of the fundamental tone-frequency generating devices are transmitted over circuits which are preselected by operation of the melody-selecting switch means, for creating the input frequencies fed to the harmony-selecting switch means, and wherein a jumper circuit receives the resulting output frequency preselected by operation of the harmony-selecting switch means, which jumper circuit output frequency constitutes the chordal group frequency which ultimately is blended with the selected fundamental tone frequency by the melody-selecting switch means, thereby forming the input frequency supplied to the amplifier.

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