

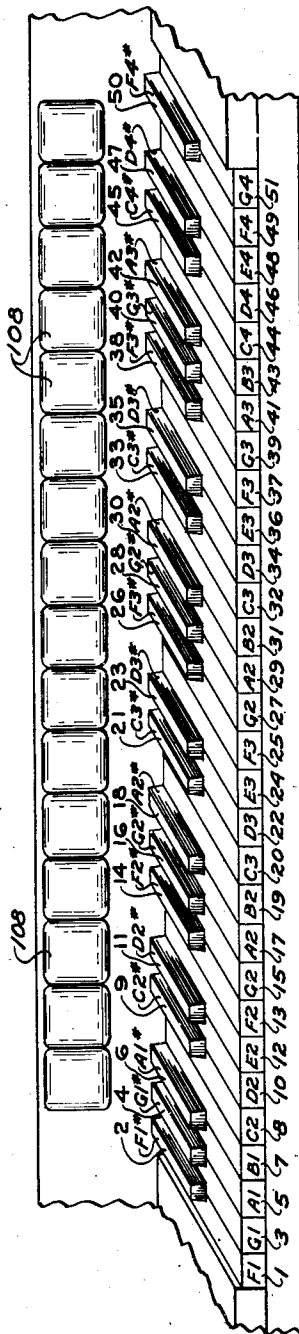
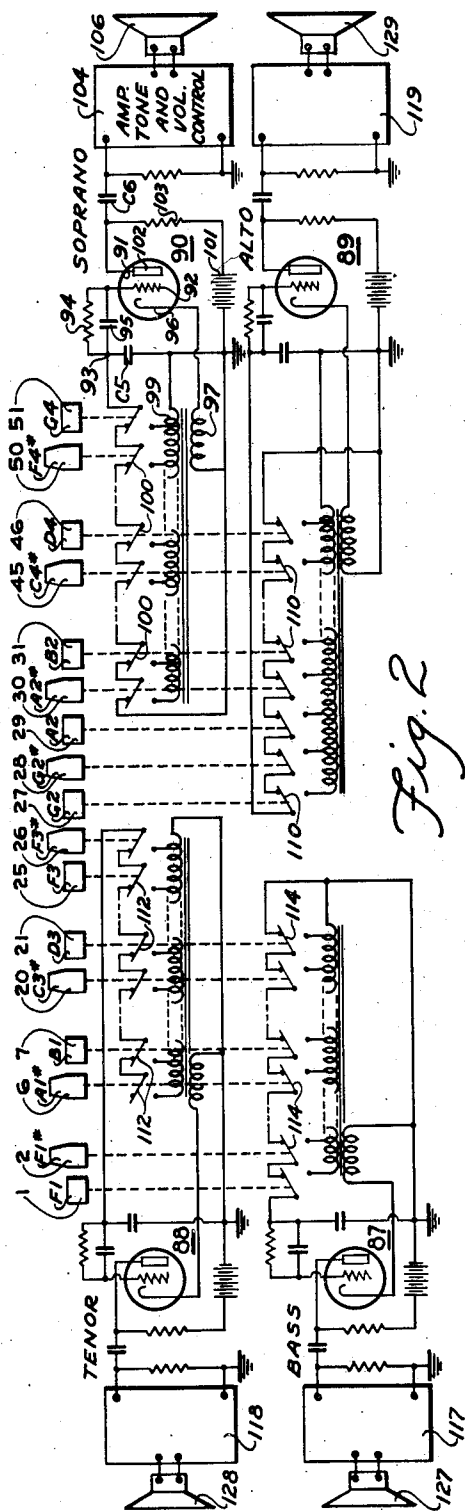
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L. HAMMOND ET AL

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ELECTRICAL MUSICAL INSTRUMENT

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Inventors
Laurens Hammond
& John M. Hartert
By Benjamin F. Hopper
Atty.

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ELECTRICAL MUSICAL INSTRUMENT

Laurens Hammond, Chicago, and John M. Hanert, Wilmette, Ill.; said Hanert assignor to Hammond Instrument Company, Chicago, Ill., a corporation of Delaware

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3 Claims. (Cl. 84—1.01)

Our invention relates generally to electrical musical instruments, and more particularly to instruments of the organ type particularly designed for the rendition of multi-part harmony music.

As more fully set forth in the co-pending application of Laurens Hammond, Serial No. 387,113, filed April 7, 1941, which has matured into Patent No. 2,274,199, dated February 24, 1942, hymns and similar multi-part harmony music may be rendered with improved results by providing an amplifier and speaker for the tones of each of the four parts, and specially separating the speakers so that singers for the various parts may be grouped about the speakers sounding their particular parts. The singers will thus be materially assisted in singing multi-part harmony.

In instruments of this character there may be provided a tone generating system for each part. Each of the tone generating systems may comprise an oscillator having its output connected to an amplifier and speaker, each oscillator being tunable to any musical note frequently within the gamut of its part.

It is an object of our invention to provide an improved keyboard arrangement and switching mechanism for controlling the various tone generating systems, or oscillators, in such manner that by depressing the keys in substantially a normal manner, the various oscillators will be tuned to the frequencies corresponding to the pitches of the notes of their respective harmony parts.

A further object is to provide a keyboard arrangement for electrical musical instruments in which the keys have the appearance of a normal standard piano keyboard arrangement, but in which some of the keys control the production of tones of the same pitch as are controlled by other keys, but emanating from different sound producing means.

A further object is to provide a unitary keyboard for an electrical musical instrument in which a part of the keyboard is adapted to control the rendition of the soprano and alto parts exclusively, while another part controls the rendition of the tenor and alto parts exclusively, of four part harmony music.

A further object is to provide an improved simplified keyboard and switching arrangement for electrical musical instruments particularly adapted for the rendition of multi-part harmony music.

Other objects will appear from the following

description, reference being had to the accompanying drawing in which:

Figure 1 is a fragmentary perspective view of the keyboard and control panel of the instrument; and

Figure 2 is a wiring diagram of representative portions of the complete instrument.

The keyboard shown in Fig. 1 is illustrated as having 51 keys 1 to 51 inclusive, which are adapted to control the production of musical tones within the range F¹—87.307 c. p. s. to G⁴—783.99 c. p. s., which has been found to be substantially the range of the singing parts in hymns and similar quartet music. From the note designations applied to the keys, it will be noted that the keys 1 to 26 inclusive control the production of notes F¹ to F³#, while keys 27 to 51 inclusive control the production of notes G² to G⁴ inclusive. Thus, a note within the range G² to F³# may be played by depression of the appropriate key within the group 15 to 26 or one within the group 27 to 38, depending upon whether such note is to be sung by the bass-tenor singers, or by the soprano-alto singers.

The manner in which the duplicate middle octave of keys is effective to accomplish the above described result will best be understood by reference to Fig. 2 which illustrates representative keys of the keyboard together with the generating systems controlled thereby.

As shown in Fig. 2, there are four oscillators 87 to 90 for the production respectively of the bass, tenor, alto and soprano parts. These oscillators are shown as of very simplified design and are intended to be representative of any suitable musical tone generating system.

The soprano oscillator 90 comprises a triode 91, the grid 92 of which is connected to a terminal 93 through a biasing resistor 94 and a condenser 95. The cathode 96 is connected to ground through a secondary winding 97 of a transformer 98. The primary 99 has one terminal thereof connected to the ground and is adapted to have a selective number of turns thereof connected to the terminal 93 upon the operation of single-pole double-throw switches 100, which are operable by keys 30 to 51 inclusive respectively.

A condenser C5 is connected between the terminal 93 and ground, and thus with the selected number of turns of the primary winding 99 forms a resonant tuning circuit of the oscillator 90. The plate circuit of the triode 91 includes a source of B current supply 101

connected to the plate 102 through a load resistor 103. The output of the oscillator 90 is supplied through a blocking condenser C6 to the input of an amplifier 104 which is connected to supply a speaker 106. The amplifier 104 may include various tone and volume control devices of any desired conventional construction. Some of these controls are adjustable and are adapted to be operated by tablets 108 (Fig. 2) positioned adjacent the keyboard for convenient operation by the player.

The switches 100 are shown as single-pole double-throw switches which, in their normal positions, form a series connection between the terminal 93 and ground, thus rendering the oscillator 90 normally non-oscillating. Upon depression of one of the keys 30 to 51, its associated switch 100 connects the terminal 93 to one of the taps of the primary winding 99, and thus connects a predetermined number of turns of the primary winding in parallel with the condenser C5 to provide the resonant circuit for the oscillator to determine its frequencies of oscillation. Due to the series connection of the switches 100, it will be apparent that if two or more keys 30 to 51 are simultaneously depressed, only the higher of the depressed keys will be effective in determining the pitch of the oscillator.

The oscillator 89 for the alto part may be identical with the oscillator 90 previously described, except for slight differences in the values of the circuit elements, and is adapted to have its frequency of oscillation controlled by keys 28 to 46 covering the range of the alto voice. These keys are adapted to operate single-pole double-throw switches 110 which are connected in series similar to the arrangement of the switches 100 except that the arrangement is such that only the lowermost of two or more simultaneously operated switches will be effective to determine the frequency to which the oscillator 89 will be tuned. Thus, if two keys within the combined soprano-alto range are simultaneously depressed, the lower of the two keys will tune the alto oscillator 89 to the frequency of the lower note, while the upper of the keys depressed will tune the soprano oscillator to the frequency corresponding to the higher of the two keys depressed, provided that the highest and lowest depressed keys are respectively in the soprano and alto ranges.

In a similar manner, keys 6 to 26 are adapted to operate single-pole double-throw switches 112 for tuning the tenor oscillator 88 to the frequency corresponding to the higher of two or more simultaneously depressed keys within this range, while the keys 1 to 21 are adapted to operate single-pole double-throw switches 114 arranged to tune the bass oscillator 87 to a frequency corresponding to (or harmonically related to) the lowermost of a plurality of keys within this range which are simultaneously depressed. It is preferable that the bass oscillator tuning system be such as will cause the sounding of a note one or two octaves lower than the indicated note designations on the keys by which it is controlled.

Thus, whenever two or more keys 1 to 26 are simultaneously depressed, the highest key will tune the tenor oscillator 88 to the corresponding frequency, while the lowest key depressed will tune the bass oscillator to the corresponding bass note frequency, provided that the highest and lowest keys depressed are respectively within the tenor and bass ranges.

The bass, tenor and alto oscillators 87, 88, 89 have their outputs connected through amplifier tone and volume control devices 117, 118, 119 to speakers 127, 128 and 129 respectively. The speakers 106, 117, 118 and 119 are preferably spacially separated so that singers for the various harmony parts may group themselves around the speakers for their respective parts, and thus be aided in singing the proper notes, as more fully described in the aforesaid application of Laurens Hammond.

In playing the instrument, the musician depresses the keys in every respect in the normal manner except that the keys corresponding to the soprano and alto parts, normally played by the right hand, are played apparently an octave higher than normal. The playing of a keyboard instrument of the piano type with the notes in the treble clef played on the keyboard an octave higher than written is very common, so that a musician apprised of the principle of operation of the keyboard has no difficulty whatsoever in playing the instrument from a conventional musical score.

Due to the keyboard and switching arrangement, the tones of the soprano part will be produced by the soprano speaker 106, while the tones for the bass, tenor, and alto parts will be produced by the speakers 127, 128 and 129 respectively. A unison tone for the soprano and alto parts will be produced by both soprano and alto speakers, while similarly, a unison tone for the tenor and bass parts will be produced by both the tenor and bass speakers.

In this respect, the instrument is unique among non-touch-responsive keyboard controlled instruments in that a unison tone sung by both the alto and soprano voices is produced by both the alto soprano speakers, and the over-all output level of the instrument is correspondingly increased. The music produced by the instrument thus corresponds very closely to the effect of the music as sung.

As has previously been mentioned, the bass oscillator 87 has its tuning system so arranged that in general it produces tone frequencies one or two octaves lower than indicated by the musical note designations on the keys. As a specific example, the bass oscillator may be arranged to sound the notes C0 to D1 when the keys bearing the note designations C2 to D3 respectively are depressed, whereas when any of the keys F1 to B1 are depressed, the tones produced will be at the pitches of the notes F0 to B0 respectively. To accomplish this result, it is merely necessary to provide only fifteen taps on the tuning inductance for the bass oscillator 87 and connect the lower contacts of the switches 114 for the keys 1 to 7 inclusive to the lower contacts for the keys 13 to 19 inclusive respectively. With this type of arrangement for the key operated switches for the bass oscillator, a deep bass tone will be produced under all circumstances so as to provide a deep full organ-like effect.

While we have shown and described a particular embodiment of our 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 more fundamental principles of the invention. We therefore desire, by the following claims, to include within the scope of our invention all such similar and modified forms of the apparatus disclosed by which substantially the results of the invention may be

obtained by substantially the same or equivalent means.

We claim:

1. In an electrical musical instrument particularly adapted for the rendition of four part 5 harmony music, the combination of tone producing systems respectively for tones of the alto and soprano parts, each of said tone producing systems including for each tone in its range a circuit having a switch when operated causes 10 its tone producing system to sound a tone corresponding to the operated switch, a first group of keys for operating said switches, some of said keys each operating switches respectively forming parts of both of said tone producing systems for controlling the operation thereof ex- 15 clusively, tone producing systems respectively for tones of the bass and tenor parts, each of the latter tone producing systems including for each tone in its range a circuit having a switch which 20 when operated causes its tone producing system to sound a tone corresponding to the operated switch, and a second group of keys for operating said latter switches, some of said keys of said second group each operating switches re- 25 spectively forming parts of said bass and tenor tone producing systems for controlling the operation thereof exclusively, said first and second groups of keys being contiguous and together forming a unitary keyboard of the piano type. 30

2. In an electrical musical instrument having a plurality of musical tone producing systems for the rendition of multi-part harmony music in which two of the parts overlap in pitch range, each of said tone producing systems including 35 circuits having switches, each of which when operated effects the production of a tone corresponding to the operated switch, a single keyboard comprising a plurality of keys in a stand-

ard piano keyboard arrangement, said keyboard providing keys in duplicate for those notes included in the range throughout which said two harmony parts overlap, and means actuated by said keys to cause operation of such of the switches of said tone producing systems as will produce musical tones corresponding in pitch to the keys depressed within the respective pitch ranges of said tone producing systems.

3. In an electrical musical instrument having musical tone generating systems of the bass, tenor, alto and soprano ranges respectively, each system including switches operable to determine the pitch of the tone produced by the system, a single keyboard for controlling the operation of said switches, said keyboard being of substantially standard piano construction formed of two sections, the first section operating switches of the soprano and alto generating systems exclusively and the second section operating switches of the bass and tenor generating systems exclusively, such of said switches as are controlled by keys of the first section causing the soprano generating system to produce a tone of a pitch corresponding to the highest of a plurality of depressed keys within the soprano range and causing the alto generating system to produce a tone of pitch corresponding to the lowest of a plurality of depressed keys within the alto range, and the switches operated by keys of the second section of said keyboard causing the tenor generating system to produce a tone of pitch corresponding to the highest of a plurality of simultaneously depressed keys in the tenor range and causing the bass generating system to produce a tone of pitch corresponding to the lowest of a plurality of depressed keys in the bass range.

LAURENS HAMMOND.
JOHN M. HANERT.