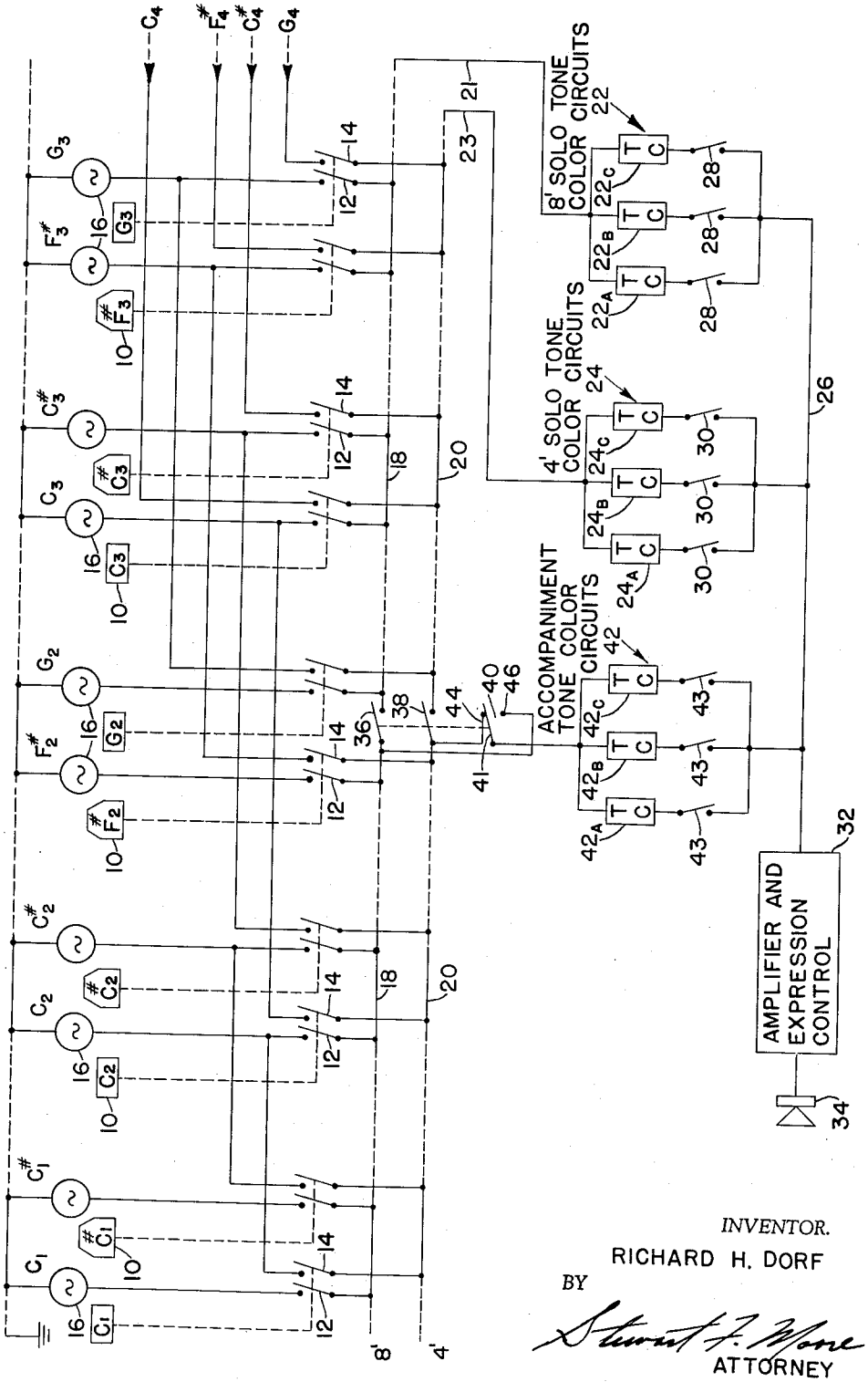
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ELECTRICAL MUSICAL INSTRUMENT

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ELECTRICAL MUSICAL INSTRUMENT

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This invention relates to electronic musical instruments and more particularly to instruments having a playing manual split into two portions, with different tone colors assigned to each portion.

Substantially all of the electronic organs being manufactured today have at least two playing keyboards or manuals. Each keyboard generally has associated therewith an independent group of stops so that a solo voice may be played on one manual and an accompaniment of a different voice played on the second manual. Most of the musical compositions generally played on electronic organs have the accompaniment part written to be played in the two octaves below middle "C" whereas the solo part is usually written to be played both in the two octaves above middle "C" and in the octave below middle "C." The "spinet" type organs with only 44 note or substantially four octave keyboards for each manual are quite suitable for playing such compositions. The accompaniment manual usually has 44 keys in order to provide for unison playing when both hands are playing notes on a single keyboard, even though only the two lower octaves are normally used.

It will be readily seen that a single playing manual would suffice if only unison playing were desired. Or, if all accompaniment music were played lower in pitch than a selected note and solo music with different tone colors were played higher in pitch than the selected note, a single manual instrument with a voicing split occurring at the selected note would provide the two manual features of a spinet-type organ. Unfortunately, many compositons have notes written for one section of the instrument, which on a split manual instrument must be played on a portion of the manual assigned to another section. The player of a split manual instrument therefore has the choice of playing the music as written and having, for example, the solo voice suddenly change into that of the accompaniment as the split point on the keyboard is traversed, or else transposing the composition into a higher key. For this reason, heretofore, single manual instruments, although economically desirable, have been musically unsatisfactory.

It is therefore an object of the invention to provide means for selectively dividing the keyboard of a single manual, electrical musical instrument normally adapted for unison playing into a solo section and an accompaniment section, each section having different tone colors, with portions of such section having playing notes of the same frequency.

It is another object of the invention to provide a keyboard type, electronic musical instrument having a single playing manual which is musically dividable into an accompaniment and solo section, each section having different groups of voices, without abrupt changes in voicing occurring within the normal frequency range of each section.

It is yet another object of the invention to provide a single manual electrical musical instrument of the split keyboard type with switch means for selectively splitting the keyboard into two frequency overlapping sections each of which is assignable to different tone colors.

These and other objects will become apparent from the following description of the invention taken in connection with the drawing in which is shown a circuit schematic,

partially in block diagram form of a portion of an electrical musical instrument incorporating the invention.

In general, the invention includes means for doubling the frequencies of tones usually associated with the accompaniment portion of a single manual instrument keyboard. Switch means are provided for both "splitting" the manual at a selected pitch and simultaneously raising the frequency of the tones selected by the accompaniment keys one octave. The accompaniment portion of the musical composition must then be played on keys positioned one octave lower than normal to establish the correct relationship between the frequency of the tones selected by the keys and the notes of the musical composition being played. An additional octave of playing keys is therefore provided at the higher frequency end of the accompaniment section before the voicing split occurs. In this manner a sufficient number of playing notes are provided in each section without resorting to the playing of notes assigned to the other section.

Referring now to the drawing, there is shown a circuit organization, partially in block schematic, of a portion of a single manual electronic organ embodying the principles of the present invention. In conventional, single manual, electronic organs as many as five octaves may be provided for the keyboard. However, in order to simplify the description of the invention, only those playing keys and associated circuitry necessary to illustrate the novel features of the invention are shown in the drawing. Thus, the lower three octaves are represented only in general by the "C" keys, with the C_1 designation indicating the lowest note on the manual, C_2 indicating the first note in the next higher octave, etc. Of course, it will be understood that the present invention is intended for use with a single manual instrument and that each note therefor has circuitry and tone generators similar to those associated with the "C" keys in the drawing.

The invention is particularly adaptable for use with instruments of the type which provide twelve master oscillators tuned to the frequencies of the notes of the highest octave and then utilize frequency dividers to provide the tone frequencies of the successively lower octaves.

Associated with playing keys **10** are key switches **12, 14** which are connected to a plurality of tone generators **16**, indicated as C_1, C_2, C_3, $C\sharp_1$, $C\sharp_2$, etc. The generators are designed to produce complex oscillations having output frequencies corresponding to the notes of a multi-octave, evenly tempered scale. Key switches **12, 14**, when actuated by pressure upon the keys **10**, connect the output tone oscillations from tone generators **16** associated with the selected keys to octavely related conductors or busses **18, 20** which are adapted to collect tones of fundamental and second harmonic pitches respectively (generally designated in organ terminology as "eight foot" and "four foot" tones), for distribution to the tone coloring circuits. While only eight and four foot tone busses are shown, it will be understood that additional key switches and tone collecting busses may be provided in a normal instrument for distributing tones having other harmonic pitches such as sixteen foot and two foot tones.

Tone collecting buss **18** is connected to tone color circuits **22** by means of a conductor **21** whereas tone collector buss **20** is connected to tone color circuits **24** by means of a conductor **23**. These tone color circuits generally designated as TC may be conventional, electrical formant filter-type circuits which are designed to represent organ stops such as the diapasons, flutes and various reed and string stops. Filters **22***a*, *b*, *c* represent the usual eight foot solo filters while filters **24***a*, *b*, *c* represent the usual four foot solo filters. Both groups are adapted to provide the solo tones for the upper or solo portion of a single keyboard type of organ. The outputs of tone color circuits **22, 24** may be selectively con-

nected to an output bus **26** by means of individually operated switches **28** and **30**, which serve as "stops" for the organ. Output bus **26** is connected to the input of an amplifier **32** provided with the usual expression control, which in turn has its output connected to a conventional sound transducer means, such as one or more loudspeakers **34**.

The solo portions of tone collecting busses **18**, **20** (the right-hand or upper portion as shown in the drawing) are connected to the accompaniment portion (left or lower portion as shown in the drawing) by means of a pair of ganged switches **36** and **38** which, when open, completely separate the tones applied to the lower and upper sections of the busses, and therefore define a "splitting point" for the single manual. Switches **36** and **38** also have ganged thereto a single-pole, double-throw twitch **40** whose movable contact arm **41** is connected to the inputs of a plurality of tone color circuits **42** which are conventional accompaniment type, formant, filters **43***a*, *b*, *c*, such as diapasons or soft flutes. These tone color circuits **42** are selectively connected to output bus **26** by means of "stop" switches **43**. The upper contact **44** of switch **40** is connected to the accompaniment side of four foot tone collecting bus **20** whereas the lower contact **46** of switch **40** is connected to the accompaniment side of eight foot tone collecting bus **18**.

When ganged switches **36**, **38**, **40** are in a closed or "unified" position, the accompaniment portions of busses **18**, **20** are respectively connected to the solo portions of the busses so that the output of every tone generator selected by operation of the manual keys **10** is fed by the busses to the same tone color circuits **22**, **24**. Closing of switches **36**, **38**, **40** places the instrument in a "unified" state, with the accompaniment section of the manual having the same tonal quality as the upper or solo section. All keys when operated now supply tones of a common harmonic designation (eight foot or four foot) to the same selected filters. Thus, irrespective of the location of a key upon the manual, all selected tones provided by tone generator **16** are supplied both to accompaniment filters **42***a*, *b*, *c* and solo filters **22***a*, *b*, *c* and **24***a*, *b*, *c*, if any of switches **43**, **28** or **30** respectively, are closed.

When switches **36**, **38**, **40** are in the upper or "non-unified" position, the two sections of busses **18**, **20** are separated at a position chosen with respect to the connections from the key switches **12**, **14** where it is desired that a split occur between the accompaniment and solo portions of the manual. In the drawing the split is shown as occurring between the connections from the F♯ and G key switches to busses **18**, **20**, in the octave immediately below middle C. Of course, the splitting position may be moved upwardly or downwardly as may be desired. However, it has been found that for most compositions, a split between F♯ and G is preferred.

When collecting busses **18**, **20** are opened by the manipulation of switches **36**, **38**, **40**, all of the four foot tones in the accompaniment section, or those which normally would sound one octave higher than usually played, are fed to the accompaniment tone color circuits **42**. Accordingly, as the player does not wish to provide an accompaniment one octave higher than normally written for a melody being played upon the upper or solo portion of the keyboard, he then moves his left hand down the keyboard one octave in order to again play the accompaniment notes in their normal frequency range. A complete octave of tone frequency overlap between the accompaniment and solo sections is therefore provided, with keys comprising this octave in each section adapted to play notes having tones of the same frequency but of different tone colors. The accompaniment section then effectively extends to F♯ above middle "C" before a split between accompaniment and solo sections of the keyboard is heard, whereas the solo section continues to extend to G below middle "C" since the frequencies of its tones remain unaffected by operation of the switches.

As the accompaniment portion of a musical composition seldom has notes written higher than F♯ above middle "C" while the solo portion of a musical composition seldom has notes written lower than G below middle "C," the split manual problem rarely, if ever, arises with the present invention.

When it is desired to play music in unison with both hands, ganged switches **36**, **38**, and **40** need only be closed so that the same tone colors are sounded by each note over the entire manual, as described above.

Although the present invention has been described as having particular utility with organs in which the tones are normally fed to octavely related collecting busses, yet it will be appreciated that it may be easily adapted to any type of keyboard operated, tone generating instrument by merely collecting and feeding octavely related tones to their respective, octavely related busses. Thus, the present invention may be utilized in cooperation with electronic organs of the type in which an individual oscillator is provided for each note and an energizing voltage for the oscillator is selectively applied by actuation of the playing keys. Furthermore, while the invention has been disclosed by means of a specific illustrative embodiment thereof, it would be obvious to those skilled in the art that other changes and modifications in the means of operation described or in the apparatus, may be made without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. In a single manual electrical musical instrument adapted for change of operation from a unified state in which all notes played are illustratively 8 foot notes to a non-unified state in which the notes played on a solo portion of said manual are said 8 foot notes while the notes played on an accompaniment portion of said manual are octavely different illustratively 4 foot notes, an output system comprising a set of audio frequency generators having output frequencies respectively corresponding to successive notes of a multioctave scale, key switches arranged to be actuated by a keyboard manual, first and second tone collecting bus bars, said key switches having a plurality of sets of contacts, one set of said keyboard contacts connecting a selected group of said generators to said first bus bar, a second set of said keyboard contacts connecting generators to said second bus bar having frequencies octavely related to said generators connected to said first bus bar, first and second switches normally closed when said instrument is in a unified state, said first and second switches being connected in series with said first and second bus bars respectively and operative to separate said bus bars into upper and lower portions at a selected position between key switch contact connections from selected adjacent notes, tone coloring output circuits connected to the upper portion of each of said bus bars, a third tone coloring circuit, a double throw switch ganged with said first and second switches for operation between two positions, a circuit connecting said third tone coloring circuit to said lower portion of said first bus bar for one position of said double throw switch, and a circuit connecting said third tone coloring circuit to said lower portion of said second bus bar for the other position of said double throw switch, whereby the notes of the lower portion of said solo section overlap the notes of upper portion of said accompaniment section when said double throw switch is in said other position.

2. In an electrical musical instrument having plural keys on a keyboard for selecting from a set of sequentially arranged sources of note frequency oscillations extending over a multioctave scale and a plurality of bus bars connectable by switches actuated by said keyboard for collecting respectively octavely related oscillations on said bus bars and also having keyboard splitting switches operable to separate each said bus bar into an upper solo portion and a lower accompaniment portion, the combination comprising octavely related solo tone color cir-

cuits having inputs respectively connected to said upper portion of said bus bars, an accompaniment tone color circuit having an input terminal, switch means operable for connecting said input terminal selectively to one of said lower portions of two of said bus bars of adjacent octaves when said busses are separated into said portions to connect said accompaniment tone color circuit to the lower of said adjacent octaves and to the other lower portions of said two bus bars when said busses are continuous to connect said accompaniment tone color circuit to the upper of said adjacent octaves, operating means for both said keyboard splitting switches and said switch

means, and output means responsive to all of said tone color circuits.

3. The invention defined in claim 2 wherein said separation occurs between selected keys adjacently disposed in the octave next below middle "C."

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