

- [54] **ELECTRONIC MUSICAL INSTRUMENT PROVIDED WITH A VOLTAGE-CONTROLLED MONOPHONIC PLAYING SECTION OPERATED BY A MANUAL OR PEDAL TONE-PLAYING SECTION**
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- [22] Filed: Nov. 1, 1974
- [21] Appl. No.: 520,129
- [30] **Foreign Application Priority Data**
Nov. 5, 1973 Japan..... 48-127143[U]
- [52] **U.S. Cl.** 84/1.17; 84/1.19; 84/1.22; 84/DIG. 20
- [51] **Int. Cl.²** G10H 1/00; G10H 5/02
- [58] **Field of Search** 84/1.01, 1.09-1.11, 84/1.13, 1.17, 1.19, 1.22, 1.24, 1.26, 1.27, DIG. 2, DIG. 8, DIG. 20

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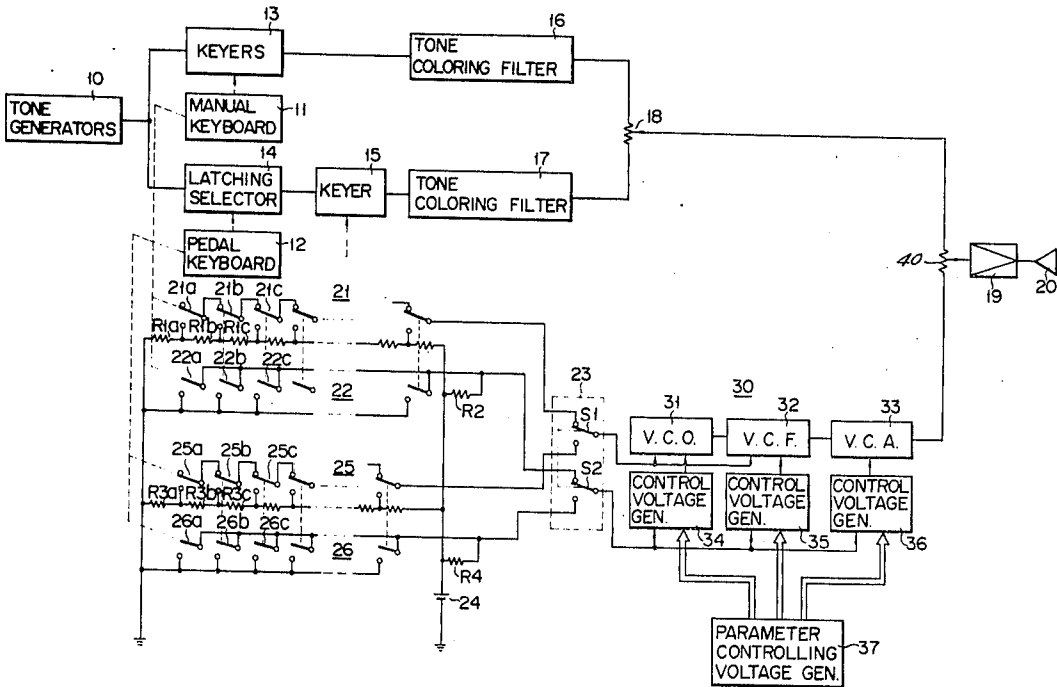
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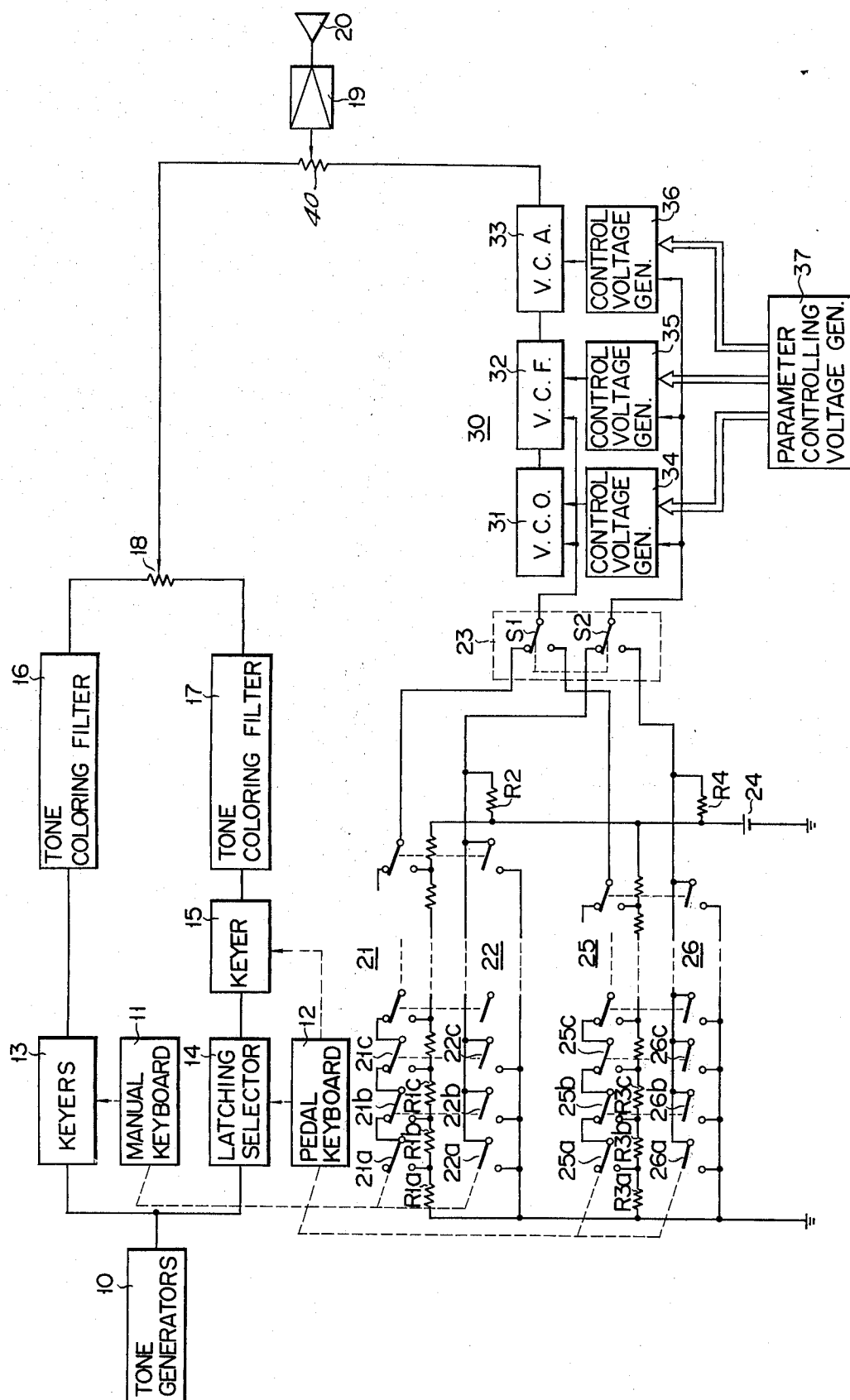
[57] **ABSTRACT**

An electronic musical instrument comprises a voltage controlled monophonic playing section as well as conventional manual and pedal tone playing sections. There are provided first and second pitch determining voltage generating circuits operatively coupled with manual and pedal keyboards respectively to generate first and second pitch determining voltage signals the amplitudes of which are functions of the notes of operated keys on the manual and pedal keyboards respectively. First and second trigger signal generating circuits are provided to produce first and second trigger signals indicative of operation of keys on the manual and pedal keyboards. A first switch is provided to selectively couple the first and second pitch determining voltages to the monophonic playing section including a voltage controlled oscillator. A second switch ganged with the first switch selectively couples the first and second trigger signals to an envelope generator for generating a control wave to control the voltage controlled oscillator.

6 Claims, 1 Drawing Figure

- [56] **References Cited**
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ELECTRONIC MUSICAL INSTRUMENT PROVIDED WITH A VOLTAGE-CONTROLLED MONOPHONIC PLAYING SECTION OPERATED BY A MANUAL OR PEDAL TONE-PLAYING SECTION

BACKGROUND OF THE INVENTION

This invention relates to an electronic musical instrument and more particularly to an electronic musical instrument, the monophonic playing section of which can be controlled during a normal performance by the manual or pedal tone playing section.

Some of the conventional electronic musical instruments are provided with a solo keyboard for a monophonic performance bearing a special tone color in addition to the upper and lower manual keyboards and the pedal keyboard. However, while a player operates the upper and lower keyboards with both of his hands, he can not play a monophonic performance. Further, the monophonic playing section having a predetermined pitch frequency range presents difficulties in carrying out a monophonic performance in a manner simulating a pedal tone performance.

SUMMARY OF THE INVENTION

The object of this invention is to provide electronic musical instruments, the monophonic playing section of which can be operated in accordance with a performance on the manual or pedal tone playing section.

According to this invention, there are provided first and second pitch determining voltage-generating circuits operatively coupled with manual and pedal keyboards of the manual and pedal tone playing sections respectively to generate pitch determining voltage signals corresponding to the notes of the depressed keys of keyboards. A first switch is provided to select and couple the first and second pitch determining voltage generating circuits to a voltage-controlled monophonic playing section, which may be provided with a voltage controlled filter and a voltage controlled amplifier as well as a voltage controlled oscillator which is supplied with the selected determining pitch voltage signal. There are further provided first and second trigger signal generating circuits respectively corresponding to the first and second pitch determining voltage generating circuits for generating trigger signals indicating the operation of any key on the manual and pedal keyboards. Output trigger signals from the first and second trigger signal generating circuits are selectively conducted through a second switch ganged with the first switch to control voltage generators for giving forth control voltage waves which are coupled to the oscillator, filter and amplifier. The control voltage wave form rises upon depression of any key on the keyboard and falls upon release of the key.

This invention enables a monophonic performance with a special tone effect to be automatically played according to the operation of keys on the manual or pedal keyboard.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE shows a block diagram of an electronic musical instrument according to one embodiment of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, reference numeral 10 denotes known tone generators provided with master oscillators and frequency dividers. The tone generators 10 produce tone signals having pitch frequencies corresponding to the notes of the keys of the manual keyboard 11 and pedal keyboard 12. Output tone signals from the tone generators 10 are applied to known keyers 13 operatively coupled with the manual keyboard 11 to selectively derive tone signals corresponding to the notes of the depressed keys on the keyboard 11. Pedal tone signals are delivered to a conventional latching selector 14 operatively coupled with the pedal keyboard 12. The latching selector 14 is stored with the note of the last depressed key on the pedal keyboard 12 and supplies a tone signal corresponding to said note to a known keyer 15 operated by the pedal keyboard 12. Tone signals selectively derived through the keyers 13 and 15 are coupled to tone coloring filters 16 and 17, respectively. Output signals from the tone coloring filters 16, 17 are transmitted to an amplifier 19 followed by a loudspeaker 20 through a mixer 18 and through a further mixer 40. The above-mentioned arrangement of the electronic musical instrument of this invention is the same as that of the prior art. Though the drawing indicates a single manual tone playing section, it is obviously possible to provide two manual tone playing sections.

According to this invention, there are provided key switches 21a, 21b, 21c . . . and 22a, 22b, 22c . . . corresponding to the keys of the manual keyboard 11. The movable contacts of the series-arranged key switches 21a, 21b, 21c . . . are successively connected to the normally closed fixed contacts of the corresponding adjacent key switches. The movable contact of a key switch positioned on the extreme right side of the manual keyboard 11, namely, corresponding to the highest note is connected to the normally closed fixed contact of a first switch S1 of a switching circuit 23 including a pair of interlockingly operated switches S1, S2 which may be disposed on the control panel of a musical instrument so as to be operated by a player. The normally open fixed contacts of the key switches are connected to contacts of resistors R1a, R1b, R1c connected in series across a power source 24 or voltage dividing points. The movable contacts of the key switches 22a, 22b, 22c are commonly connected to the normally closed fixed contact of the second switch S2 and also to the power source 24 through a resistor R2. The normally open fixed contacts of the key switches 22a, 22b, 22c are grounded. Pairs of key switches 21a-22a; 21b-22b; 21c-22c; . . . have their movable contacts changed over in operation upon depression of the corresponding keys of the manual keyboards 11 as shown by broken lines. A first key switch array including the key switches 21a, 21b, 21c . . . constitutes a first pitch determining voltage generating circuit 21 which supplies the first switch S1 with a voltage signal the amplitude of which is a function of the note of the depressed key of the manual keyboard 11. According to the illustrated embodiment, the first key switch array is of the high tone preference type, but may be of the low tone preference type. The key switches 22a, 22b, 22c . . . jointly constitute a first trigger signal generating circuit 22 for generating negative going trigger signals indica-

tive of the operation of key on the manual keyboard 11, the generation of a trigger signal continuing from key depression to key release.

Further according to this invention, there are provided key switches 25a, 25b, 25c . . . and 26a, 26b, 26c . . . corresponding to the keys of the pedal keyboard 12. The key switches 25a, 25b, 25c . . . are connected in series like the key switches 21a, 21b, 21c . . . so as to have their movable contacts connected successively to the normally closed fixed contacts of the adjacent key switches. The movable contact of a key switch positioned on the extreme right side of the series of the key switches 25a, 25b, 25c . . ., namely, corresponding to the highest note on the pedal keyboard 12 is connected to the normally open fixed contact of the first switch S1. The normally open fixed contacts of the key switches 25a, 25b, 25c are connected to the contacts of resistors R3a, R3b, R3c . . . connected in series across the power source 24, namely, voltage dividing points. The movable contacts of the key switches 26a, 26b, 26c . . . are commonly connected to the normally open fixed contact of the second switch S2 and also to the power source 24 through a resistor R4. The normally open fixed contacts of key switches 26a, 26b, 26c . . . are grounded. The movable contacts of paired key switches 25a, 26a; 25b, 26b; 25c, 26c; . . . are changed over in operation, as shown by broken lines, upon depression of the corresponding keys of the pedal keyboard 12. A third key switch array including the key switches 25a, 25b, 25c . . . constitutes a second pitch determining voltage generating circuit 25 which supplies the first switch S1 with a voltage signal the amplitude of which is a function of the note of depressed key on the pedal keyboard. A fourth key switch array including key switches 26a, 26b, 26c . . . constitutes a second trigger signal generating circuit 26 for generating a negative going trigger signal indicating the depression of key on the pedal keyboard 12, the generation of the trigger signal continuing from key depression to key release.

A voltage controlled monophonic playing section 30 is disposed on the output side of the switching circuit 23. This monophonic playing section 30 has a voltage-controlled oscillator (VCO) 31 whose input terminal is connected to the movable contact of the first switch S1. The VCO 31 generates a tone signal corresponding to the note of a depressed key on the manual or pedal keyboard 11 or 12 in response to a pitch determining voltage signal supplied from the first or second pitch voltage generating circuit 21 or 25 through the first switch S1. A pitch determining voltage signal is supplied also to VCF 32 to determine the cut-off frequency thereof. Namely, VCF 32 comes to have a cut-off frequency which corresponds to the note of a depressed key. An output signal from the VCO 31 is supplied to the input terminal of a voltage controlled filter (VCF) 32, the output terminal of which is connected to the input terminal of a voltage-controlled amplifier (VCA) 33. The output terminal of the VCA 33 is connected to the input terminal of the amplifier 19 through mixer 40.

The movable contact of the second switch S2 is connected to control voltage generators or envelope generators 34, 35, 36 for VCO 31, VCF 32, VCA 33 respectively. The envelope generators 34, 35, 36 generate known control waves rising upon depression of a key on the keyboard and decaying upon release thereof in response to the trigger signal drawn out of the first or

second trigger signal generator through the second switch S2. The VCO 31 modulates the frequency of the produced tone signal in response to the control wave from the envelope generator 34. The cutoff frequency of the VCF 32 varies with the control voltage applied. In the VCF 32, the control wave from the envelope generator 35 is mixed with the pitch determining voltage signal supplied from the first switch S1, thereby causing the cutoff frequency of the VCF 32 to correspond to the amplitude of the pitch determining voltage applied or the note of depressed key. The VCA 33 supplies a tone signal delivered to the amplifier 19 with an envelope corresponding to the control waveform from the envelope generator 36.

The above-mentioned VCO 31, VCF 32, VCA 33 and envelope generators 34, 35, 36 may be of the conventional arrangement as disclosed in U.S. Pat. No. 3,886,836. The control wave may have various voltage controlled parameters such as a length of time required for the control wave to rise from the level of key depression to an attack level, namely, an attack time; the attack level; a length of time required for the control wave to decay from the attack level to a sustain level, namely, a first decay time; the sustain level; and a length of time required for the control wave to decay from the level of key release to the original level, namely, a second decay time. These parameters may advisably be controlled by parameter controlling voltage signals from parameter-controlling voltage generators 37, which may consist of a power source and a plurality of potentiometers connected across the power source as disclosed in U.S. Pat. No. 3,886,836. The respective envelope generators 34-36 are supplied with parameter controlling voltage signals for varying the above-mentioned parameters through the sliding arms of the potentiometers of generators 37 which are arranged on the control panel of an electronic musical instrument and controlled by a player. In this case, each parameter of the control wave varies with the amplitude of a parameter controlling voltage signal.

The electronic musical instrument of this invention arranged as described above can produce a monophonic performance with a special tone effect by a player's change over operation of the switches S1, S2 included in the switching circuit 23 so as to automatically actuate the voltage controlled playing section simultaneously with a performance on the manual or pedal keyboard 11 or 12. If an electronic musical instrument comprising upper and lower manual keyboards is provided with a third pitch voltage generating circuit and a third trigger signal generating circuit with the first and second switches S1, S2 of the switching circuit 23 formed of triple-throw switches, then it is possible to carry out a monophonic performance even when both upper and lower manual keyboards 11 are operated at the same time. Further, if the key controlled voltage dividing circuit 25 is so arranged as to cause the VCO 31 to produce a bass tone upon receipt of a pitch determining voltage signal from the circuit 25, then a bass tone monophonic performance can be played.

What is claimed is:

1. An electronic musical instrument comprising:
 - a manual keyboard having a plurality of keys;
 - a pedal keyboard having a plurality of keys;
 - a manual tone playing section including tone generators, first keyer means coupled to said tone generators and operatively coupled with said manual key-

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board, and first tone coloring filter means coupled to said first keyer means;

a pedal tone playing section including tone generators, second keyer means coupled to said tone generators and operatively coupled with said pedal keyboard, and second tone coloring filter means coupled to said second keyer means;

first key controlled variable voltage source means operatively coupled with said manual keyboard for developing at a single output terminal thereof a first pitch determining voltage signal the amplitude of which is a function of the note of an operated key on said manual keyboard;

second key controlled variable voltage source means operatively coupled with said pedal keyboard for developing at a single output terminal thereof a second pitch determining voltage signal the amplitude of which is a function of the note of an operated key on said pedal keyboard;

a voltage controlled playing section including a voltage controlled oscillating means responsive to a pitch determining voltage signal for generating a tone signal the pitch of which is a function of the amplitude of the pitch determining voltage signal;

switch means coupled between said first and second key controlled voltage source means and said voltage controlled playing section and including a first switch for selectively coupling outputs of said first and second key controlled voltage source means to said voltage controlled oscillating means; and

sound reproducing means coupled to the outputs of said tone coloring filter means of said manual and pedal playing sections and to a tone signal output of said voltage controlled playing section.

2. An electronic musical instrument according to claim 1 further comprising first trigger signal generating means operatively coupled with said manual keyboard for generating a first trigger signal indicative of operation of a key on said manual keyboard; second trigger signal generating means operatively coupled

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with said pedal keyboard for generating a second trigger signal indicative of operation of a key on said pedal keyboard; and wherein said voltage controlled playing section comprises first control wave generating means coupled to said voltage controlled oscillating means and responsive to a trigger signal for generating a control wave for said voltage controlled oscillating means; and said switch means comprises a second switch ganged with said first switch for selectively coupling the first and second trigger signals to said first control wave generating means.

3. An electronic musical instrument according to claim 2 wherein said voltage controlled playing section further comprises voltage controlled filter means coupled to said voltage controlled oscillating means; and second control wave generating means coupled to said voltage controlled filter means and responsive to the trigger signal derived from said second switch for generating a control wave for said voltage controlled filter means.

4. An electronic musical instrument according to claim 3 wherein said voltage controlled playing section further comprises voltage controlled amplifying means coupled to said voltage controlled filter means; and third control wave generating means coupled to said voltage controlled amplifying means and responsive to the trigger signal derived from said second switch for generating a third control wave for said voltage controlled amplifying means.

5. An electronic musical instrument according to claim 4 wherein said sound reproducing means is coupled to the output of said voltage controlled amplifying means.

6. An electronic musical instrument according to claim 1 comprising a mixing means coupling said outputs of said manual and playing sections and said output of said voltage controlled playing section to said sound reproducing means.

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