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 [33] **Japan**
 [31] **43/71863**

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[54] **METHOD AND SYSTEM FOR GENERATING TREMOLO EFFECTS IN ELECTRONIC MUSICAL INSTRUMENTS**
6 Claims, 5 Drawing Figs.

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 [51] Int. Cl..... G10h 1/04
 [50] Field of Search..... 84/1.25, 1.01, 1.24

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ABSTRACT: In an electronic organ having plain keys, tremolo effects or mandolin effects are obtained by a system which comprises a pulse-generating circuit of such construction as to detect lateral movements of the playing keys and produce a detected signal in accordance with the lateral movement, which pulse generating circuit further frequency-multiplies the detected signal and shapes the frequency-multiplied signal into a pulse, which circuit further includes a conversion circuit wherein the waveform of the pulse is converted into a desired form, and an amplitude-modulation circuit wherein the amplitude of a musical signal delivered by the manipulation of the playing keys is modulated in accordance with the waveform pulse. With this system, tremolo effects or mandolin effects are obtained by the lateral manipulation of the playing keys.

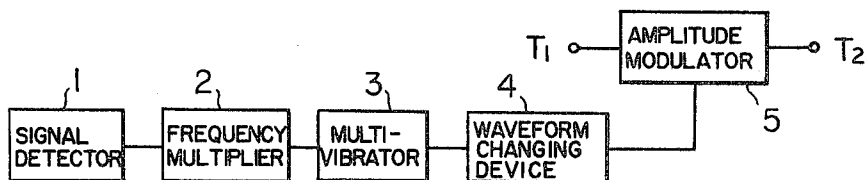
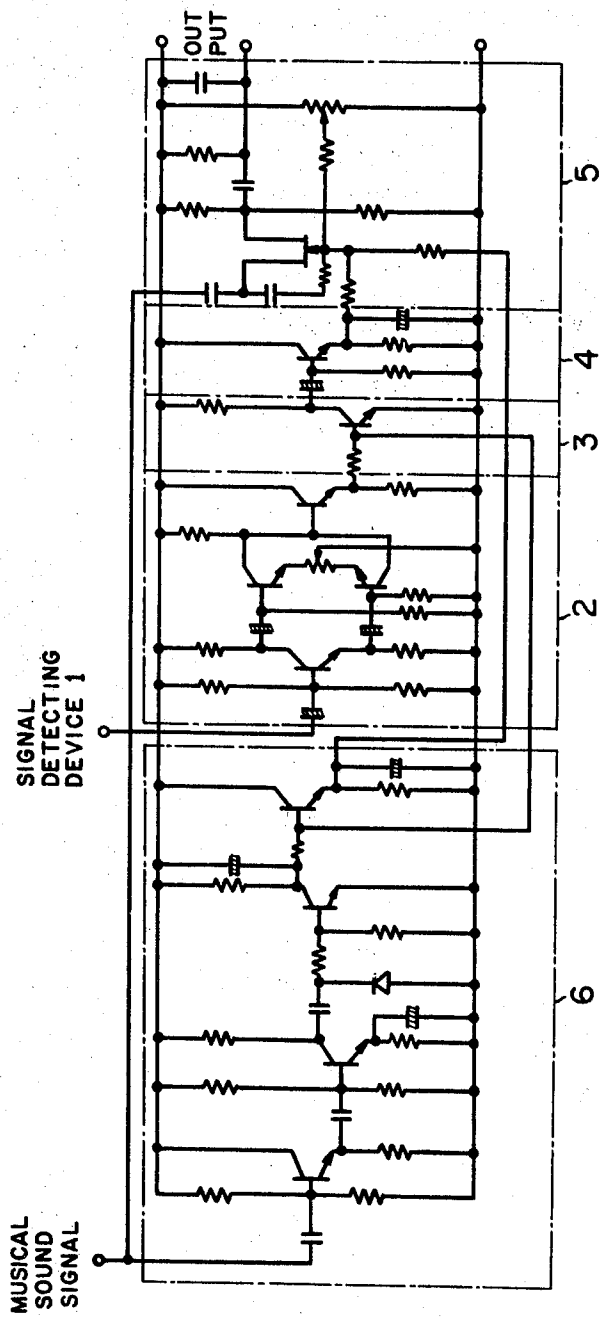


FIG. 5



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FIG. 1

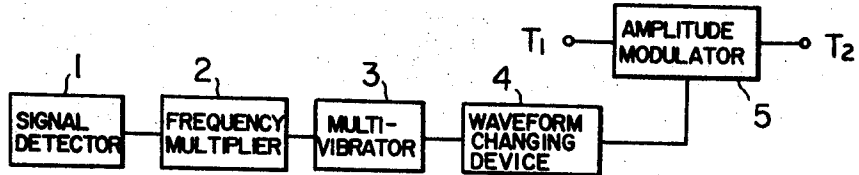


FIG. 2

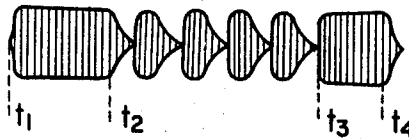


FIG. 3

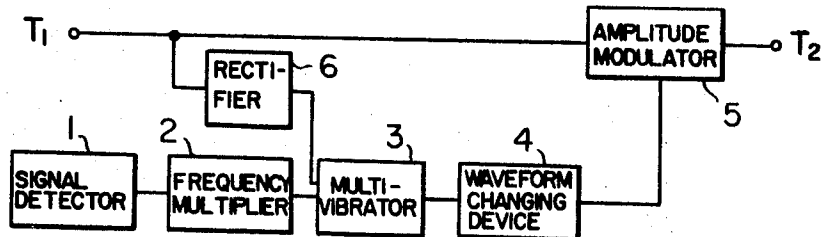
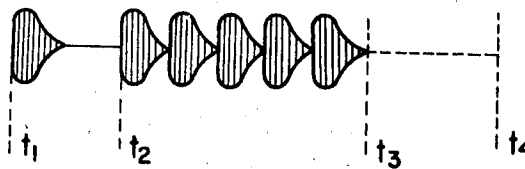


FIG. 4



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METHOD AND SYSTEM FOR GENERATING TREMOLO EFFECTS IN ELECTRONIC MUSICAL INSTRUMENTS

BACKGROUND OF THE INVENTION

This invention relates generally to electronic musical instruments, and more particularly to a new method and system for generating tremolo effects in electronic musical instruments in which the lateral (left-and-right as viewed by the player) movements of keys are detected as electrical signals by means of photoelectric element or the like, and amplitude modulation is thereby accomplished with these signals.

Tremolo effects (or mandolin effects) in an electronic musical keyboard instrument are ordinarily obtained by amplitude modulation of musical tone signals with ultralow frequency signals of from 12 to 13 Hz. However, in none of the heretofore proposed electronic musical instruments could the modulation frequency be varied freely during musical performance in accordance with musical tempo or some other musical characteristic.

SUMMARY OF THE INVENTION

Therefore, the principal object of the present invention is to provide a novel method and system for generating tremolo effects in electronic musical instruments wherein the signal frequency for generating tremolo effects can be freely controlled as desired by the player.

Another object of the present invention is to provide a novel method and system for generating tremolo effects or mandolin effects as desired which is simple in construction and economical in production.

Still another object of the present invention is to provide a novel method and system for generating tremolo effects which have frequencies multiplied by a certain factor to the frequencies of lateral movements of keys.

These and other objects of the present invention may be accomplished by a novel method and system for realizing the method which is characterized in that an electric signal created by the lateral movements of keys is applied to a pulse generating circuit, the waveform of the pulse obtained from the pulse generating circuit is converted to a desired form in a waveform conversion circuit, and a musical tone signal is amplitude-modulated in accordance with the output of the waveform conversion circuit so that a musical tone having a desired tremolo envelope can be obtained.

The nature, principle, and utility of the invention will be made more apparent by the following description when read in conjunction with the accompanying drawings, in which like parts are designated by like reference numerals and characters.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a block diagram indicating an example of tremolo effect generating method and system according to the present invention;

FIG. 2 is graphical representation indicating an output signal with an envelope, obtained from the output terminal of the system indicated in FIG. 1;

FIG. 3 is a block diagram indicating another example of the tremolo effect generating method and system according to the invention; and

FIG. 4 is a graphical representation indicating an output signal having an envelope, obtained from the output terminal of the system indicated in FIG. 3.

FIG. 5 is embodying circuit of the block diagram shown in FIG. 3.

DETAILED DESCRIPTION

In general, strings of a mandolin are made of several pairs of strings, each pair consisting of two similar strings adjacent each other. As result, a slow reciprocal movement of fingers

on a pair of strings generates sound four times and a fast reciprocal movement of fingers on the above-mentioned strings generates sound substantially two times. In the present method and system in an electronic musical instrument, musical sounds are generated twice or four times in case of a lateral movement of the player's fingers on a key of the instrument.

Referring now to FIG. 1 showing a block diagram of an example of the tremolo effect generating method and system according to the present invention, there is provided a signal detecting device 1 which detects a lateral minute vibration of each key (not shown) of an electronic musical instrument and converts the vibration into an electric signal. The signal detecting device 1 is composed of a transducer element such as a photoelectric element, and the electric signal thus obtained is thereafter sent to a frequency multiplying circuit 2 for obtaining an output frequency two or four times higher than that of the original signal.

The output signal from the frequency multiplying circuit 2 in turn operates a monostable multivibrator 3 serving as a pulse shaper so that a pulse signal is obtained from the output terminal of the multivibrator 3. In this case, the multivibrator 3 can be replaced to a clipper. The signal-detecting device 1, the frequency-multiplying circuit 2, and the pulse-shaper 3, constitute a pulse-generating circuit. The waveform of the pulse signal obtained from the monostable multivibrator 3 is then converted in a waveform conversion circuit 4 into a sinusoidal waveform when a tremolo effect is desired, and into a sawtooth waveform when a mandolin effect is desired.

The output signal from the waveform conversion circuit 4 is applied to an amplitude modulator 5. Thus, a music tone arriving at the incoming terminal T_1 is amplitude modulated with the output signal from the waveform conversion circuit 4, and the thus modulated tremolo (or mandolin effect) output is delivered from the output terminal T_2 .

FIG. 2 shows a waveform (envelope) of the musical tone obtained from the output terminal T_2 of the amplitude modulator 5. It is seen that generation of a musical sound of a constant amplitude is started when the key is depressed at an instant t_1 , a tremolo effect is caused at a time instant t_2 when the fingers of the player are moved laterally, the tremolo effect stops at a time t_3 when the stopping the lateral movement of the player's fingers, and the player's fingers are detached at a time t_4 .

In FIG. 3 showing another example of the tremolo effect generating method and system according to the present invention, wherein like members are designated by like reference numerals, there is further provided a rectifying circuit 6 which rectifies the musical sound signals delivered by the manipulation of the playing keys and applied to the input terminal T_1 and a rectified output of the rectifying circuit 6 is applied to the monostable multivibrator 3. To other input terminal of the monostable multivibrator 3, there is applied, as in the case of the system shown in FIG. 1, a signal obtained from the lateral movement detecting device 1, and the frequency of this signal is multiplied in the frequency multiplying device 2.

The output of the monostable multivibrator 3 is then subjected to a waveform conversion in the waveform conversion circuit 4, and the output signal thus obtained is applied to the amplitude modulator 5. It is seen a difference between FIG. 1 and FIG. 3 in a point that an musical signals applied to the input terminal T_1 are passed through the amplitude modulator 5 only when the output signal from the monostable multivibrator 3 is applied to the amplitude modulator 5. Thus, from the output terminal T_2 , musical sounds with accompanying tremolo (or the mandolin) effects are obtained.

FIG. 4 shows an output waveform of musical sounds having an envelope formed in accordance with the method and the system indicated in FIG. 3.

When key is depressed at a time t_1 , the monostable multivibrator 3 is operated by the musical signal applied to the input terminal T_1 , generating a single percussive tone signal which is not followed by an continuous signal. Then, at a time t_2 , if the fingers are moved laterally while the key is held in the

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depressed condition, the output signal from the lateral movement detector will operate the monostable multivibrator 3, and the musical signal will be vibrated at a frequency corresponding to twice or four times of the original frequency of the lateral movement of the fingers. At a time t_3 , the generation of the musical sound is stopped by stopping the lateral movement of the fingers, and at a time t_4 the player's fingers are detached from the key.

In the case illustrated in FIG. 3, it can be played so as to repeat only a percussive tone signal as designated by t_1 .

With the above described arrangement, the playing of the musical instrument creates an auditory sensation substantially similar to that produced by actual playing of a mandolin.

By the organization of the present invention as described above, the frequency of tremolo effects (or mandolin effects) can be controlled in accordance with the desire of the player becomes a value equal to the product of the frequency of the lateral movement of the fingers and a predetermined member.

I claim:

1. A method of generating tremolo effects in an electronic musical instrument having keys which key musical sounds when manipulated, said method comprising the steps of generating an electric signal by lateral movement of each of said keys, and applying said signal to a pulse-generating circuit, converting the waveform of the resulting output signal from said pulse-generating circuit, and amplitude-modulating a musical sound signal with the thus converted output signal.

2. A system for generating tremolo effects in an electronic musical instrument having keys which key musical sounds when actuated, said system comprising a pulse-generating circuit including means generating an electric signal by lateral

movement of each of said keys, a conversion circuit means wherein the waveform of the resulting generated output signal from said pulse-generating circuit is converted to a desired form, and an amplitude-modulation circuit means wherein the amplitude of a musical sound signal is modulated in accordance with the resulting output of said waveform conversion circuit.

3. A system for generating tremolo effects in an electronic musical instrument having keys, comprising a pulse generating circuit to which an electric signal created by lateral movement of each of said keys is applied, a conversion circuit for converting the wave form of the resulting output signal from said pulse generating circuit to a desired form, an amplitude-modulation circuit for modulating the amplitude of a musical sound signal in accordance with the resulting output of said waveform conversion circuit, and a rectifying circuit for rectifying said musical signal and applying the thus rectified output to said pulse generating circuit.

4. A method of generating tremolo effects in an electronic musical instrument having keys for keying musical sounds when actuated, said method comprising the steps of generating an electric signal by lateral movement of each of the keys, frequency-multiplying the generated electric signal, shaping the multiplied signal, converting the waveform of the resulting shaped signal, and amplitude-modulating a musical sound signal with the converted signal.

5. A method as claimed in claim 4, wherein said generated electric signal is multiplied by a factor of 2.

6. A method as claimed in claim 4, wherein said generated electric signal is multiplied by a factor of 4.

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