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SHIGEAKI MABUCHI
APPARATUS FOR PRODUCING PEDAL SOUNDS IN ELECTRIC
MUSICAL INSTRUMENTS
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3,189,674

Fig. 1.

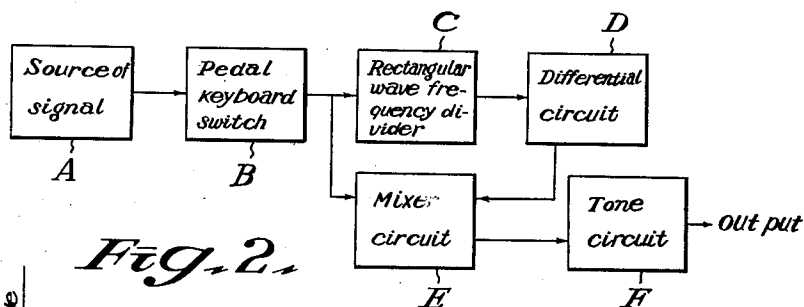


Fig. 2.

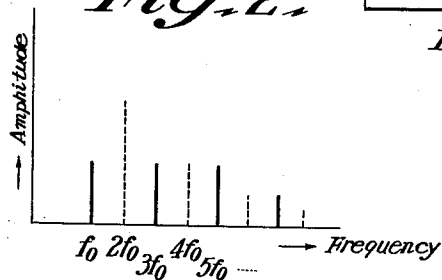
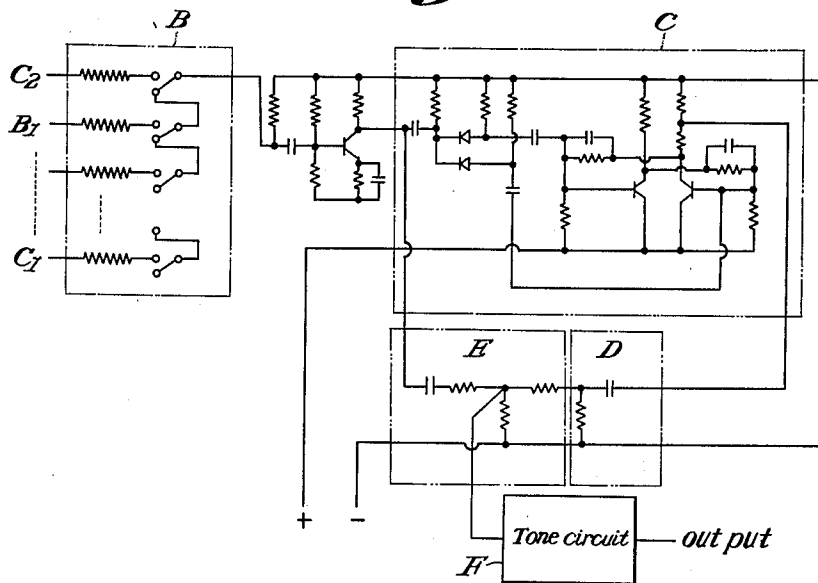


Fig. 3.



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APPARATUS FOR PRODUCING PEDAL SOUNDS IN ELECTRIC MUSICAL INSTRUMENTS

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2 Claims. (Cl. 84—1.17)

My invention relates to a method of and apparatus for producing pedal sounds in electric musical instruments.

Generally, pedal keyboard sounds of electric musical instruments have low frequency, so that loudspeakers are liable to be overloaded, or it is required to decrease the overall sound level of the musical instrument. If one were to try to faithfully produce sounds, it would be uneconomical because very large amplifiers and loudspeakers would be required.

One object of the present invention is to provide a novel method of producing pedal sounds in electric musical instruments which can eliminate the above disadvantages.

A further object of the present invention is to provide a new and improved apparatus for producing pedal sounds in electric musical instruments, which can greatly decrease the load on the amplifier and, moreover, is of excellent characteristics and is economical.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The invention itself, however, as to its organization together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing, in which:

FIG. 1 shows a block diagram of an apparatus for producing pedal sounds in accordance with the present invention;

FIG. 2 shows a chart of frequency analysis, for describing the principle of the present invention;

FIG. 3 is a connection diagram showing the detail of portions B, C, D and E of FIG. 1.

Generally stated, the present invention is practiced by utilizing a flip-flop type or astable-multivibrator type frequency divider having an output of rectangular wave form which is rich in odd higher harmonics as the frequency divider for pedal sounds operating at a sound level which is higher by one octave. If desired, the frequency divider may be arranged in such a manner that higher harmonics which are distributed as shown by full lines in FIG. 2 by using a differential circuit and higher harmonic components having proper amplitude and shown by dotted lines in FIG. 2 are mixed therewith to make the second and third higher harmonics of frequencies $2f_0$ and $3f_0$ stronger than the fundamental component of frequency f_0 . Furthermore, when the mode of producing higher harmonics by means of a tone circuit, it is able to impress the fundamental sound to listeners by the second and third higher harmonic components of frequencies $2f_0$ and $3f_0$, without introducing the fundamental fre-

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quency component (f_0) hearing of which by ear is very difficult into the speaker; said introduction causing overload of the speaker. In extreme conditions, a suitable filter may be used to reduce the component of frequency f_0 to substantially zero to obtain similar results.

Furthermore, the pedal sound is usually composed of a single sound. Accordingly, if the circuit is constructed so that the input signal to the frequency divider can be changed from one sound to the other sound, only one circuit may be used without providing a number of frequency dividers for each tone. This system is economically advantageous, and furthermore the source of the audio signal for any one note or key oscillates at a frequency twice that represented by the note or key.

Referring to FIGS. 1 and 3, the device A, B, C, D, E and F represent, respectively, a source of signal having a frequency higher by one octave (i.e. hand operated keyboard signal), a pedal keyboard switch, a rectangular wave frequency divider, a differential circuit, a mixer circuit, and a tone circuit.

The operation of the embodiment of FIG. 3 is as follows.

Signals C_1 and C_2 for keyboards having a frequency higher by one octave are changed over by the pedal keyboard switch B which is constructed in such a manner that only the signal having higher frequency is admitted even when keys for two tones are depressed simultaneously. This signal is supplied to the flip-flop circuit C after being amplified. Since the wave form of this output is rectangular, it is passed through the differential circuit D and mixed with an amplified input wave to the flip-flop circuit, in the mixer circuit E at a ratio of 1 to 2. The output from the mixer circuit E is passed through the tone circuit F which consists essentially of a low pass filter to obtain pedal sounds having the characteristics as described above.

Thus, the present invention can greatly decrease the load imposed upon the loudspeaker or amplifier and can provide a novel method of and apparatus for producing pedal sounds in electric musical instruments, which are economical and yet have excellent characteristics.

In accordance with the provisions of the patent law, I have explained the principle and operation of my invention and have illustrated and described what I consider to represent the best embodiment thereof. However, I desire to have it understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

What I claim is:

1. In an electrical musical instrument, an arrangement for producing pedal sounds, comprising in combination, a source of signals for keyboard; pedals designed to provide a sound of a certain frequency, each of the signals of said source corresponding to one of said pedals but being at a frequency one octave higher than that which said pedal is to provide; a rectangular wave frequency divider, the input side of which is connected to said source; a pedal switch between said frequency divider and said source;

a mixer circuit, the input side of which is connected to the output side of said switch and the output side of said frequency divider so as to mix the signal from said source with the output of said frequency divider.

2. A device as claimed in claim 1, including a differential circuit coupled to the output of said frequency divider, said mixer circuit mixing said signal from said source with the output of said differential circuit, and a tone circuit connected to the output side of said mixer circuit.

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