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[54] **PLURAL KEYBOARD ELECTRONIC MUSICAL INSTRUMENT WITH BALANCER AND REVERBERATION ARRANGEMENT**
10 Claims, 4 Drawing Figs.

[52] U.S. Cl. **84/1.17,**
84/1.24
 [51] Int. Cl. **G10h 1/02**
 [50] Field of Search **84/1.01,**
1.17, 1.24, 1.27, (B,M,R,K)

ABSTRACT: In an electronic musical instrument including two keyboard sections, signals from each section are supplied to a first balancer circuit which controls the proportion of signal intensities which appear at two lines each corresponding to each of the sections, then the signals of the two lines are on the one hand mixed directly and on the other hand fed to a second balancer circuit which mixing the two signals further controls the mixing proportion and in turn fed to a reverberation device, and the directly mixed signal and the output signal from the reverberation device are mixed and supplied to the following stage of the circuit.

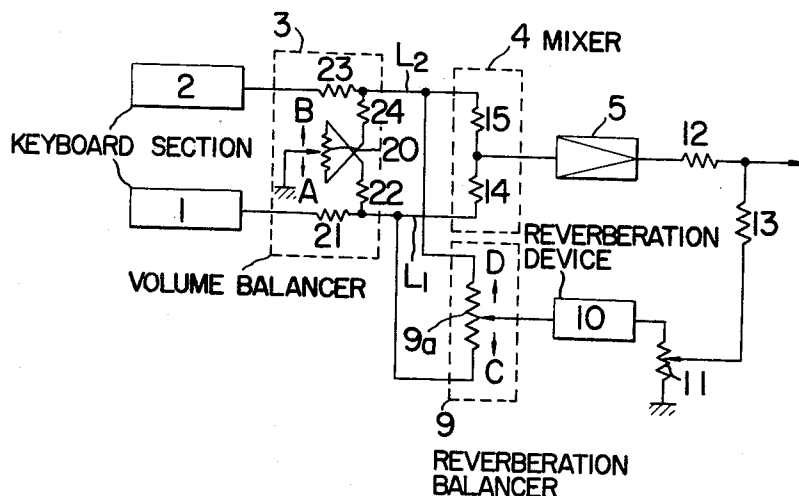


FIG. 1

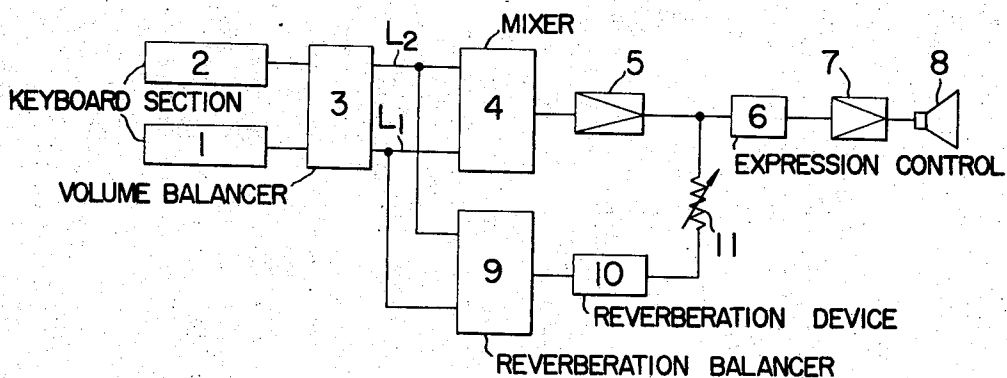
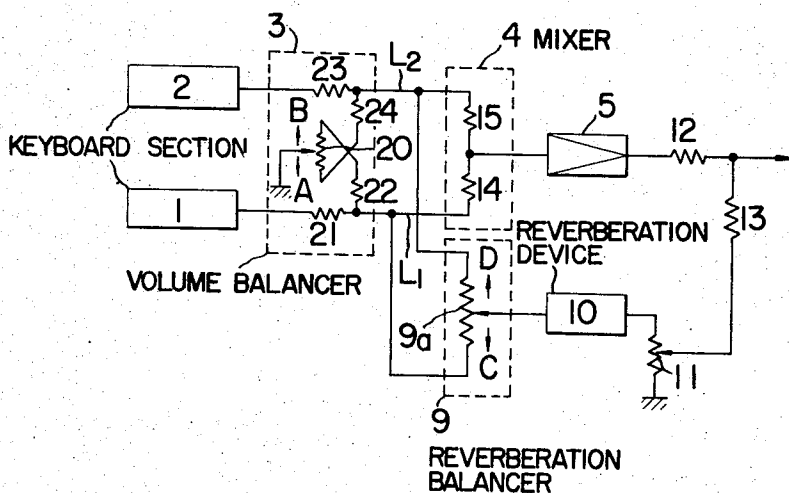


FIG. 2



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FIG. 3

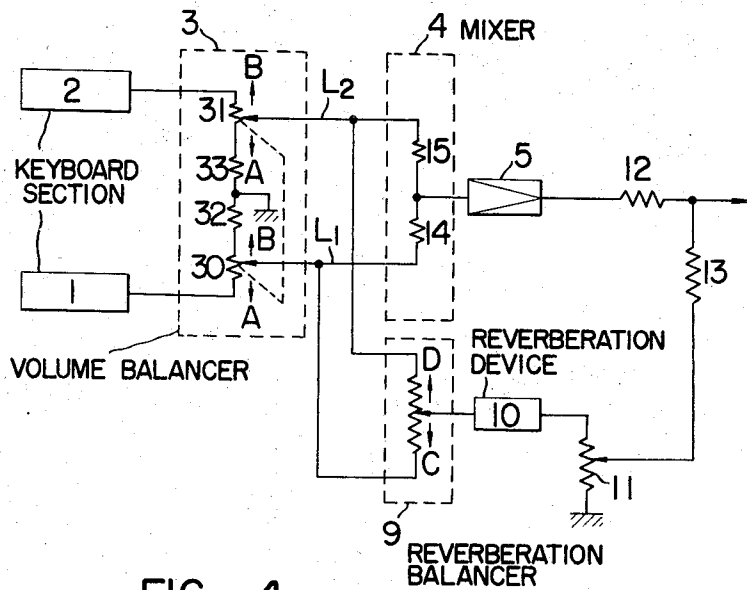
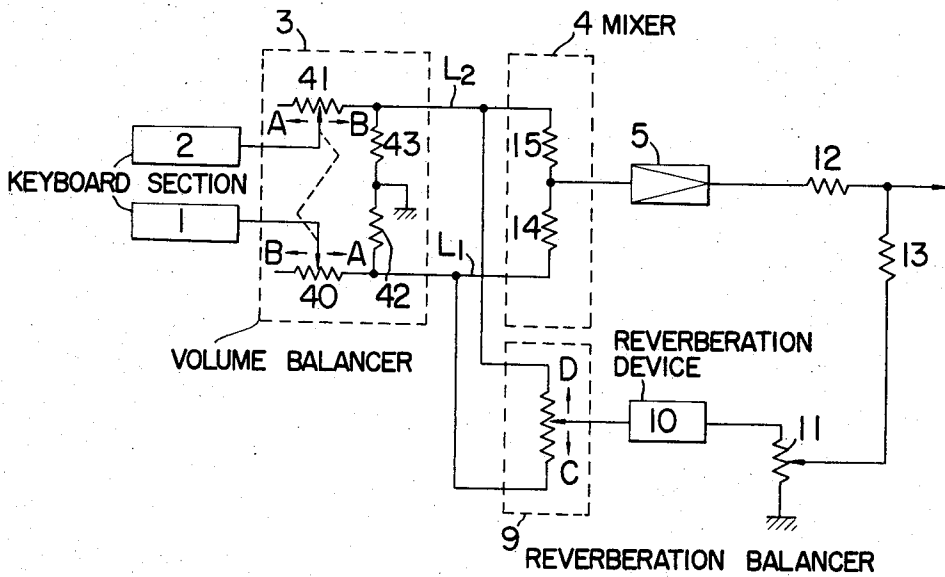


FIG. 4



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PLURAL KEYBOARD ELECTRONIC MUSICAL INSTRUMENT WITH BALANCER AND REVERBERATION ARRANGEMENT

BACKGROUND OF THE INVENTION

The present invention relates to a balancer arrangement for electronic musical instruments.

The present invention relates to a balancer arrangement in an electronic musical instrument having two keyboard sections and a reverberation device.

An electronic musical instrument, generally, has two keyboard sections, e.g. a lower manual section and an upper manual section or a single manual which is divided into two sections of a left half and a right half, and in addition is provided with a reverberation device to obtain the effect of auditorium music. On such an instrument, a melody is usually played by one of the two keyboard sections and an accompaniment by the other keyboard section. The conventional instrument is therefore provided with a volume balancers for controlling the mixing proportion (volume balance) of the signals from the one keyboard section and the other keyboard section to maintain proper balance of melody tones and accompaniment tones, but is not provided with means for controlling the mutual proportion (reverberation balance) of the reverberation time of the signals from the one keyboard section and that of the signals from the other.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved balancer arrangement for an electronic musical instrument having two keyboard sections, in which a reverberation device is utilized to give reverberation effects to both keyboard section signals and the mutual proportion of the reverberation times of both keyboard section signals is controlled as desired by the instrument player.

The foregoing object and other objects, as well as the characteristic features of the invention, will be described hereinafter in conjunction with the accompanying drawings, in which the same or equivalent members are designated by the same reference numerals and characters.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic block diagram of an electronic musical instrument provided with the balancer arrangement of the present invention, and

FIGS. 2 to 4 are circuit diagrams showing, respectively, different embodiments of a balancer arrangement according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

According to the present invention an electronic musical instrument comprises, as shown in FIG. 1, two keyboard sections 1 and 2 each including tone generators, keying circuits and tone filters, means 3 to control the volume balance of the signals from said two keyboard sections respectively appearing at lines L_1 and L_2 , means 4 to mix the signals on L_1 and L_2 , an amplifier 5, an expression control 6, a power amplifier 7 and a speaker 8 as a direct (nonreverberatory) signal path and, in addition, means 9 to mix the signals from the lines L_1 and L_2 and simultaneously to control the mixing proportion of said two signals, a reverberation device 10 which usually consists of a drive amplifier, a reverberation unit of coil springs and a pickup amplifier to produce a reverberatory signal and a volume control 11 as a reverberatory path, the reverberatory signal being admixed to the direct signal. In the present invention, the most characteristic feature is that the signals from the two keyboard sections 1 and 2 are respectively led to two separate lines L_1 and L_2 with the signal proportion being controlled by a volume balancer 3 before mixing and these once-volume-balance-controlled signals on L_1 and L_2 are led to a further balancer, i.e. a reverberation balancer 9 where the two signals are mixed and the mixing proportion is further con-

trolled and then fed to the reverberation device 10. By the manipulation of the reverberation balancer it is selected which keyboard section has how much longer reverberation time of the signal than the other, which means a reverberation balance. The reverberation time is determined by the ratio of the intensity of the reverberatory signal to that of the nonreverberatory signal. By the manipulation of the volume balancer it is selected which keyboard section has now much louder signal, which means a volume balance. In this case, the volume balancer controls the relative intensities of the signals on lines L_1 and L_2 which are respectively supplied to both nonreverberatory circuit (mixer 4) and reverberation circuit (reverberation balancer 9) simultaneously, and therefore it does not influence the reverberation time of the resultant signal of each keyboard section. The volume balancer controls only the volume balance and the reverberation balancer controls only the reverberation balance.

Hereinafter the description is made according to preferred embodiments of this invention. Needless to say, the instrument includes other necessary devices such as a vibrato effect producing device or other sections such as a pedal section as in the conventional instrument.

Referring to FIG. 2, the instrument comprises lower and upper keyboard sections 1 and 2, a volume balancer 3 consisting of resistors 21 and 23 which are respectively connected between the output sides of the keyboard sections and the lines L_1 and L_2 and of resistors 20 (variable), 22 and 24 which are connected between lines L_1 and L_2 , a reverberation balancer 9 consisting of a variable resistor 9a connected also between the lines L_1 and L_2 , a reverberation device 10 the input side of which is connected to a movable contact of the variable resistor 9a, a mixer 4 consisting of resistors 14 and 15 which are connected in series to each other between the lines L_1 and L_2 , an amplifier 5 the input side of which is connected to connection point between resistors 14 and 15, a variable resistor 11 connected between the output side of the reverberation device 10 and a ground, and resistors 12 and 13 connected between the output side of the amplifier 5 and a movable contact of the variable resistor 11. The connection point between the resistors 12 and 13 is connected to a next stage, e.g. an expression control 6 as shown in FIG. 1.

In the instrument of FIG. 2, the variable resistor 20 operates to adjust volume balance, thereby to adjust relative quantities of the tone signals produced, respectively, by the lower and upper keyboard sections. That is, the intensity of the tone signal from the lower keyboard section 1 appearing at the line L_1 becomes progressively greater depending upon adjustment of the movable contact of the variable resistor 20 towards the direction of the arrow A. On the other hand, at this time the intensity of the tone signal from the upper keyboard section 2 appearing at the line L_2 becomes smaller. Furthermore, when the movable contact of the variable resistor 20 is adjusted toward the direction of the arrow B, the intensity relation becomes the reverse of that described above, with the tone signal produced by the lower keyboard section and led to the line L_1 becoming smaller and the tone signal produced by the upper keyboard section and led to the line L_2 becoming larger. Accordingly, irrespective of the fact that the produced tone is a reverberatory tone or a nonreverberatory tone it is possible to determine the volume proportion of the lower and upper keyboard tones by adjusting the movable contact of the variable resistor 20. In this case the nonreverberatory tones are introduced, in the state mixed through the resistors 14 and 15, into the succeeding stage, so that the mixing proportion between the lower keyboard tone and the upper keyboard tone which are nonreverberatory tones can be determined by adjusting the variable resistor 20.

Furthermore, since the variable resistor 9a operates as a reverberation balancer, the more the movable contact of the resistor 9a is adjusted toward the direction of the arrow C, the more the tone signal which has appeared on the line L_1 and introduced into the reverberation device 10 through the resistor 9a increases, and the tone signal which has appeared on the

line L_2 and introduced into said device 10 decreases. Accordingly, a substantial part of the lower keyboard tone becomes a reverberatory tone and a substantial part of the upper keyboard tone becomes a nonreverberatory tone because of the fact that a substantial part of the keyboard signal produced by the upper keyboard section and passing through the line L_2 is introduced into the amplifier 5 through the resistor 15. If the movable contact of the variable resistor 9a is adjusted toward the direction of the arrow D, the operation becomes the reverse, whereby a substantial part of the lower keyboard tone becomes a nonreverberatory tone and that of the upper keyboard tone becomes a reverberatory tone.

Now, for example, when the movable contact of the variable resistor 9a is set at a desired position, and the movable contact of the variable resistor 20 is adjusted toward the direction of the arrows A or B, the tone signal appearing on the line L_1 is increased or decreased and that appearing on the line L_2 is decreased or increased in response to this. In this case, in connection with each of the tone signals appearing on the lines L_1 and L_2 , quantities of the signals divided into the amplifier 5 and reverberation device 10 are previously determined by values of the resistors 14, 15 and position of the movable contact of the variable resistor 9a, so that the ratio of the reverberatory tone to the nonreverberatory tone (this determines the reverberation time length) produced by the lower keyboard and the ratio of those produced by the upper keyboard are maintained, respectively, at certain constant values.

Furthermore if, in reverse, the movable contact of the variable resistor 20 is set at a certain desired position and the volume ration between the tones produced respectively by the lower and upper keyboard sections is set at a specific value, it will be possible to increase and decrease the quantity of the reverberatory tone produced by the lower keyboard section and to decrease and increase the quantity of the reverberatory tone produced by the upper keyboard section, depending upon the position to which the movable contact of the variable resistor 9a is moved, whereby the reverberatory effect due to either keyboard section can be emphasized.

The embodiment of the invention shown in FIG. 3 differs from that shown in FIG. 2 in that volume balance adjustment is carried out by means of two variable resistors 30 and 31. Referring to FIG. 3, the movable contacts of the variable resistors 30 and 31 are constructed so that they are jointly concurrently adjusted toward the direction of arrow A or B and are respectively connected to the lines L_1 and L_2 thereby varying the resistance between one line and its electrical ground return inversely relative to the resistance between the other line and its respective electrical return. In this example also, as in the case of the example of FIG. 2, the more the movable contacts of the resistors 30 and 31 are adjusted toward the direction of the arrow A, the more the tone signal appearing on the line L_1 increases, and that appearing on the line L_2 decreases. If this adjustment is carried out in reverse, the operation is reversed. The other functions are the same as those of the example of FIG. 2.

The other embodiment of the invention shown in FIG. 4 differs from that of FIG. 2 in only the organization of the volume balancer. That is, variable resistors 40 and 41 are provided and their movable contacts are respectively connected to the output sides of the lower and upper keyboard sections. One of the two terminals of each of the variable resistors 40 and 41 is opened and, between the other terminals of these resistors, resistors 42 and 43 are connected in series. The junction between the resistors 42 and 43 is grounded; the connection point of the resistors 40 and 42 is connected to the line L_1 ; the connection point of the resistors 41 and 43 to the line L_2 ; and a reverberation balancer 9 is connected between the lines L_1 and L_2 . The other circuit composition of the example of FIG. 4 is the same as that of FIG. 2. In the example of FIG. 4, also, the movable contacts of the resistors 40 and 41 are jointly concurrently adjusted, as in the case of the example of FIG. 3, to in-

versely vary the respective effective resistance of the resistors 40 and 41, and if these movable contacts are adjusted toward the direction of arrow A, the tone signal appearing on the line L_1 increases and that appearing on the line L_2 decreases. Of course, when adjustment of the movable contacts of the resistors 40 and 41 is carried out in reverse, the operation becomes reverse.

According to the present invention, as will be understood from the foregoing description in connection with the embodiments thereof as illustrated in FIGS. 2, 3, and 4, it is possible to carry out, individually and irrespective of other adjustments, relative adjustment of volumes of the tone signals produced by the lower and upper keyboard sections and adjustment of relative reverberation time lengths between the lower keyboard tones and the upper keyboard tones, and to maintain the ratio of the reverberatory tone to the nonreverberatory tone of each of the lower and upper keyboard tones at an almost constant value in the course of the volume adjustment, so that the volume can be freely adjusted in a state wherein a desirable reverberatory effect is retained.

I claim:

1. In an electronic musical instrument having at least two keyboard sections; a balancer arrangement comprising in combination, means for respectively leading signals from said keyboard sections to corresponding two lines and controlling relative intensities of said signals on said two lines, means for mixing said signals to obtain a first mixed signal, means for mixing the signals from said two lines and controlling a mixing proportion thereof to obtain a second mixed signal, a reverberation device which receives said second mixed signal and produces a reverberatory signal, and means for translating said first mixed signal and said reverberatory signal into sounds.

2. In an electronic musical instrument as set forth in claim 1, a balancer wherein said means for mixing and controlling the mixing proportion of the signals from said two lines in a second mixed signal comprises a reverberation balancing resistance connected between said two lines with means for variably connecting said reverberation device to said reverberation balancing resistance for varying the resistance between each respective line and said variable connection inversely relative to the proportion of the signal from the respective line in said second mixed signals.

3. In an electronic musical instrument as set forth in claim 1, a balancer wherein said means for controlling relative signal intensities on said two lines comprises an interconnection therebetween including a variable resistance means connected between said two lines and inversely variably connected between both of said lines and the electrical return therefor with a minimum fixed resistance between each respective line and its electrical return.

4. In an electronic musical instrument as set forth in claim 3, a balancer wherein said means for mixing and controlling the mixing proportion of the signals from said two lines in a second mixed signal comprises a reverberation balancing resistance connected between said two lines with means for variably connecting said reverberation device to said reverberation balancing resistance for varying the resistance between each respective line and said variable connection inversely relative to the proportion of the signal from the respective line in said second mixed signal.

5. In an electronic musical instrument as set forth in claim 1, variable resistance means connecting the output of said reverberation device to the input of said translating means.

6. In an electronic musical instrument as set forth in claim 1, a balancer wherein said means for controlling relative signal intensities on said two lines comprises an interconnection between said means leading signals from said keyboard sections including a separate resistance connected between each keyboard section output and the electrical return therefor with each line connected to its respective resistance by a resistance variable connector, said resistance variable connectors being constructed concurrently adjustable for varying the

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resistance between one line and its electrical return inversely relative to the resistance between the other line and its respective electrical return.

7. In an electronic musical instrument as set forth in claim 6, a balancer wherein said means for mixing and controlling the mixing proportion of the signals from said two lines in a second mixed signal comprises a reverberation balancing resistance connected between said two lines with means for variably connecting said reverberation device to said reverberation balancing resistance for varying the resistance between each respective line and said variable connection inversely relative to the proportion of the signal from the respective line in said second mixed signal.

8. In an electronic musical instrument as set forth in claim 1,

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a balancer wherein said means for controlling relative signal intensities on said two lines comprises a separate variable resistance in said means leading signals from each respective keyboard section and being constructed concurrently inversely variable.

9. In an electronic musical instrument as set forth in claim 8, wherein said signal intensity control means includes a separate resistance connected between the output of each of said variable resistances and the electrical return for the respective line.

10. In an electronic musical instrument as set forth in claim 9, variable resistance means connecting the output of said reverberation device to the input of said translating means.

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