

[54] **ELECTRONIC MUSICAL INSTRUMENT
 WITH BUILT-IN TAPE RECORDER**

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 179/100.1 A, 100.1 PS, 100.2**

[56] **References Cited**

UNITED STATES PATENTS

3,562,397	2/1971	Uchiyama et al.	84/1.02
3,011,378	12/1961	Hurvitz	84/1.02
3,197,543	7/1965	Williams	84/1.28
3,257,493	6/1966	Hurvitz	84/1.02

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[57] **ABSTRACT**

A multichannel tape recorder and variously selectable switches on its recording and reproducing sides are connectable between each of keyboard circuits and the audio amplifier of an electronic musical instrument, whereby a large variety of operations and utilizations of the combination of the instrument and the tape recorder are afforded.

5 Claims, 4 Drawing Figures

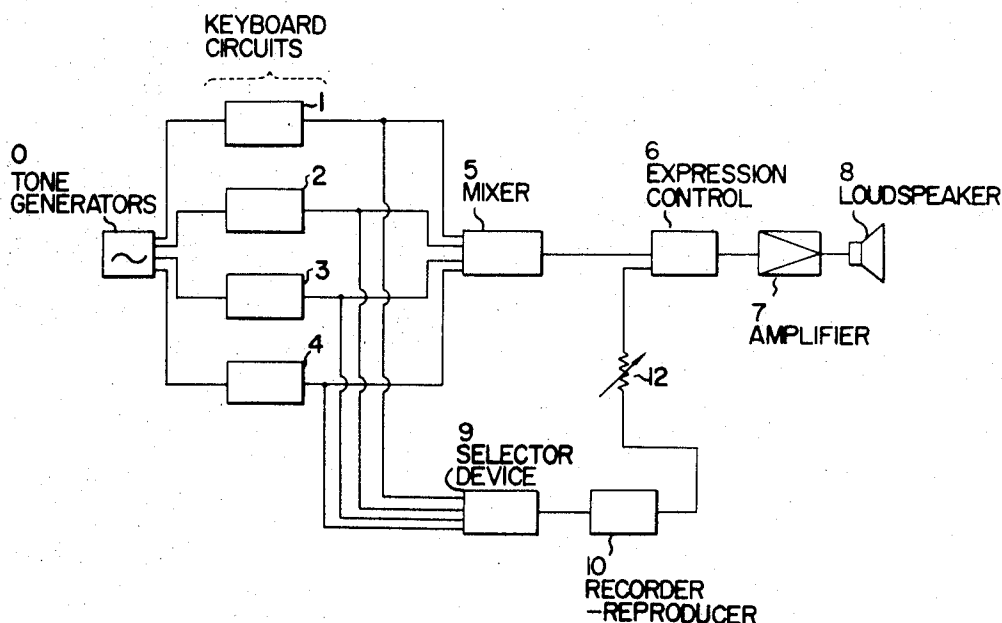


FIG. 1

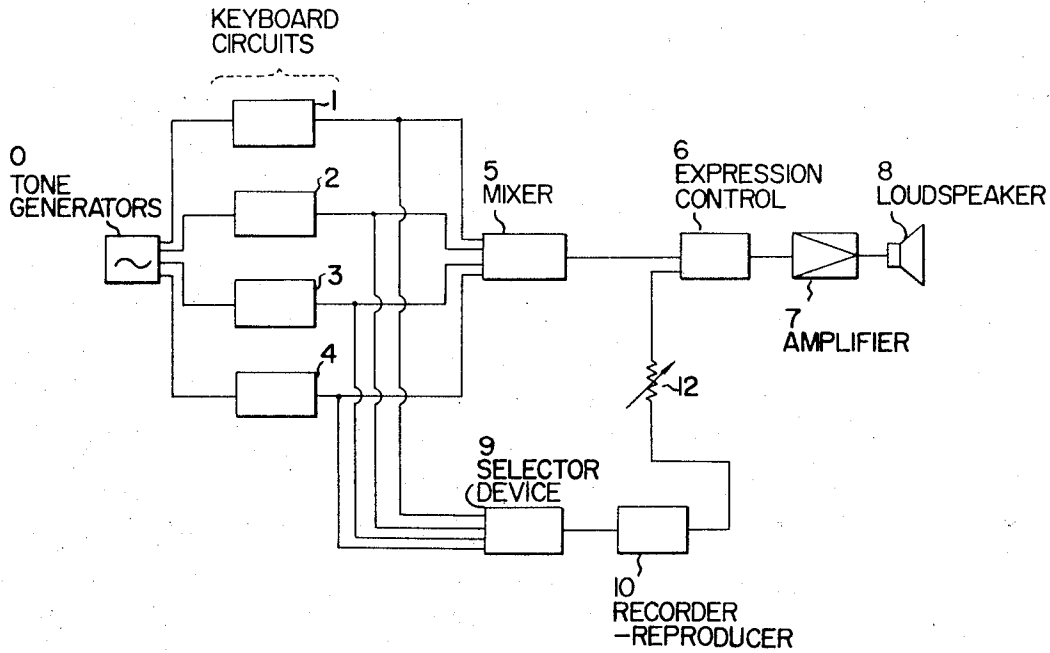
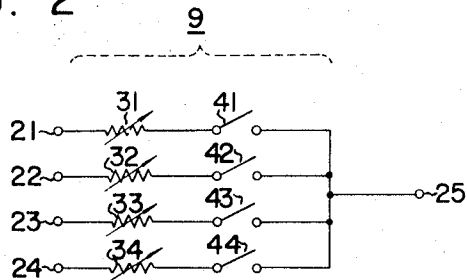


FIG. 2



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FIG. 3

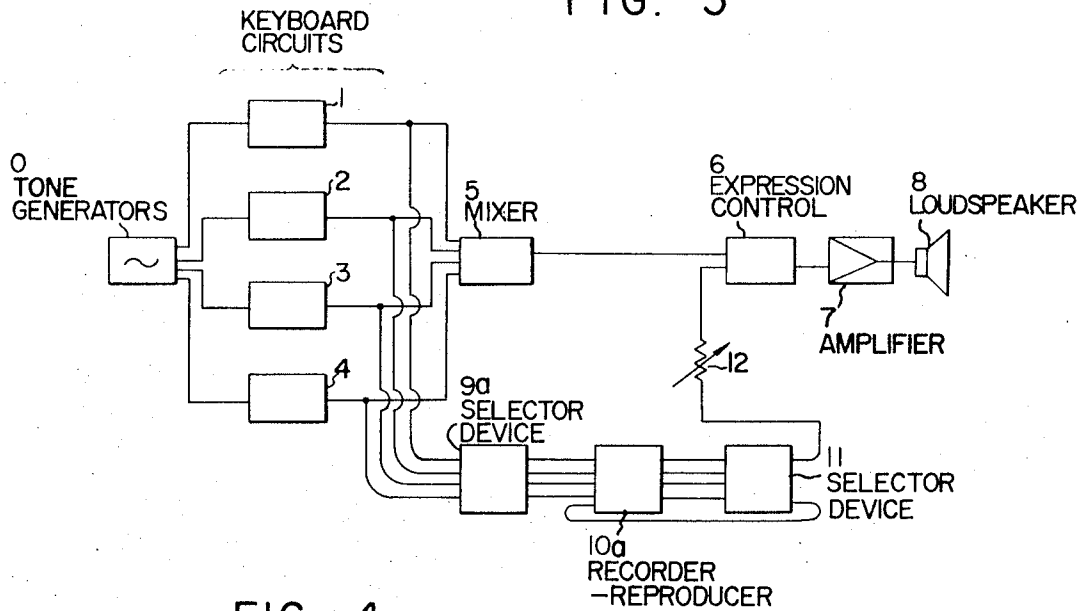
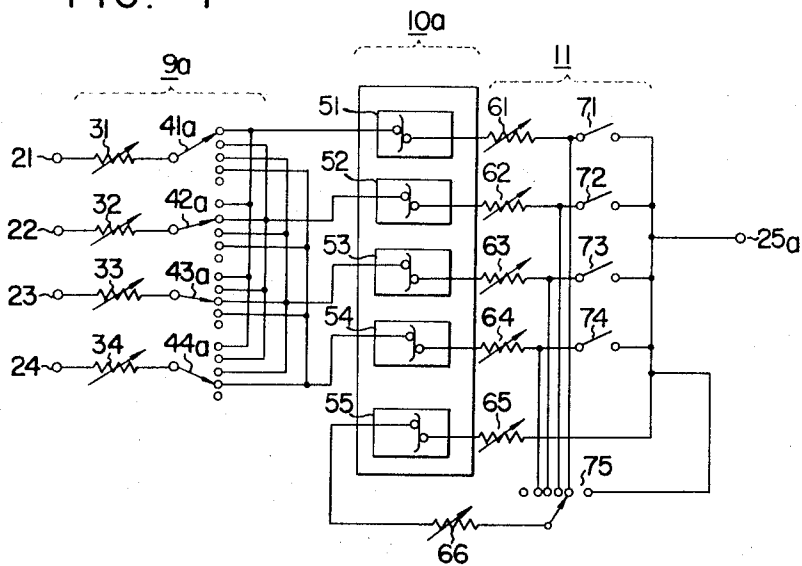


FIG. 4



ELECTRONIC MUSICAL INSTRUMENT WITH BUILT-IN TAPE RECORDER

BACKGROUND OF THE INVENTION

This invention relates generally to the field of electronic musical instruments and to the field of magnetic sound recording and reproducing devices.

Heretofore, there have been no electronic musical instruments, as far as we are aware, which are provided with "built-in" magnetic sound recording-reproducing devices (hereinafter referred to as "tape recorders"). Accordingly, in order to record a musical rendition played on an electronic musical instrument, it has been the practice in each instance to bring together the musical instrument and a separate tape recorder and to record the musical rendition as a combination of tones of the various keyboards of the electronic musical instrument, the recorded music being reproduced by the tape recorder through its loudspeaker.

Such a practice is mere recording and reproducing completed music and, moreover, entails difficulties in preparation and operation. Such a practice may be satisfactory for mere appreciative listening to reproductions of recorded music or for simultaneous playing of the electronic musical instrument or some other musical instrument as the recorded music is reproduced, but when it is desired to use the separate tape recorder for practice in playing the electronic musical instrument, inconveniences such as the following are encountered.

For example, when the accompaniment in a musical piece is to be practiced, only the melody is recorded previously, and playing of the accompaniment is practiced as the melody thus recorded is being reproduced. In this case, however, if only the melody is played on the instrument in order to obtain a recording of only the melody, the rhythm tends to become unstable, and a correct musical rendition cannot be accurately recorded.

SUMMARY OF THE INVENTION

It is an object of the present invention to overcome the above described deficiency by providing an electronic musical instrument of the type having plurality of keyboards and associated circuits such as keying circuits and filter circuits, in which instrument at least one selector device and a tape recorder are connectable between each of the keyboard circuits and the audio amplifier of the musical instrument.

A feature of the musical instrument of the invention is that the tones produced on each of the keyboards can be selected singly or in combinations by one selector device and recorded to be subsequently reproduced through the expression control the amplifier and loudspeaker of the musical instrument.

According to the present invention, briefly summarized, there is provided an electronic musical instrument of the type having a plurality of keyboard circuits for producing respective keyboard signals and having at least an expression control, an amplifier and a loudspeaker for rendering the keyboard signals as audible sound, characterized by the combination therein and therewith of selector means for selecting desired single signals and combinations of signals from the keyboard circuits and a tape recorder for recording signals thus selected and for reproducing signals thus recorded and transmitting the same through the amplifier and loud-

speaker of the instrument thereby to render the signals thus recorded and reproduced as audible sound.

According to the invention, in another aspect thereof, the tape recorder in the above described combination is a multichannel tape recorder, and selector means are also provided to select signals and combinations of signals reproduced by the tape recorder.

The nature, details, and utility of the invention will be more clearly apparent from the following detailed description with respect to preferred embodiments of the invention, when read in conjunction with the accompanying drawings, in which like parts are designated by like reference numerals.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a block diagram showing the essential organization of one example of an electronic musical instrument constituting an embodiment of the invention;

FIG. 2 is an electrical connection diagram showing one example of organization of the selector device of the instrument illustrated in FIG. 1;

FIG. 3 is a block diagram showing the essential organization of another example of an electronic musical instrument according to the invention; and

FIG. 4 is an electrical connection diagram showing one example of organization of the selector devices and tape recorder device of the instrument illustrated in FIG. 3.

DETAILED DESCRIPTION

Referring first to FIG. 1, the example of an electronic musical instrument according to the invention shown therein has tone generators 0 for transmitting tone signals through switches and filters provided within keyboard circuits 1, 2, 3, and 4 to a mixer 5. The resulting combined output of the mixer 5 is passed through an expression control 6, amplified by an amplifier 7, and radiated as sound by a loudspeaker 8. The parts of the instrument as described are of known organization and operation.

In accordance with the invention, in this example, a selector device 9 and a tape recorder 10 are provided on the output sides of all keyboard circuits of the above described electronic musical instrument so that tones from the keyboard circuits can be selected or combined as desired and recorded. In addition, the output (reproduction) side of the tape recorder 10 is connected through a variable resistor 12 for output adjustment to the aforementioned expression control 6.

The tone signals from the keyboard circuits, that is, upper keyboard tones from the upper keyboard circuit 1, lower keyboard tones from the lower keyboard circuit 2, pedal keyboard tones from the pedal keyboard circuit 3, and percussion sounds from the percussion keyboard circuit 4, are supplied respectively to input terminals 21, 22, 23, and 24 of the selector device 9 (FIG. 2) and, selected or combined as desired by switches 41, 42, 43, and 44 within the selector device. The tones thus selected or combined are sent through a common output terminal 25 to the input (recording) side of the tape recorder 10 to be recorded.

The selector device 9 is further provided with variable resistors 31, 32, 33, and 34 for input adjustment which are connected in series respectively between the input terminals 21, 22, 23, and 24 and the switches 41, 42, 43, and 44. Thus, the magnitude of the input to the

tape recorder can be adjusted for each keyboard tone signal.

The switches 41 through 44 and the variable resistors 31 through 34 within the selector device 9, the variable resistor 12 for output adjustment, and the drive control part of the tape recorder are controllably actuated by control actuators, such as levers and knobs, which are mounted on the front face or top face of the outer structure of the musical instrument in positions where they can be easily manipulated by the player of the instrument.

While the tape recorder 10 used in the musical instrument of the invention may be of the open-reel type, a tape recorder of the cartridge type (cassette type, or magazine type), which is of miniature size and can be easily operated, is more suitable for the practice of the invention.

While, in the example illustrated in FIG. 1, the tape recorder 10 is provided before (on the input side of) the expression control 6, an alternative arrangement wherein expression controls operating respectively for the keyboard circuits 1 through 4 are also provided respectively after these keyboard circuits, and the tape recorder 10 is provided after the expression control may also be used.

Furthermore, it is possible, while playing the musical instrument and operating the tape recorder 10 to record the music thus played, to pass the tones from the keyboard circuits 1, 2, 3, and 4 through the mixer 5 the expression control 6, the amplifier 7, and the loudspeaker 8 thereby to render the music simultaneously as sound. Alternatively, it is also possible to play the musical instrument and render the music as sound in the above described manner without operating the tape recorder 10.

By thus providing an electronic musical instrument with a selector device and a tape recorder in accordance with the invention, the tones from the keyboard circuits can be selected or combined and recorded. Accordingly, it is possible, for example, to record a musical rendition resulting from a combination of tones from the keyboards and then to play the musical instrument simultaneously as the rendition thus recorded is reproduced, whereby a multiple ensemble or concert effect can be rendered.

Furthermore, when the accompaniment of a musical piece is to be practiced, it is possible, as the musical piece is fully played in the normal manner with all keyboards, to record only the melody to become a reference produced by a specific keyboard and then to practice the accompaniment as this melody thus recorded is reproduced.

In this case, the tones of the accompaniment may be cut out completely by means of a switch or they may be recorded in a manner such that they can be heard faintly by adjusting the variable resistors 31 through 34 for input adjustment. Then, during reproduction, playing in concert with the recorded music can be practiced, in which case an even greater effectiveness is afforded.

When the tape recorder is installed before the expression control as in the example illustrated in FIG. 1, the input signals to the tape recorder are of constant level and are readily recorded. Furthermore, since the recorded tones are of constant volume, it is also possible to practice rendering of expression forte, piano,

crescendo, decrescendo wherein the volume control is operated.

On the other hand, when the tape recorder is provided after expression control devices to record volume-controlled tones, tones with expression fully imparted thereto can be recorded. Therefore, by playing the electronic musical instrument simultaneously in concert as the tones thus recorded are reproduced or by reproducing the tones in concert with a natural (non-electronic) musical instrument, a multiple ensemble effect can be rendered.

Moreover, even when a miniature tape recorder such as that of the cartridge type is used, reproduced music satisfactory in volume and tone quality for an electronic musical instrument can be produced since the amplifier and loudspeaker of the electronic musical instrument itself is utilized. At the same time, when the electronic musical instrument is played simultaneously as a previously recorded musical piece is reproduced, an extremely refined and deep musical feeling can be created since the tones from both sources are blended and rendered through one and the same loudspeaker.

In addition, by positioning the various control actuators within convenient reach of the player of the electronic musical instrument, a great variety of musical effects can be readily rendered and, moreover, easily varied even during the rendition of a musical piece.

In another embodiment of the invention as illustrated in FIGS. 3 and 4, musical effects which heretofore could not be attained are afforded by an organization wherein a multichannel tape recorder 10a is provided after a number of keyboard circuits 1, 2, 3, and 4, the tones from which are recorded in respective channels, and the signals thus recorded are selected or combined by a selector device 11 and reproduced. In other respects, this organization is similar to that of the preceding example.

For selection or combination of the various keyboard tones, a selector device 9a for recording is provided before the multichannel tape recorder 10a thereby to afford selection as desired. This arrangement affords convenience in that it is thereby possible to combine the various keyboard tones and to select unoccupied channels.

For the tape recorder 10a, a tape recorder of miniature type such as a cartridge type (cassette type, or magazine type) or of the open-reel type having from 4 to 8 channel positions is used and is so installed that tones selected by the selector device 9a can be recorded in any vacant channel of the tape recorder. Furthermore this multichannel tape recorder 10a is of a type wherein a single driving device drives a single recording tape having therein multiple tracks for recording and reproducing.

The selector device 11 for reproduction is operated to accomplish selection whereby tones thus recorded in the multichannel tape recorder 10a can be selected or reproduced simultaneously at will as necessary and is provided after the tape recorder 10a.

In this example, also, it is possible to play the musical instrument in the ordinary manner through the various keyboard circuits 1, 2, 3, and 4, the mixer 5, expression control 6, amplifier 7, and loudspeaker 8 without operating the multichannel tape recorder 10a. Furthermore, the control actuators for accomplishing these operations are all mounted on the structure of the

electronic musical instrument at positions within easy reach of the player, as in the preceding example.

The tones reproduced by the multichannelized tape recorder 10a are rendered as sound through the use of the amplifier 7 and loudspeaker 8 of the electronic musical instrument with the expression control 6 installed after the tape recorder 10a as shown in FIG. 3. Alternatively, an expression control for each keyboard circuit can be provided before the tape recorder 10a.

As in the preceding example, the output sides of the keyboard circuits 1 through 4 are connected respectively to inlet terminals 21, 22, 23, and 24 of the selector device 9a. In the selector device 9a, as shown in FIG. 4, these inlet terminals are connected respectively through variable resistors 31, 32, 33, and 34 for adjustment of respectively recording inputs to the movable contacts of recording input selection switches 41a, 42a, 43a, and 44a for selectively switching their input signals to any of the channels of the multichannel tape recorder 10a. The movable contact of each of the selection switches 41a through 44a can successively contact stationary contacts which are respectively connected to different channels 51, 52, 53, and 54 of the multichannel tape recorder 10a.

Thus, tones from any of the keyboard circuits can be switched to any of the channels of the tape recorder 10a to be recorded.

The output (or reproducing) side of the channels 51 through 54 are connected through respective variable resistors 61, 62, 63, and 64 for reproduction output adjustment and reproduction output switches 71, 72, 73, and 74 to a common terminal 25a. The variable resistors 61 through 64 are operable to adjust reproduced tones which have been recorded in the channels 51 through 54, and the switches 71 through 74 are operable to select or combine tones thus adjusted. The terminal 25a is connected through the variable resistor 12, expression control 6, and amplifier 7 to the loudspeaker 8.

Furthermore, junctions between the variable resistors 61 through 64 and their respective reproduction output switches are connected to respective stationary contacts of a reproduction output feedback selector switch 75. The movable contact of this sector switch 75 for selectively contacting the stationary contacts is connected through a variable resistor 66 for feed-back adjustment to the input (recording) side of a vacant channel (a fifth channel 55 in the example illustrated in FIG. 4). The output (reproduction) side of the channel 55 is connected through a variable resistor 65 to the common terminal 25a.

Thus, the reproduction outputs adjusted by the variable resistors 61 through 64 can be selected as desired and fed back, after further adjustment, to be recorded in channel 55. By thus recording and simultaneously reproducing the above mentioned outputs and sending the resulting signals through the terminal 25 to be rendered as audible sound through the loudspeaker 8 in the same manner as described hereinabove, it is possible to obtain an echo effect due to the positional lag between the recording element and the reproducing element.

Since, in the above-described example of the electronic musical instrument of the invention, selector devices and a multichannel tape recorder are incorporated within the musical instrument, it is possible to select recorded tones by means of the selector device for

reproduction and to reproduce the tones of the various keyboards either separately or simultaneously.

Furthermore, by providing the selector device for recording before the tape recorder, it is possible by operating the selector device to record signals produced from the various keyboard circuits so that the tones from each keyboard circuit are recorded in a respective channel or so that the tones from different keyboard circuits are combined and recorded separately or simultaneously.

Since complicated modes of recording and reproducing can be accomplished in this manner, it is possible to achieve objects in musical practice of a high degree in the musical sense, for example, by omitting only the keyboard tones to be practiced and by recording and reproducing the other tones.

When the multichannel tape recorder 10a is placed before the expression control 6 as shown in FIG. 3, the level of the input into the tape recorder is constant, whereby recording is facilitated, and practice in rendering expression by operating the expression control is possible. When, alternatively, an expression control is provided before the tape recorder for each keyboard circuit, tones with expression fully imparted thereto can be recorded.

Further features and advantages of the above described example of the invention are similar to those of the preceding example illustrated in FIGS. 1 and 2.

It should be understood, of course, that the foregoing disclosure relates to only preferred embodiments of the invention and that it is intended to cover all changes and modifications of the examples of the invention herein chosen for the purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention as set forth in the appended claims.

What we claim is:

1. In an electronic musical instrument including a tone generator, a plurality of keyboard circuits connected thereto and having filters for producing respective keyboard signals providing complete musical notes at respective keyboard outputs, an expression control having an input and an output, the input being connected to receive said complete musical notes from the keyboard outputs, an amplifier having an input and an output, the input being connected to the output of said expression control, and a loudspeaker connected to the output of said amplifier for giving out said keyboard signals as audible sound, the improvement comprising: a select means having inputs and an output, the inputs being connected to outputs of said plurality of keyboard circuits for selecting and delivering desired single signals and combinations of signals from said keyboard circuits; and a magnetic sound-recording and reproducing device connectable to the output of said selector means for recording signals thus selected and for providing an output of the recorded signals; and means connecting the output from said magnetic sound-recording and reproducing device to the input of said expression control, whereby recorded signals can be reproduced from the instrument when the instrument is being simultaneously played by operating said plurality of keyboard circuits, and wherein a mixer device for frequency mixing is interposed and connected between the outputs of said plurality of keyboard circuits and the input of said expression control, said magnetic recording and reproducing device along with said selec-

tor means forming a series circuit connectable in parallel with said mixer device.

2. In an electronic musical instrument including a tone generator, a plurality of keyboard circuits connected thereto and having filters for producing respective keyboard signals providing complete musical notes at outputs thereof, an expression control having an input and an output, the input being connected to receive said complete musical notes, an amplifier having an input and an output, the input being connected to the output of said expression control, and a loudspeaker connected to the output of said amplifier for giving out said keyboard signals as audible sound, the improvement comprising in combination a multichannel magnetic sound-recording and reproducing device having inputs connectable to the outputs of said plurality of keyboard circuits for recording said keyboard signals and for reproducing signals thus recorded at outputs thereof; a selector means provided between the keyboard outputs and the inputs of said magnetic sound recording and reproducing device, and between the outputs of said magnetic sound recording and reproducing device and the inputs of said expression control, for respectively selecting single signals and combinations of signals from said keyboard outputs, and for transmitting reproduced selected signals to said expression control; and wherein said selector means includes a switching means connected between the inputs and outputs of said magnetic sound recording and reproducing device for selecting at least one of said reproduced signals and for feeding back the same to a vacant channel of the multichannel sound recording and reproducing device.

3. In an electronic musical instrument including a tone generator, a plurality of keyboard circuits connected thereto and having filters for producing respective keyboard signals providing complete musical notes at outputs thereof, at least one expression control having an input and an output, the input being connected to receive said complete musical notes, an amplifier having an input and an output, the input being connected to the output of said expression control, and a loudspeaker connected to the output of said amplifier for giving out said keyboard signals as audible sound, the improvement comprising in combination: a selector means having inputs and outputs, the inputs being connected to the outputs of said plurality of keyboard circuits for selecting and delivering desired single signals and combinations of signals from said keyboard circuit; and a multichannel magnetic sound-recording and reproducing device connectable to the output of said se-

lector means for recording signals thus selected and for providing an output of the recorded signals; and means connecting the output from said magnetic sound-recording reproducing device to the input of said expression control, whereby recorded signals can be reproduced from the instrument when the instrument is being simultaneously played by operating said plurality of keyboard circuits, and wherein said instrument includes an additional selector means connected at an output device for selectively transmitting one or more of selected channels into the input of said expression control.

4. The electronic musical instrument as claimed in claim 3 further comprising feedback means for returning at least part of the output of said additional selector device to an input of said multichannel magnetic sound recording and reproducing device.

5. In an electronic musical instrument including a tone generator, a plurality of keyboard circuits connected thereto and having filters for producing respective keyboard signals providing complete musical notes at outputs thereof, at least one expression control having an input and an output, the input being connected to receive said complete musical notes, an amplifier having an input and an output, the input being connected to the output of said expression control, and a loudspeaker connected to the output of said amplifier for giving out said keyboard as audible sound, the improvement comprising in combination: a selector means having inputs and outputs, the inputs being connected to the outputs of said plurality of keyboard circuits for selecting and delivering desired single signals and combinations of signals from said keyboard circuit; and a multichannel magnetic sound-recording and reproducing device connectable to the output of said selector means for recording signals thus selected and for providing an output of the recorded signals; and means connecting the output from said magnetic sound-recording and reproducing device to the input of said expression control, whereby recorded signals can be reproduced from the instrument when the instrument is being simultaneously played by operating said plurality of keyboard circuits, and wherein a mixer device for frequency mixing is interposed and connected between the outputs of said plurality of keyboard circuits and the input of said expression control, said multichannel magnetic recording and reproducing device along with said selector means forming a series circuit connectable in parallel with said mixer device.

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