

United States Patent

[11] 3,562,397

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[21] Appl. No. **726,945**
[22] Filed **May 6, 1968**
[45] Patented **Feb. 9, 1971**
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[32] Priority **May 6, 1967**
[33] **Japan**
[31] **42/28,502 42/28,503, and 42/28,504**

[56]

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[54] **ELECTRONIC MUSICAL INSTRUMENT WITH
BUILT-IN TAPE RECORDER**
6 Claims, 5 Drawing Figs.

[52] U.S. Cl..... **84/1.02,**
84/1.28, 84/171

[51] Int. Cl..... **G10h 3/04,**
G11b 31/00

[50] Field of Search..... **84/1.01-**
—1.04, 1.17, 1.28 (T), 2—5, 170—171, 461, 462;
179/100.1(A), 100.1(PS)100.2

ABSTRACT: A tape recorder is variously connectable by switching to one or more parts of the electrical circuitry of an electronic musical instrument, the switching being readily controllable by the instrument player, whereby a musical piece being played can be recorded and subsequently reproduced through a part of the circuitry and the loudspeaker(s) of the instrument, and, moreover, the instrument can be simultaneously played as a recording is being so reproduced through the same loudspeaker(s).

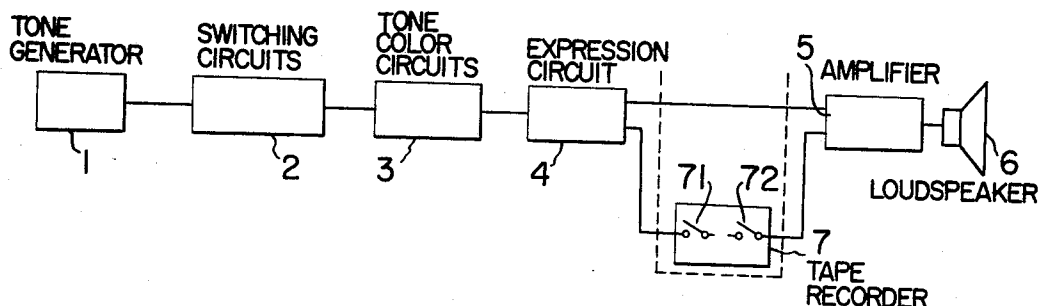


FIG. 1

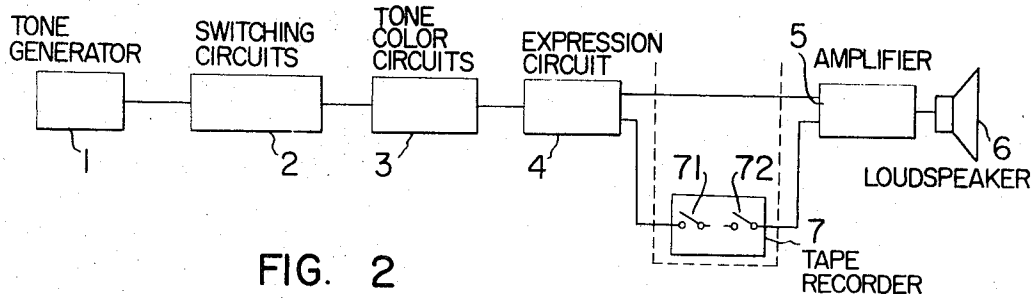


FIG. 2

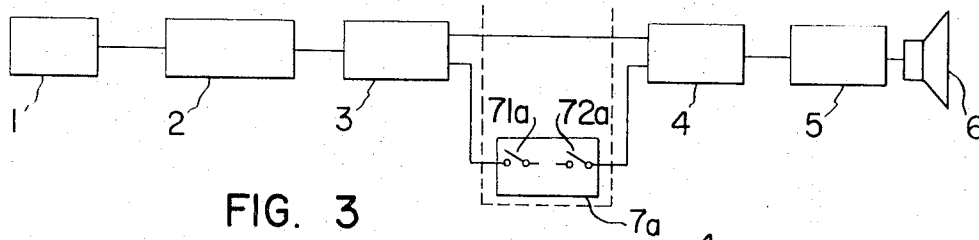


FIG. 3

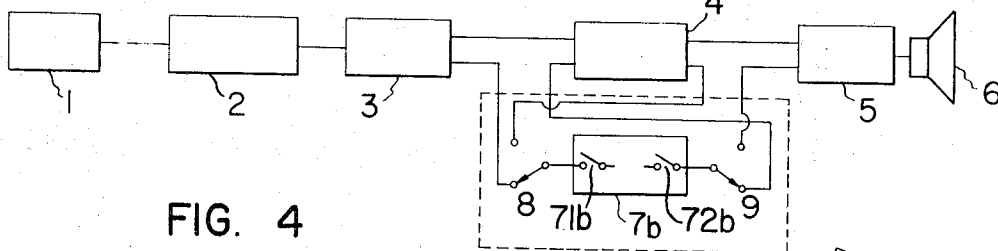


FIG. 4

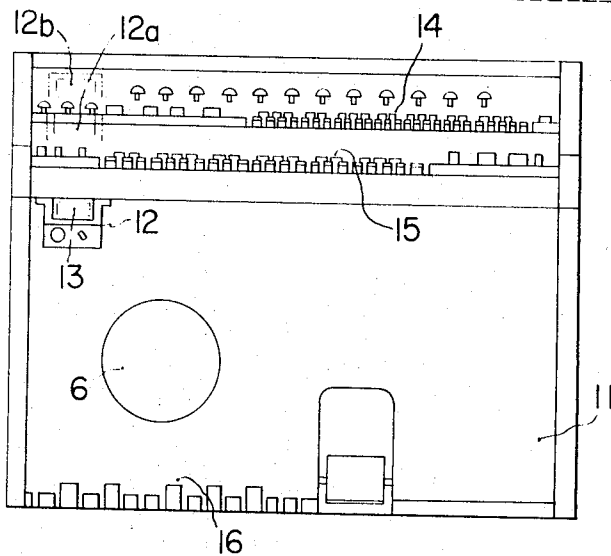
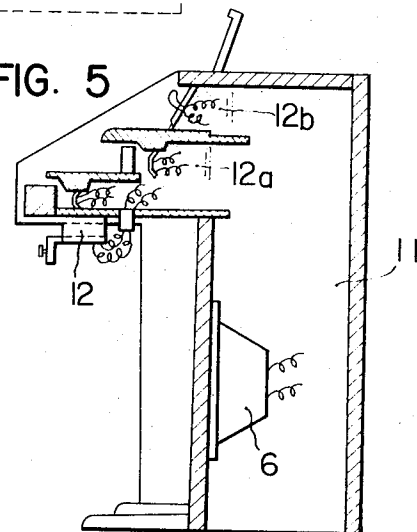


FIG. 5



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ELECTRONIC MUSICAL INSTRUMENT WITH BUILT-IN TAPE RECORDER

BACKGROUND OF THE INVENTION

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

More particularly, the invention relates to new electronic musical instruments having built-in magnetic sound recording and reproducing devices (hereinafter referred to as "tape recorders").

Among conventional electronic musical instruments known heretofore, there are none, as far as we are aware, in which tape recorders are provided. For this reason, in instances when it is desired to record a musical rendition being played by such an instrument or to reproduce a musical rendition previously recorded, a separate tape recorder becomes necessary. In such instances, heretofore, it has been necessary to connect the separate tape recorder electrically to the electronic musical instrument to obtain a combination whereby to accomplish sound recording and reproduction.

Such a procedure, however, is troublesome, entailing inconvenience and difficulties in handling and operation. Moreover, when musical sound from the loudspeaker of the musical instrument is received by means of a microphone and recorded, undesirable and extraneous sounds such as noise from the surroundings and the percussive tapping noise due to the keys are also recorded at the same time, whereby a satisfactory musical recording cannot be made.

SUMMARY OF THE INVENTION

It is an object of the present invention to supplement this deficiency by providing electronic musical instruments with built-in tape recorders connectable electrically in at least one part of the electrical circuitry of their respective instruments.

Another object of the invention is to provide electronic musical instruments each with a built-in tape recorder which is electrically connectable as stated above in a wide variety of connective states whereby the instrument can be played in the normal manner without sound recording; music played can be recorded, recorded music can be reproduced through the loudspeaker of the instrument, and recorded music can be thus reproduced as the instrument is simultaneously played.

According to the present invention, briefly summarized, there is provided, in an electronic musical instrument having at least tone color circuits, an expression circuit, and an amplifying circuit sequentially connected in that order, the combination therewith of a tape recorder and switching means for selective on-off switching of the tape recorder between the tone color circuits and the expression circuit or between the expression circuit and the amplifying circuit, for selective on-off switching between the tone color circuits and the expression circuit and between the expression circuit and the amplifying circuit.

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 embodiment of the invention;

FIG. 2 is a block diagram showing another embodiment of the invention;

FIG. 3 is a block diagram showing still another embodiment of the invention;

FIG. 4 is a front elevational view showing one example of embodiment of the invention as applied to an electronic musical instrument of the console type;

FIG. 5 is a side elevational view, in vertical section, of the musical instrument shown in FIG. 4.

DETAILED DESCRIPTION

The electronic musical instrument according to the invention, in general, is of the type having a tone generator 1, a switching circuit group 2, a tone color circuit group 3, an expression circuit 4, an amplifying circuit 5, and one or more loudspeakers 6 which are all of respective types known in the art, and which are connected in the order named as shown in FIGS. 1, 2, and 3.

In one embodiment of invention as illustrated in FIG. 1, a tape recorder 7 is connectable by means of on-off switching means as shown by 71 and 72 which are usually installed in the tape recorder in connection with the playback and record control actuators between the expression circuit 4 and the amplifying circuit 5, the recording input and reproducing output terminals of the tape recorder 7 being connected respectively to the output side of the expression circuit 4 and the input side of the amplifier 5. The tape recorder 7 is of a compact and easily operable type such as a cartridge or cassette type or a magazine type or is of the open reel type.

On the other hand, the signal from the tone generator 1 can be conducted directly from the expression circuit 4 to the amplifying circuit 5, without being passed through the tape recorder 7, by means of on-off switching means (not shown) operated by control means, which together with control means for operating the aforementioned switching means and the tape recorder 7 are mounted at positions on the musical instrument structure within easy reach of the musician playing the instrument.

According to the invention, the switching circuits 2 are operated by manipulatable instrument parts such as, for example, an upper keyboard 14, a lower keyboard 15, and a pedal keyboard 16 of an electronic musical instrument as illustrated in FIGS. 4 and 5 and as described hereinafter. The signal from the tone generator 1 is thereby selectively derived and transformed by the tone color circuits 3 into signals of the desired tone color, thereby creating various musical effects, and the resulting signals are adjusted in volume in the expression circuit 4. The music thus completed can then be recorded on a magnetic tape in the tape recorder 7 by closing the switching means 71.

Therefore, by reproducing in another magnetic sound-recording and reproducing device the tape thus recorded, the completed music can be heard in its originally rendered state. Furthermore, the musical instrument can be played and caused merely to render music without causing the tape recorder to operate by the aforementioned switching means operated by a control actuator such as a control button or knob (not shown) by known type. This control actuator and various other control actuators are installed at positions within easy reach of the player of the musical instrument, whereby a variety of control actions are facilitated, and even at an intermediate point during a musical rendition, recording can be carried out without interrupting the rendition.

Accordingly, music recorded by the built-in tape recorder can be reproduced, by manipulating one of the above-mentioned control actuators to close the switching means 72, through the amplifying circuit 5 and the loudspeaker 6, whereby the music thus reproduced is of rich tone quality and abundant volume as though the musical instrument were being played. By means of still another control actuator, the musical instrument can be simultaneously played while music is being thus reproduced, the music thus played and thus reproduced being rendered simultaneously through the same loudspeaker 6, whereby the effect of a duet or ensemble can be rendered.

A further feature of the musical instrument of the invention is that it can be used effectively for practice in playing the instrument by playing in concert the same musical piece as a correctly rendered and recorded musical piece as the latter is being reproduced, errors in playing thereby being readily audible to the player in the resulting musical.

In another embodiment of the invention as illustrated in FIG. 2, a tape recorder 7a is connectable between the tone color circuits 3 and the expression circuit 4 of an electronic

musical instrument thereby to afford recording tones of a constant level produced by the tone color circuits. As in the preceding example of the invention, various switching means as shown by 71a and 72a which are usually installed in the tape recorder in connection with the playback and record control actuators thereof and their control actuators (not shown) for controlling the tape recorder and its connection to the musical instrument are provided at positions within easy reach of the player of the instrument.

In the operation of the musical instrument of the above described construction, signals from the tone generator are selected by the switching circuits 2 operated by the manipulation of the keys (for example, keys 14, 15, and 16 in FIG. 4), and corresponding tones thus obtained are sent to the tone color circuits 3, where desired tone colors are obtained by the manipulation of control actuators, and the resulting signals can be conducted to the tape recorder 7a with the switching means 71a closed. Accordingly, since desired tone colors are derived in the tone color circuits and music of a constant level (in the sense that it is unrelated to the expression process) is caused to be recorded, great convenience is afforded in dynamic range of the recording level, and, moreover, recording is possible at any time since the tape recorder is incorporated in the instrument circuitry in a built-in manner.

As in the preceding example of the invention, various connections, such as connection of the output of the tone color circuit 3 to the tape recorder 7a or directly to the expression circuit 4 and connection of the reproduction output of the tape recorder 7a to the expression circuit 4, can be made at will by manipulation of control actuators.

Furthermore, since the tape recorder 7a is provided before the expression circuit 4, constant tones of small volume variations can be recorded by selecting the recording conditions at the optimum level. At the time of reproduction with the switching means 72a closed, moreover, exercise in rendering expression, that is exercise in varying the tone volume in accordance with the expression marks on a musical score, can be carried out. As in the preceding example of the invention various effects such as duet and ensemble rendition can, of course, be rendered by playing the instrument simultaneously with the reproduction of recorded music.

In a further embodiment of the invention as illustrated in FIG. 3, the electronic musical instrument has a tape recorder 7b provided with selection switches 8 and 9 whereby tone signals produced by the tone color circuits 3 can be selectively passed from the tape recorder 7b, through the expression circuit 4, and then to the amplifying circuit 5 or passed from the expression circuit 4, through the tape recorder 7b, and then to the amplifying circuit 5. That is, the tape recorder 7b can be selectively switched and connected either between the tone color circuits 3 and the expression circuit 4 or between the expression circuit 4 and the amplifying circuit 5. Also in this case, the tape recorder 7b includes switching means 71b and 72b associated with the play-back and record control actuators thereof as in the conventional tape recorder.

Accordingly, in the actual operation of the switching means in the instant musical instrument, there take place the following typical connecting states.

1. tone color circuit 3 → expression circuit 4 → the amplifying circuit 5.
2. tone color circuit 3 → expression circuit 4 → amplifying circuit 5 and tone color circuit → input of sound recording and reproducing device 7b
3. output of the sound recording and reproducing device 7b → expression circuit 4 → amplifying circuit 5
4. tone color circuits 3 → expression circuit 4 → amplifying circuit 5 and expression circuit 4 → input of the sound recording and reproducing device 7b
5. output of the sound recording and reproducing device 7b → amplifying circuit 5
6. tone color circuit 3 → expression circuit 4 → amplifying circuit 5 and output of the sound recording and amplifying device 7b → amplifying circuit 5

Thus, the musical instrument in this case has the advantageous features of the two preceding examples of the invention as well as the feature of selectability. Furthermore, the tape recorder 7b can be totally cut out, and direct connections between the tone color circuits 3, the expression circuit 4 and the amplifying circuit 5 can be made by means of switches (not shown). The control actuators for these switches, those for the switches 8 and 9, and those for controlling the tape recorder 7b are all installed at points with easy reach of the instrument player as in the preceding examples of the invention.

One example of application of the invention to an actual electronic musical instrument is illustrated in FIGS. 4 and 5, in which there is shown an electronic organ having a console 11, internal electrical circuitry (not shown), keyboards 14, 15 and 16, and a loudspeaker 6 all of known construction. In addition, according to the invention, a mounting frame 12 is installed on the front face or upper front face of the structure 11 in a position within easy reach of the organ player such as in the key slip 12a between the two manual keyboards 14, 15, below a key bed, in the interior of a keyboard side panels, and inside of the stop panel 12b.

The mounting frame 12 is adapted to accommodate a tape recorder 13 mounted detachably thereon or therein and is provided with electrical connecting means such as connectors for disconnectably connecting the terminals of the tape recorder to the internal electrical circuits of the organ. The mounting frame 12 is in a suitable form such as a box frame, a base frame, or a recess or cavity so that the tape recorder can be mounted thereon or therein by any suitable method such as slide fitting, clipping, screw fastening, or emplacement.

In this specific example, a compact and easily operable tape recorder such as a cassette tape recorder is suitable. The aforementioned control actuator such as buttons or knobs for various control switching are mounted near the stop knobs.

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.

We claim:

1. In an electronic musical instrument having a tone generator (1), switching circuits (2), tone color circuits (3), an expression circuit (4), an amplifying circuit (5), and at least one loudspeaker (6) connected sequentially in the order named, the combination therewith of a magnetic sound recording and reproducing device (7), a recording input terminal of said recording and reproducing device being connected to the output side of said expression circuit and a reproducing output terminal of said recording and reproducing device being connected to the input side of said amplifying circuit.

2. In an electronic musical instrument having a tone generator (1), switching circuits (2), tone color circuits (3), an expression circuit (4), an amplifying circuit (5), and at least one loudspeaker (6) connected sequentially in the order named, the combination therewith of a magnetic sound recording and reproducing device (7a), a recording input terminal of said recording and reproducing device being connected to the output side of said tone color circuits and a reproducing output terminal of said recording and reproducing device being connected to the input side of said expression circuit.

3. In an electronic musical instrument having a tone generator (1), switching circuits (2), tone color circuits (3), an expression circuit (4), an amplifying circuit (5), and at least one loudspeaker (6) connected sequentially in the order named, the combination therewith of a magnetic sound recording and reproducing device (7b) and switching means for selective on-off switching of the sound recording and reproducing device between the tone color circuits and the expression circuit, for selective on-off switching of said device between the expression circuit and the amplifying circuits, for selective on-off switching between the tone color circuits and the expression

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circuit, and for selective on-off switching between the expression circuit and the amplifying circuit.

4. The combination as claimed in claim 3 in which the sound recording and reproducing device (7b) is detachably mounted in the musical instrument, and said device and said instrument are provided with respectively mating connection means whereby all electrical circuit paths between said device and said instrument can be readily connected and disconnected.

5. The combination as claimed in claim 3 in which the switching means are controllable by manual control actuators positioned within easy reach of a player playing the instrument.

6. The combination as claimed in claim 3 in which, by the

operation of the switching means, one state can be selectively established from among the connective states of: tone color circuits (3) to expression circuit (4) to amplifying circuit (5); tone color circuits (3) to expression circuit (4) to amplifying circuit (5) and tone color circuits (3) to input of sound recording and reproducing device (7b); output of said device (7b) to expression circuit (4) to amplifying circuit (5); tone color circuits (3) to expression circuit (4) to amplifying circuit (5) and expression circuit to input of said device (7b); output of said device (7b) to amplifying circuit (5); and tone color circuits (3) to expression circuit (4) to amplifying circuit (5) and output of said device (7b) to amplifying circuit (5).

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