United States Patent [19]

Peterson et al.

[11] **3,829,597**

[45] **Aug. 13, 1974**

[54] **KEYBOARD INSTRUMENT PLAYER SYSTEM WITH TIME DIVISION MULTIPLEXING TECHNIQUES AND SYNCHRONIZED RHYTHM DEVICE**

[76] Inventors: **Richard H. Peterson,** 11748 Walnut Ridge Drive 60464; **Robert A. Finch,** 12219 South 89th Avenue, both of Palos Park, Ill.

[22] Filed: **Apr. 26, 1973**

[21] Appl. No.: **354,844**

[52] **U.S. Cl.** **84/1.03,** 84/462, 84/DIG. 12

[51] **Int. Cl.** **G10h 1/00**

[58] **Field of Search** ... 84/1.02, 1.03, 1.28, DIG. 29, 84/1.01, 461, 462, DIG. 12

[56] **References Cited**

UNITED STATES PATENTS

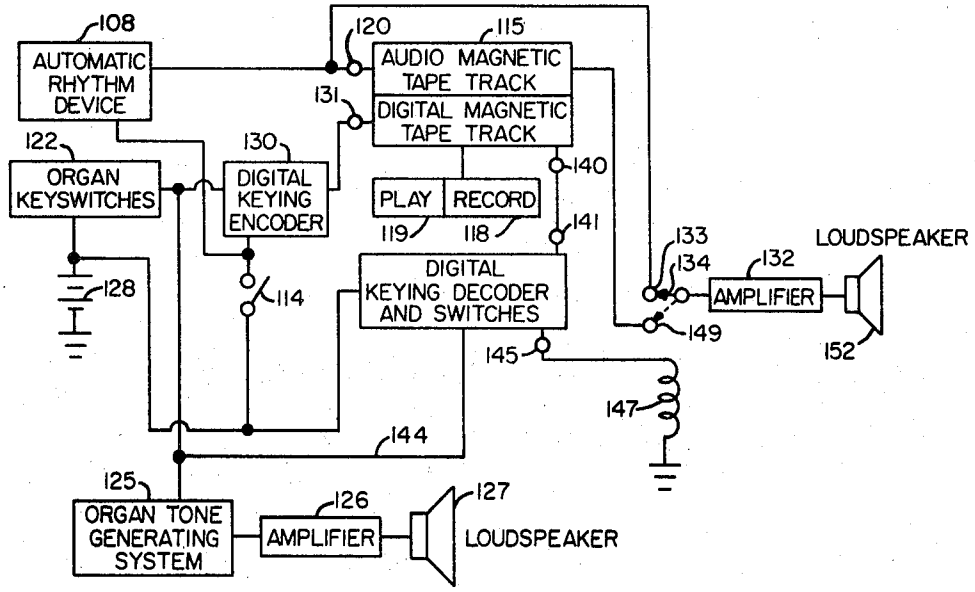
2,533,461	12/1950	Illsley	84/1.28
3,250,847	5/1960	Chamberlain	84/1.28
3,272,907	9/1966	Chamberlain	84/1.28
3,546,354	12/1970	Uchiyama	84/1.02
3,562,398	2/1971	Benjamin	84/1.03
3,604,299	9/1971	Englund	84/1.03
3,610,799	10/1971	Watson	84/1.01
3,647,929	3/1972	Milde, Jr.	84/1.01
3,683,096	8/1972	Peterson et al.	84/1.03 X
3,697,661	10/1972	Deutsch	84/1.01
3,781,452	12/1973	Vauclain	84/1.28
3,789,719	2/1974	Maillet	84/1.03 X

Primary Examiner—Richard B. Wilkinson
Assistant Examiner—Stanley J. Witkowski
Attorney, Agent, or Firm—Jones and Lockwood

[57] **ABSTRACT**

A player type electrically operated musical instrument includes a rhythm device for producing timed repetitive rhythm patterns of unpitched or semi-pitched percussive sounds. Information as to the playing of the keys of the instrument is encoded in digital form on one track of a magnetic tape using time division multiplexing techniques. The sounds produced by the rhythm device are simultaneously recorded on a second "audio" channel on the same magnetic tape. On "playback", the digital channel is decoded and used to "play" the same or a similar musical instrument, and the audio channel is reproduced to provide a rhythm accompaniment synchronized to the performance of the instrument. Information encoded on the digital track automatically disconnects the rhythm instrument during playback and connects the audio channel of the tape player to the reproducing system.

11 Claims, 2 Drawing Figures



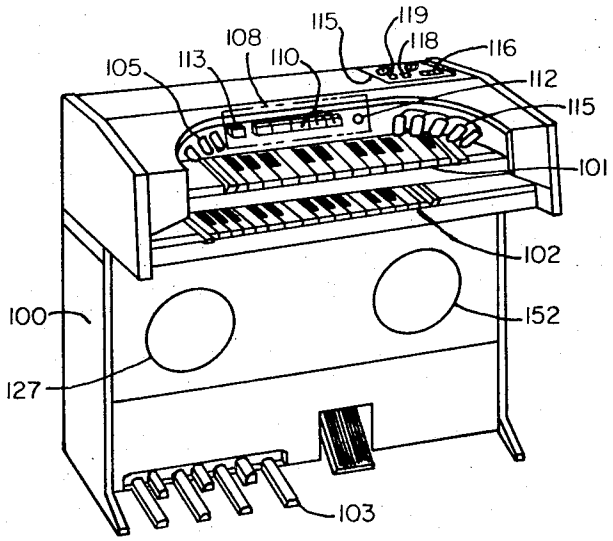


Figure 1

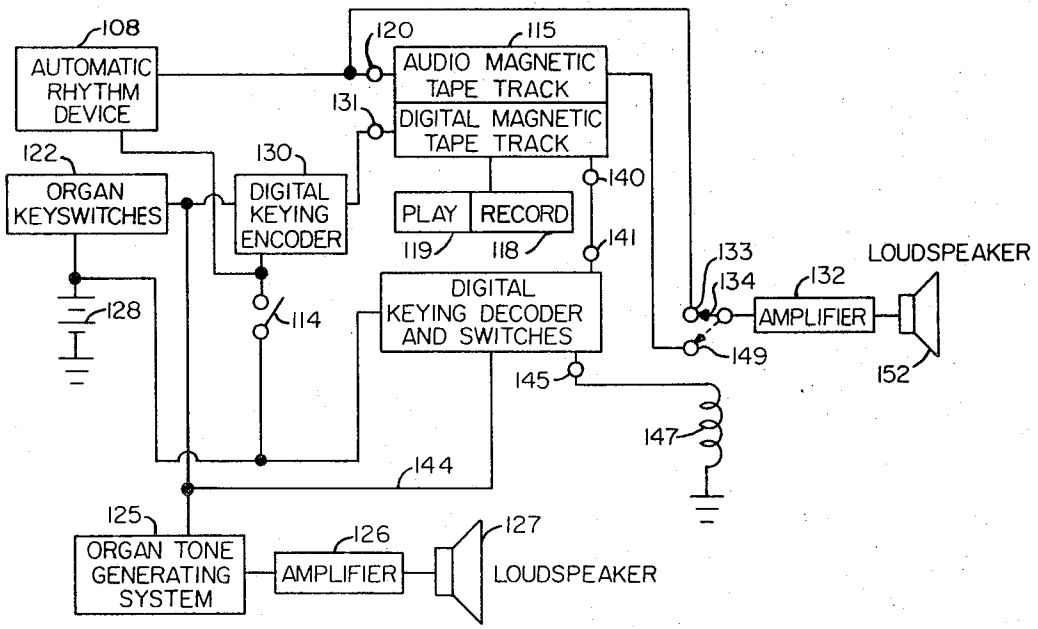


Figure 2

KEYBOARD INSTRUMENT PLAYER SYSTEM WITH TIME DIVISION MULTIPLEXING TECHNIQUES AND SYNCHRONIZED RHYTHM DEVICE

BACKGROUND OF THE INVENTION

This invention relates generally to the subject matter disclosed in prior U.S. Pat. No. 3,683,096 dated Aug. 8, 1972, and titled Electronic Player System for Electrically Operated Musical Instrument. More specifically, the present invention is directed to the problem of maintaining synchronism between the playing of a musical instrument by an automatic player device and the sounds produced by an automatic rhythm device, which may have been used during the original performance, to produce patterns of unpitched or semi-pitched musical sounds. Such rhythm devices are well known and are disclosed, for example, in U.S. Pat. Nos. 3,105,106; 3,146,290; 3,247,307; 3,255,292 (Re, 26,521); 3,358,068; 3,383,542; and 3,478,633.

SUMMARY OF THE INVENTION

Our prior U.S. Pat. No. 3,683,096 discloses a Player System for Electrically Operated Musical Instruments. In the system disclosed, information representing the manipulation of the playing keys of a musical instrument, such as an organ, is converted to electrical signals and recorded digitally on magnetic tape using a conventional cassette recorder. A system known as time division multiplexing is used to encode the "keying" information on the magnetic tape. On playback the recorded signal is "decoded" and used to operate a series of semiconductor "switches" to "play" a similar or the same musical instrument.

Many keyboard instruments now include an automatic rhythm playing device, one type of which is sold commercially under the name Select-A-Rhythm, and marketed by Gulbransen Industries of Chicago, Illinois. The incorporation of such a rhythm device complicates the operation of the "player" instrument in that it is not economically practical to use the digital system to operate the automatic rhythm instrument. In the present invention two types of magnetic recording, on two separate tracks, are utilitized. One track is used for encoding, digitally, information for "keying" the instrument, and for controlling the second "audio" track, upon which the sounds of the automatic rhythm instrument are "linearly" recorded.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of an electronic organ with a rhythm device.

FIG. 2 is a combination block, schematic drawing of a player system according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, **100** is an electronic organ having conventional keyboards **101** and **102** and pedal clavier **103.** The usual stop controls **105** determine the character of the tone that will be heard when the keys and pedals are played. **108** is the control panel for an automatic rhythm instrument for producing rhythmic combinations of various unpitched or semi-pitched sounds, such as cymbols, drums, claves, brushes, and the like. The pushbuttons **110** permit the selection of one or a

combination of desired rhythm patterns such as, ballad, rock, tango, waltz, and so on. The tempo control **112** adjusts the tempo of the rhythm pattern, and the start - stop control **113** starts and stops the production of the rhythm sounds. In ordinary use, the performer, having preset the tempo control to a suitable tempo for the music to be played, turns on the rhythm unit by pushing the "on" button **113,** and then proceeds to play the keys and pedals of the instrument in time with the automatically produced rhythm pattern. With some rhythm devices the tempo can be controlled to a considerable degree by an automatic mechanism which senses the rate of pedal key depression and adjusts the tempo automatically. For example if he wants to speed-up his rhythm he may do so by gradually speeding up his playing, and the rhythm device will automatically sense the speed-up and speed-up the tempo accordingly. **115** is a magnetic tape recorder having at least two separate magnetic "tracks". The controls **116** are conventional and serve to turn the tape recording device on and off and to perform the usual rewind and fast forward functions.

Referring now to FIG. **2,** the automatic rhythm device **108** is connected to the audio input terminal **120** of the tape recorder **115.** Whenever one of the buttons **110** of FIG. **1** is depressed, an automatic rhythm pattern is produced by the automatic rhythm device **108** and the audio signals produced by the rhythm device will be applied to the input of amplifier **132** by way of relay contacts **133** and **134,** and will be heard through the loudspeaker **152.** In addition, the signals from the rhythm device **108** are connected to the input terminal **120** of the tape recorder **115,** and will be recorded in linear form on the audio track, providing the the "record" button **118** is depressed.

Conventional organ keyswitches **122** are understood to be physically connected to be operated by the keys **101, 102,** and the pedals **103** (FIG. **1**) and are connected to a conventional organ tone generating system **125.** The particular tone generating system employed is not a part of the present invention, it being understood that any of the many known systems would be appropriate. The output of the tone generating system is connected to the amplifier **126,** and thence to loudspeaker **127,** which reproduces the sound of the organ portion of the instrument. Also connected to the organ keyswitches is the digital keying encoder **130** which is preferably of the type shown in FIG. **1** of our prior U.S. Pat. No. 3,683,096, previously referred to. The output of the digital keying encoder is connected to the input terminal **131** of the digital track of the magnetic recorder **115,** and again assuming the record button **118** is depressed, information as to the instantaneous open or closed condition of the organ keyswitches will be recorded in the form of digital data on the digital magnetic tape track. Also connected to the digital keying encoder **130** is the rhythm on/off switch **114** which is also connected to the source of potential **128.** The rhythm on/off switch **144** is physically attached to and is operated by, the on/off knob **113** in FIG. **1.** Whenever switch **113** is closed and the rhythm device is operating this information is digitally encoded on the digital track.

To recreate the complete musical performance, the magnetic tape is rewound, and the "play" button **119** (FIG. **1**) is depressed, which puts the magnetic tape recorder in its playback mode. Under these conditions,

the output of the digital magnetic track will appear at terminal **140** and will be connected to the input of the digital keying decoder terminal **141.** The decoder also includes a series of semiconductor switches which are operated by the decoder. The operation of this decode system is explained in connection with FIG. **7** of the prior U.S. Pat. No. 3,683,096 previously referred to. The electronic switches which are a part of the decoder are connected in parallel with the organ keyswitches by means of cable **144.** In this manner The original organ performance is duplicated and once again the sound of the original performance is heard through loudspeaker **127.**

In addition, because the condition (open or closed) of switch **113** was digitally encoded an output voltage will now appear at decoder output terminal **145** for such periods of time during the original performance when switch **113** was closed. Whenever such a voltage is present, relay **147** is energized, thus pulling switchblade **134** away from contact **133** and into contact with terminal **149** as indicated in FIG. **2** by the dotted line position of the contact **134.** Terminal **149** is connected to the output of the audio track of the magnetic tape recorder, and thus the audio signals that were recorded during the original performance will be connected to the amplifier **132** and will be reproduced by loudspeaker **152.** Thus the complete performance, including rhythm and organ, will be reproduced, and with the original rhythm accompaniment heard in perfect synchronism with the "player" performance of the organ.

Generally only one of the many available rhythm patterns capable of being produced by the automatic rhythm device, is appropriate to a particular musical selection. For example if a waltz is played, only the waltz rhythm would be appropriate and it would be very undesirable if the automatic rhythm device was to produce a tango or a bossa nova accompaniment during playback while the organ was recreating a waltz melody. This problem is solved by the apparatus of the invention because if a rhythm effect was used during encoding of the organ performance, upon playback the automatic rhythm device is automatically locked out and only the recorded rhythm sound is heard.

Others may readily adapt the invention to various uses by employing one or more of the novel elements disclosed. As at present advised, we desire to claim the following subject matter:

We claim:

1. A keyboard instrument player system for recording and later recreating a musical performance, comprising:

an electrically operated musical instrument having a plurality of playing key-operated keyswitches;

an electrically operated tone generating system connected to and responsive to said keyswitches to produce pitched musical tones;

a rhythm device for producing selected rhythm sound patterns;

a tape recorder having first and second magnetic tracks, and means for operating said recorder in a record mode;

a time division multiplex encoder connected to said keyswitches to encode information as to the on or off condition of said keyswitches;

means feeding said encoded information to said tape recorder to record said information in digital form on said first magnetic track when said tape recorder is in its record mode; and

means feeding said rhythm sound patterns to said tape recorder to record said patterns on said second magnetic track when said tape recorder is in its record mode.

2. The player system of claim **1,** further including:

means providing a playback mode for said tape recorder;

a keying decoder having a plurality of electrical switches corresponding to said keyswitches;

means connecting said keying decoder between the output of said first track of said tape recorder and said tone generating system during said playback mode, said keying decoder receiving said information in digital form and operating said electrical switches in accordance therewith, said tone generating system responding to said electrical switches to produce pitched musical tones; and

means for reproducing said rhythm sound patterns recorded on said second track of said tape recorder during said playback mode.

3. The player system of claim **2,** further including an amplifier and a loudspeaker connected to the output thereof and means connecting said rhythm device to the input of said amplifier to produce sound patterns; said means for reproducing said recorder rhythm sound patterns including means for selectively disconnecting said rhythm device from said amplifier input and connecting the output of said second track of said tape recorder to the input of said amplifier.

4. The player system of claim **3,** including further means connected to said encoder to encode information as to the on or off condition of said rhythm device, said last-named encoded information being recorded in digital form on said first track.

5. The player system of claim **4,** wherein said means for selectively disconnecting said rhythm device comprises switching means responsive to said keying decoder.

6. In a keyboard instrument player system for recording and later recreating a musical performance, an electrically operated musical instrument including playing key-operated keyswitches; an electrically operated tone generating system responsive to said keyswitches to produce selected pitched musical tones; a rhythm device for producing, independently of said tone generating system, selected rhythm patterns; a tape recorder having a first magnetic track; means for operating said recorder in a record or playback mode; means for recording on said first track digital information as to the condition of said keyswitches during a musical performance while said recorder is in said record mode; decoder means connected between said tape recorder and said tone generator, said tone generator responding to said digital information during said playback mode to recreate said musical performance, the improvement comprising:

a second magnetic track for said tape recorder;

means for recording in linear form on said second track said selected rhythm patterns, said patterns being recorded simultaneously with said digital information during said musical performance; and

means for reproducing, during said playback mode, said recorded rhythm patterns simultaneously with the recreation of said musical performance,

whereby said rhythm sound patterns are synchronized with said recreated musical performance.

7. The player system of claim 6, further including output means connected to said rhythm device for producing rhythm sound patterns; said means for reproducing said recorded rhythm patterns including switch means disconnecting said rhythm device from said output means and connecting the output of said second magnetic track to said output means, whereby said recorded rhythm patterns are reproduced as rhythm sound patterns.

8. The player system of claim 7, wherein said switch means comprises relay means operable in the playback mode of said recorder.

9. The player system of claim 7, wherein said means for recording digital information as to the condition of said keyswitches further includes means for recording digital information as to the operation or nonoperation of said rhythm device, and wherein said switch means is responsive during said playback mode to recorded digital information as to the operation of said rhythm device.

10. A keyboard instrument player system for recording and later recreating a musical performance comprising:

an electrically operated musical instrument including playing key-operated keyswitches;

an electrically operated tone generating system, said keyswitches being connected to said tone generating system to produce pitched musical tones;

a rhythm device for producing selected rhythm patterns of unpitched or semi-pitched musical sounds;

a tape recorder having first and second magnetic tracks;

means operating said tape recorder in either a record or a playback mode;

a time division multiplex keying encoder having its input connected to said keyswitches for encoding information as to the on or off condition of said keyswitches and having its output connected to said tape recorder when said recorder is in the record mode to record said information in digital form on said first magnetic track of said tape recorder;

means for simultaneously recording rhythm sounds from said rhythm device on said second magnetic track of said tape recorder;

a keying decoder connected during said playback mode to the output of said first magnetic track of said tape recorder;

a series of switches operated by said decoder and connected in parallel with said keyswitches to operate said tone generating system;

an amplifier and a loudspeaker connected to the output of said rhythm device; and

means for disconnecting said rhythm device from said amplifier and loudspeaker and for connecting the output of said second magnetic track to the input of said amplifier.

11. The instrument described in claim 10 wherein said means for disabling said rhythm device and for connecting the output of said second track to the input of said amplifier comprises means controlled by digital information encoded by the encoder and decoded by the decoder.

* * * * *