An electronic musical instrument for automatically changing tone colors of musical sounds comprises a plurality of tone color formation circuits for providing different tone colors to a tone signal selectively derived from tone generators in response to operation of a keyboard and a switch circuit having switching elements for receiving the differently tone-colored signals respectively. The switch elements are rendered conductive to pass the tone signals therewithin in a preselected order in response to control signals which are recorded on one channel of a two-channel recording medium such as a stereophonic disk or tape. The other channel of the recording medium is recorded with music information adapted to accompany a melody performance to be carried out by a player with the electronic musical instrument. The control signals are recorded on the recording medium at so proper positions thereof that musical sounds being produced by the electronic musical instrument are caused to be varied at proper points of time in conformity with melody and accompaniment performances. The control signals may be utilized to control rhythm section sounds in various ways.

1 Claim, 4 Drawing Figures
ELECTRONIC MUSICAL INSTRUMENT WITH RHYTHM SELECTION PULSE GENERATOR

BACKGROUND OF THE INVENTION

This invention relates to an electronic musical instrument and more particularly to an electronic musical instrument capable of automatically changing tone colors of musical sounds or controlling rhythm accompaniment section sounds in various ways in accordance with advance of a performance effected by a player.

With a conventionally designed electronic musical instrument, tone colors of musical sounds being produced are caused to be varied by operation of manual preset switches and the like by a player during a performance. In order to provide rhythm effects to a performance of an electronic musical instrument, there is utilized an automatic rhythm performance apparatus which may be incorporated into the electronic musical instrument or separately provided therefrom. In this case, the player must operate manual switches arranged on the automatic rhythm performance apparatus to control rhythm sounds in generation thereof, rhythm patterns or tone colors associated therewith independently of operation of a manual keyboard of the electronic musical instrument. As mentioned above, since it is necessary for a player to operate many switches in addition to operation of a keyboard of an electronic musical instrument to carry out an effective performance, an extremely high technique is required to play the electronic musical instrument. It is an object of the present invention to provide an electronic musical instrument in which a player can carry out effective performances without operation of many switches.

It is another object to provide an electronic musical instrument capable of automatically changing tone colors of musical sounds, or controlling rhythm sounds in generation thereof, rhythm patterns or tone colors associated therewith in response to external control signals.

SUMMARY OF THE INVENTION

According to one aspect of the present invention there is provided an electronic musical instrument comprising: tone generators; a keyboard section coupled to the tone generators for selectively drawing out tone signals from the tone generators; a plurality of tone color formation means coupled to the keyboard section for providing different tone colors to the tone signals selectively drawn out from the tone generators; a switching circuit coupled to said plural tone color formation means and having switching elements for receiving the differently tone-colored signals respectively, the switching elements being sequentially enabled in response to control signals from a control signal source to pass the differently tone-colored signals therethrough in a preselected order.

In accordance with the present invention there is used a two-channel recording medium such as a stereophonic disk or tape. The control signals are recorded on one channel of the recording medium and the other channel of the recording medium is recorded with musical information which may be adapted to accompany a melody performance to be carried out by the electronic musical instrument.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a block diagram of an electronic musical instrument embodying the present invention; FIG. 2 is a two-track magnetic tape as a two-channel recording medium utilized in the present invention; FIG. 3 shows especially circuit diagrams of control signal detector and preset switching circuit shown in FIG. 1; and FIG. 4 shows another embodiment of the present invention wherein control signals are utilized to control rhythm sounds.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, tone signals from tone generators 11 are selectively fed through a keyboard section 12 of an electronic musical instrument to a plurality of, for example, first, second and third tone coloring filters 13, 14 and 15. The output signals of the tone coloring filters 13, 14 and 15 are mixed through tone volumes (variable resistors for volume control) 16a, 17a and 18c to produce a first musical tone signal. Further, the output signals of the tone coloring filters 13, 14 and 15 are mixed through two sets of tone volumes 16b, 17b and 18b and 16c, 17c and 18e to produce second and third musical tone signals, respectively. By adjusting the respective tone volumes, the first, second and third musical tone signals are permitted to have different tone colors from each other. The first through third musical tone signals are selectively conducted through a preset switching circuit 19 to an amplifier 20 which is followed by a loud speaker (not shown) through a terminal 21.

The preset switching circuit 19 mentioned above is controlled by control signals from a multi-channel (such as stereophonic) reproducer 22 which reproduces simultaneously two or more channel signals from a multi-channel recording medium such as a stereophonic disk or tape. For example, a magnetic tape 23 as the multi-channel recording medium has, as shown in FIG. 2, at least two tracks 24 and 25, the first track 24 of which being recorded with musical information adapted to accompany a melody performance to be carried out by the electronic musical instrument, and the second track 25 of which being recorded with the control signals designated at A and B. The control signals may be recorded on the second track 25 of the magnetic tape 23 at proper positions, for example, at positions corresponding to boundary portions between respective musical phrases of musical information recorded on the first track 24 of the tape 23.

The reproduced control signals from the reproducer 22 are detected by a detector 26, and the preset switching circuit 19 is controlled by the control signals so as to select the first musical tone signal in accordance with the first control signal A, for example, and the second musical tone signal with the second control signal B.

With the electronic musical instrument constructed as mentioned above, a player operates a keyboard to play the electronic musical instrument in accordance with accompaniments reproduced from the first track 24 of the tape 23 by the reproducer 22. At the same time, in accordance with advance of the melody and accompaniment performances, the control signals are fed to the preset switching circuit 19 from the repro-
ducer 22 through the detector 26 to automatically change the tone colors of musical sounds being produced by the electronic musical instrument.

With reference to FIG. 3 there will now be discussed in more detail the preset switching circuit 19 and control signal detector 26 of FIG. 1. The reproducer 22 comprises a well-known pickup or head assembly 30 for reproducing stereophonic disks or tapes. The first and second reproduced outputs from the pickup or head assembly 30 are supplied to first and second preamplifiers 31 and 32 respectively. The first reproduced output corresponds to the musical information recorded on the first channel 24 of the tape 23 and the second reproduced output to the control signals recorded on the second channel 25. Accordingly, the output signals of the preamplifier are supplied to the control signal detector 26 which comprises an amplifier 33 and a Schmitt circuit 34 following thereafter. The Schmitt circuit 34 produces an output when the output level of the amplifier 33 reaches the threshold level of the Schmitt circuit.

The preset switching circuit 19 comprises two cascade-connected flip-flop circuits 35 and 36 and the first one 35 of which being connected to receive the output of the Schmitt circuit 34. Output leads a, b, c and d of the respective flip-flop circuits 35 and 36 are coupled to two-input AND circuits 37, 38 and 39 with predetermined selective combinations of respective outputs of the flip-flop circuits 35 and 36. Thus, the AND circuits 37, 38 and 39 produce positively going sequential pulses 37A, 38A and 39A, the widths of which are equal to time intervals between control signals recorded on the recording medium.

There are disposed between input terminals 43, 44 and 45 receiving the first, second and third musical tone signals respectively and an output terminal 46 of the preset switching circuit 19 field effect transistors of switching elements 40, 41 and 42 the gates or control electrodes of which receive the enabling signals 37A, 38A and 39A from the AND circuits 37, 38 and 39 respectively.

The operation of the preset switching circuit 19 shown in FIG. 3 is as follows: Upon reproduction of the first control signal A, for example, recorded on the recording medium 23 shown in FIG. 2 by means of the pickup or head assembly 30 the Schmitt circuit 34 included in the control signal detector 26 produces an output which in turn reverses the state of the flip-flop circuit 35. The reversed state of the flip-flop circuit 35 is maintained until the next control signal B is reproduced.

In accordance with the states of the flip-flop circuits 35 and 36, the AND circuit 37, for example, produces an output signal 37A to render the corresponding switching element 40 conductive. As a result, the first tone signal supplied to the input terminal 43 is fed to the output terminal 46. Next, upon reproduction of the control signal B, the AND circuit 38, for example, produces an output signal 38A to feed the second tone signal from the input terminal 44 to the output terminal 46. In this case, since the AND circuit 37 has ceased to produce the output signal 37A, the first tone signal is not conducted to the output terminal 46. In such manner as mentioned above, the first, second and third tone signals are sequentially drawn out at the output terminal 46. It should be noted that, after the third tone signal has been drawn out, there will exist a period of time wherein all the switching elements 40, 41 and 42 are simultaneously rendered nonconductive so that none of the tone signals is drawn out at the output terminal 46. This can be used as a pause period. This pause, however, can be prevented by recording on the recording medium a control signal immediately behind the control signal by which the passage of the third tone signal from the input terminal 45 to the output terminal 46 is caused to be stopped. That is to say, by rendering the simultaneously nonconducting period of all the switching elements 40, 41 and 42 extremely short, it becomes possible to render the switching elements 42 and 40 conductive substantially in succession.

The accompaniment signals reproduced from the recording medium by means of the pickup or head assembly 30 may be applied through the preamplifier 31 to an amplifier and in turn a loud speaker (not shown) associated with the reproducer 22, but may be otherwise mixed with the tone signals from the preset switching circuit 19 as shown.

The reference numeral 47 is a switch to reset both the flip-flop circuits 35 and 36, which is used by a player after play of a composition to prepare for performance of a next composition.

FIG. 4 shows a block diagram of another embodiment of the present invention which is applied to the automatic rhythm playing apparatus. In FIG. 4, clock pulses from a clock pulse generator 51 are applied to a counter 52 including a plurality of cascade-connected flip-flop circuits. Two output leads of the respective flip-flop circuits of the counter 52 are coupled to a well known rhythm pattern pulse generator 53 which includes AND circuits for producing a plurality of sequential pulses in accordance with outputs of the flip-flop circuits in the counter 52, and a matrix circuit for producing a plurality of rhythm signals each having a preselected rhythm pattern with selective combinations of the sequential pulses. The rhythm signals from the rhythm pattern pulse generator 53 are respectively coupled to input terminals of a rhythm selection circuit 54 which has a common output terminal. The rhythm selection circuit 54 comprises a plurality of switching elements or field effect transistors 55 connected between the respective input terminals and the common output terminal. The output terminal of the rhythm selection circuit 54 is connected to a single input terminal of a tone generator cancellation circuit 56 having multiple output terminals. There are disposed switching elements or field effect transistors 57 between the single input terminal and the respective output terminals of the tone generator cancellation circuit 56. The output terminals of the tone generator cancellation circuit 56 are respectively coupled to input terminals of percussion tone generators 58 producing tone signals of percussion instruments such as cymbals, maracas, claves and drums when activated by output signals of the tone generator cancellation circuit 56.

The control signals reproduced from the recording medium are supplied through the preamplifier 32 and detector 26 to a differentiator 59, output signals of which are selectively supplied to a reset circuit 61, a rhythm selecting pulse generator 62 or a percussion tone generator cancelling pulse generator 63 through a manual single-pole triple-throw switch 60.

The reset circuit 61 includes a flip-flop circuit 64, output of which is coupled to the respective flip-flop circuits of the counter 52.
The rhythm selecting pulse generator 62 produces, in response to the output signals of the differentiator 59, positively going sequential pulses 65 for rendering conductive the switching elements 55 in the rhythm selection circuit 54 respectively. The percussion tone generator cancelling pulse generator 63 produces, in response to the output signals of the differentiator 59, negatively going sequential pulses 66 for rendering nonconductive the switching elements 57 in the tone generator cancellation circuit 56 respectively.

There will now be described the operation of the electronic musical instrument shown in FIG. 4. Upon connection of the movable contact of the manual switch 60 to an upper fixed contact termed as RHYTHM ON/OFF, the flip-flop circuit 64 reverses its state in response to the output signals of the differentiator 59 every time a control signal is reproduced. Accordingly, the respective flip-flop circuits of the counter 52 are reset or set in accordance with the state of the flip-flop circuit 64 in the reset circuit 61. The counter 52 counts the clock pulses from the clock pulse generator 51 when the respective flip-flop circuits thereof are set so that the rhythm pattern pulse generator 53 produces the rhythm pattern pulses or rhythm signals at the respective output leads thereof. One of these rhythm signals having different rhythm patterns from each other is fed to the tone generator cancellation circuit 56 through a single conducting one of the switching elements 55 in the rhythm selection circuit 54. In the tone generator cancellation circuit 56, the switching elements 57 are conducted except one so that the rhythm signal from the rhythm selection circuit 54 is supplied through the conducting switching elements 57 to the percussion tone generators 58 connected thereto, to thereby obtain a plurality of percussion sounds with an identical rhythm pattern.

Next, when the movable contact of the manual switch 60 is connected to a middle fixed contact termed as RHYTHM SELECTION the output signals of the differentiator 59 are supplied to the rhythm selecting pulse generator 62 which comprises a plurality of cascade-connected flip-flop circuits and AND circuit like the preset switching circuit 19 shown in FIG. 3. In the absence of the output signals from the differentiator 59, that is, when the movable contact of the switch 60 is not connected to the middle fixed contact, the rhythm selecting pulse generator 62 produces one positively going pulse at an output terminal thereof in accordance with the states of the respective flip-flop circuits to thereby render only one of the switching elements 55 conductive. Upon successive reception of the output signals from the differentiator 59, the rhythm selecting pulse generator 62 generates positively going sequential pulses at the output leads thereof so that the switching elements 55 of the rhythm selection circuit 54 are rendered conductive sequentially whereby respective ones of predetermined rhythm patterns are sequentially selected.

Where the movable contact of the manual switch 60 is connected to a lower fixed contact termed as TONE GENERATOR SELECTION, the percussion tone generator cancelling pulse generator 63 produces negatively going pulses 66 sequentially at the output leads thereof. The switching elements 57 of the tone generator cancellation circuit 56 are sequentially rendered nonconductive by the negatively going pulses 66 so that the percussion tone generators 58 are sequentially cancelled in such a manner that only one of the percussion tone generators which have heretofore been energized is deenergized and the remaining one percussion tone generator which has heretofore been deenergized is energized. The percussion tone generator cancelling pulse generator 63 includes a plurality of cascade-connected flip-flop circuits and AND circuits which are constructed so as to produce the negatively going pulses. In case the cancelling pulse generator 63 receives no output signals from the differentiator, one negatively going pulse is generated in accordance with the states of the respective flip-flop circuits included therein to disable only the corresponding one of the switching elements 57 in the tone generator cancellation circuit 56. It will be appreciated that where the cancellation pulse generator 63 produces positively going pulses like the rhythm selecting pulse generator 62, then the percussion tone generators are selectively energized one by one.

What is claimed is:

1. An electronic musical instrument comprising:
a clock pulse generator;
a counter connected to receive clock pulses from said clock pulse generator, said counter having a plurality of flip-flop circuits;
a rhythm pattern pulse generator connected to receive output signals from the respective flip-flop circuits in said counter for producing a plurality of rhythm signals each having a predetermined rhythm pattern;
a rhythm selection circuit including a plurality of input terminals connected to receive said plurality of said rhythm signals respectively, an output terminal, and switching elements connected between said output terminal and said respective input terminals;
a tone generator cancellation circuit having an input terminal connected to said output terminal of said rhythm selection circuit, a plurality of output terminals, and switching elements connected between said input terminal and said respective output terminals;
percussion tone generators connected to said output terminals of said tone generator cancellation circuit respectively;
a reset circuit having a flip-flop circuit an output of which is coupled to the respective flip-flop circuits in said counter, said reset circuit setting or resetting the respective flip-flop circuits in said counter in response to control signals from an external control signal source;
a rhythm selecting pulse generator for producing sequentially pulses in response to said control signals, each of said sequential pulses being applied to each of said switching elements in said rhythm selection circuit to render said switching elements conductive sequentially;
a percussion tone generator cancelling pulse generator for producing sequential pulses in response to said control signals, each of said sequential pulses being applied to each of said switching elements in said tone generator cancellation circuit to render said switching elements nonconductive sequentially; and
a manual switch connected to receive said control signals from said external control signal source for selectively supplying said control signals to said reset circuit, rhythm selecting pulse generator and said percussion tone generator cancelling pulse generator.