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Okamoto

[11] **3,840,691**

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[54] **ELECTRONIC MUSICAL INSTRUMENT WITH AUTOMATIC RHYTHM SECTION TRIGGERED BY ORGAN SECTION PLAY**

[75] Inventor: **Shimaji Okamoto,** Hamamatsu, Japan

[73] Assignee: **Nippon Gakki Seizo Kabushiki Kaisha,** Shizuoka-ken, Japan

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[30] **Foreign Application Priority Data**

Oct. 18, 1971 Japan 46-82353

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

[51] **Int. Cl.** **G10h 5/06**

[58] **Field of Search** .... 84/1.01, 1.03, 1.24, DIG. 12

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Primary Examiner—Richard B. Wilkinson
Assistant Examiner—U. Weldon
Attorney, Agent, or Firm—Flynn & Frishauf

[57] **ABSTRACT**

An electronic musical instrument comprises an organ section including playing keys and an automatic rhythm playing section including a clock pulse oscillator, counter stages, a rhythm pattern pulse encoder, rhythm selector switches, rhythm tone generators, a key depression detector, a rhythm cycle end detector, and a start-stop control. When keys are depressed on the first beat in every measure, a trigger signal is produced from the key depression detector and fed to the start-stop control, thereby initiating the automatic rhythm performance. When the automatic performance comes to the end of its rhythm cycle, another trigger signal is produced from the rhythm cycle end detector and fed to the start-stop control, thereby terminating the automatic rhythm performance. The rhythm section plays automatic rhythm performance cycle by cycle upon key depression in the organ section. The automatic rhythm performance will thus be in better accord with the organ section playing tempo.

10 Claims, 6 Drawing Figures

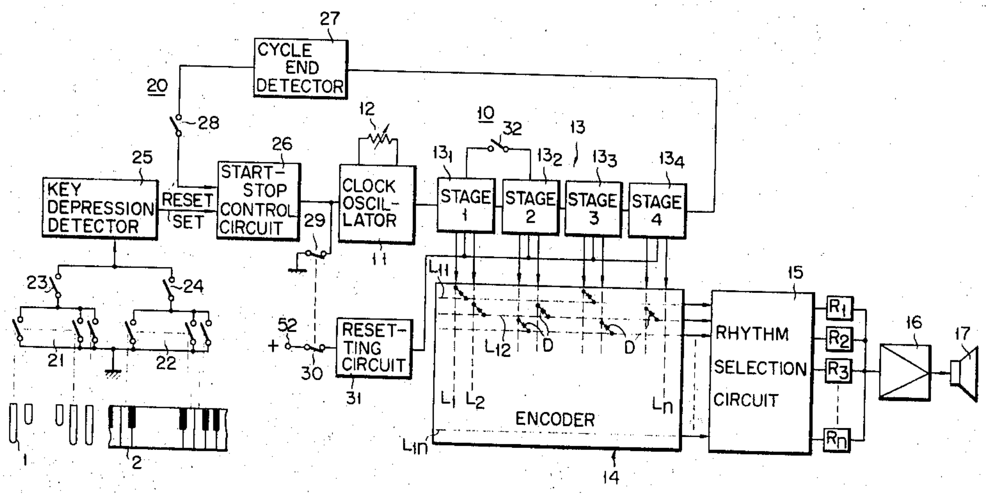
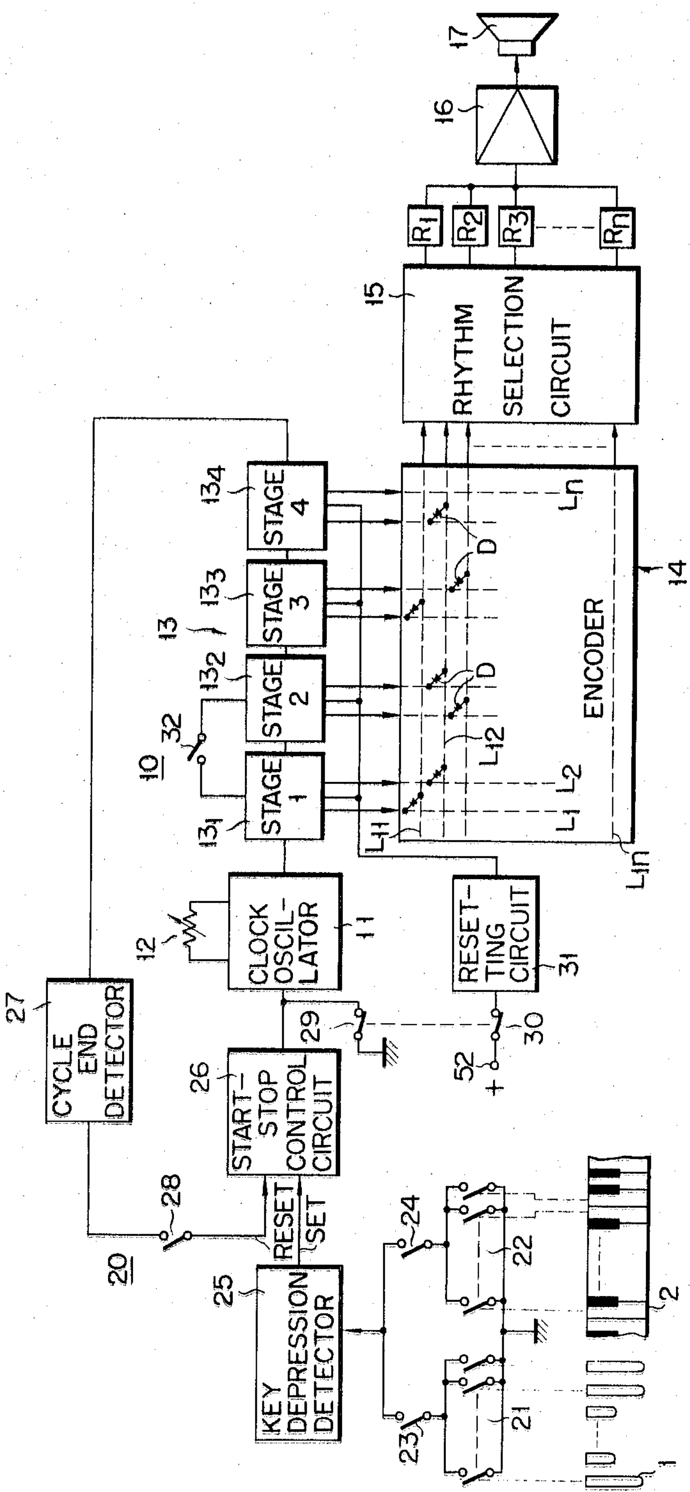


FIG. 1



17
16
R1
R2
R3
Rn
15
RHYTHM SELECTION CIRCUIT
STAGE 1
STAGE 2
STAGE 3
STAGE 4
131
132
133
134
13
10
32
D
L11
L12
L1
L2
Ln
L1n
ENCODER
14
CLOCK OSCIL-LATOR
11
12
RESET-TING CIRCUIT
31
30
52
29
CYCLE END DETECTOR
27
START-STOP CONTROL CIRCUIT
26
RESET
SET
28
20
KEY DEPRESSION DETECTOR
25
24
23
22
21
2
1

FIG. 2

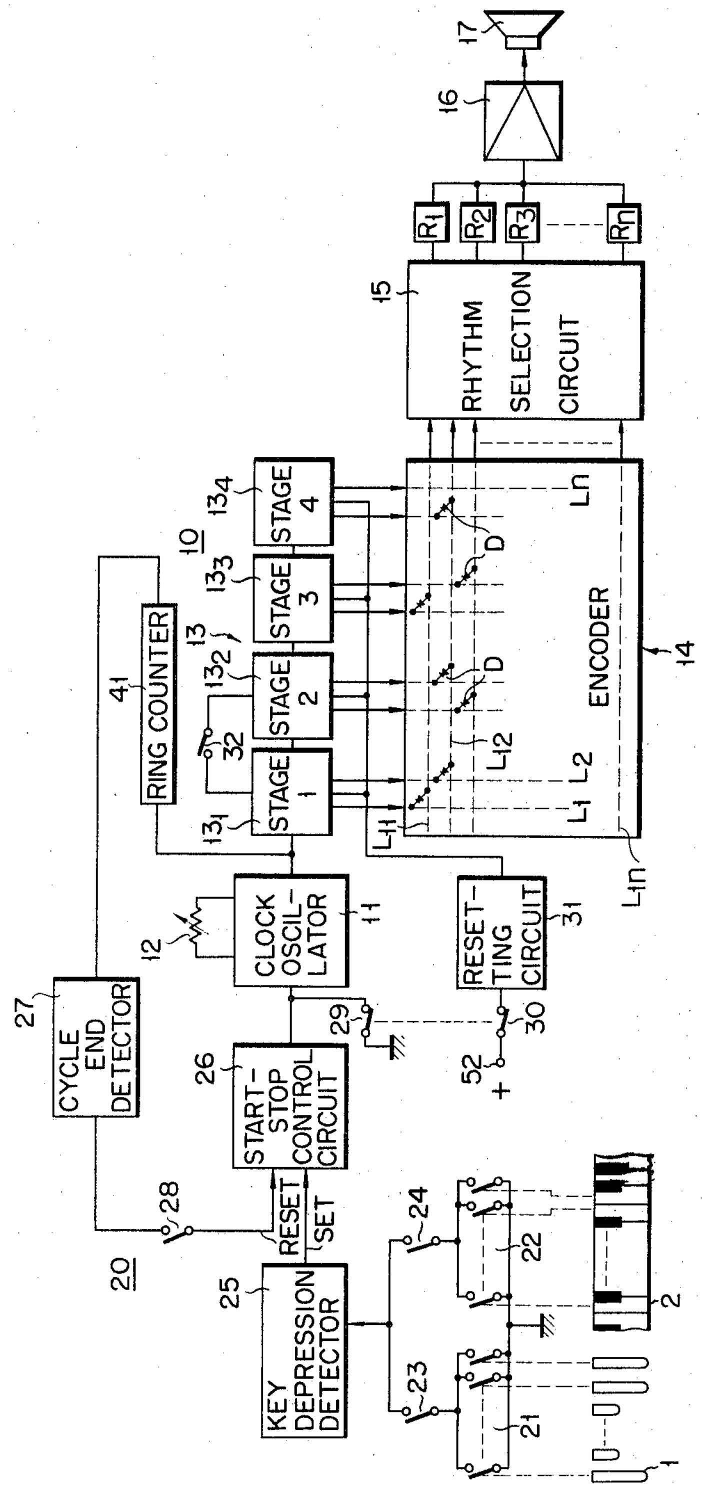

RHYTHM SELECTION CIRCUIT
ENCODER
STAGE 1
STAGE 2
STAGE 3
STAGE 4
RING COUNTER
CLOCK OSCIL-LATOR
RESET-TING CIRCUIT
CYCLE END DETECTOR
START-STOP CONTROL CIRCUIT
KEY DEPRESSION DETECTOR
RESET
SET
R1
R2
R3
Rn
Ln
L1
L2
L11
L12
L1n
D
10
11
12
13
14
15
16
17
20
21
22
23
24
25
26
27
28
29
30
31
32
41
52

FIG. 3

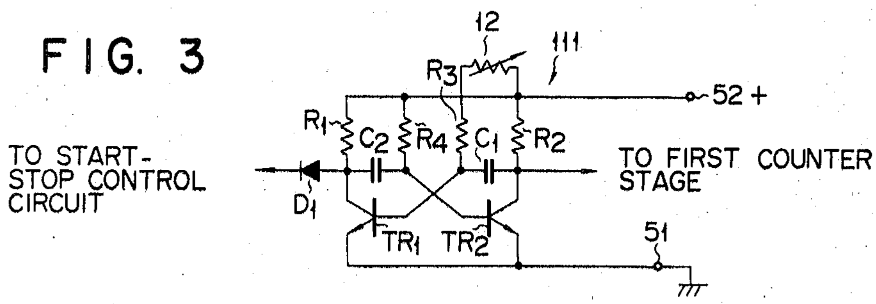


FIG. 4

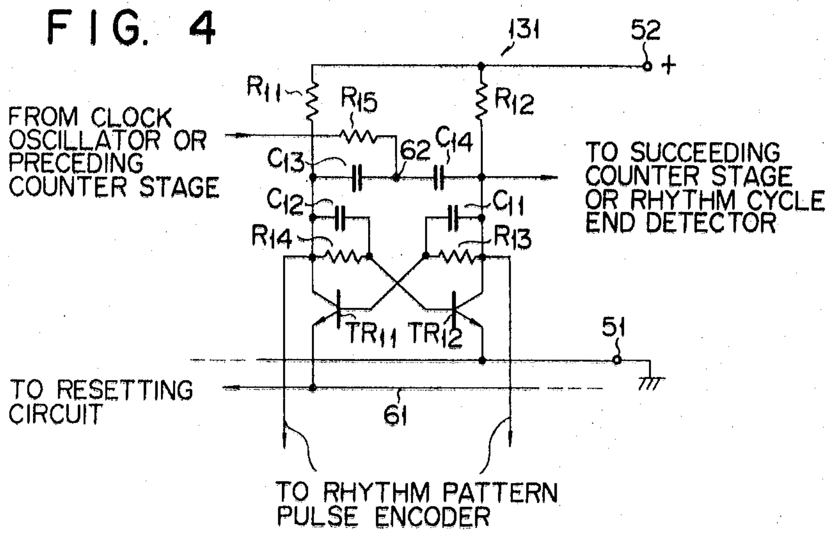
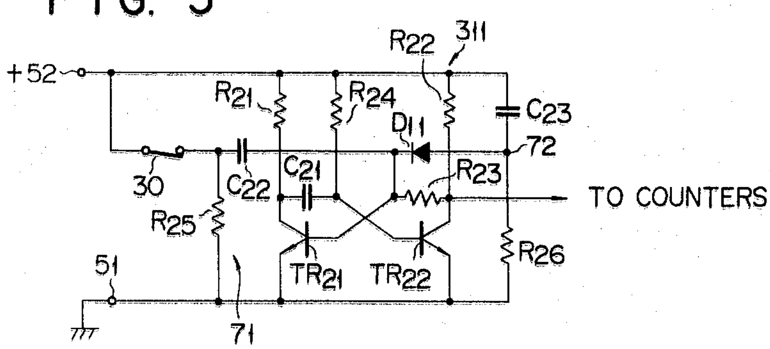


FIG. 5



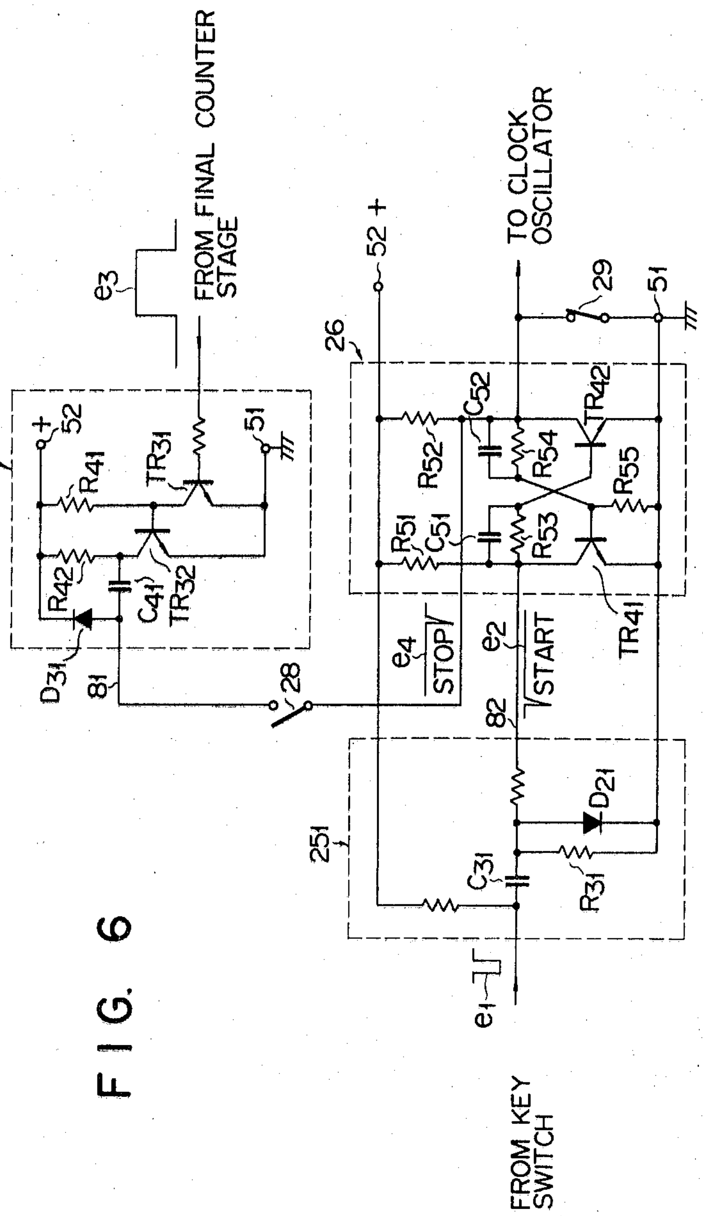

FROM FINAL COUNTER STAGE
e3
27
52
+
R41
TR31
51
R42
C41
TR32
D31
81
28
26
52 +
TO CLOCK OSCILLATOR
29
51
R52
C52
TR42
R54
R51
C51
R53
R55
TR41
e4
STOP
e2
START
82
251
D21
C31
R31
e1
FROM KEY SWITCH

FIG. 6

ELECTRONIC MUSICAL INSTRUMENT WITH AUTOMATIC RHYTHM SECTION TRIGGERED BY ORGAN SECTION PLAY

This invention relates to an electronic musical instrument such as an electronic organ and more particularly to a type provided not only with an inherent organ section but also with an automatic rhythm section.

Automatic rhythm instruments heretofore put to practical application generally include a clock pulse oscillator adapted to generate a repetitive basic tempo pulse train having a frequency or time width corresponding to the shortest beat unit (e.g. a quaver or semiquaver) of the rhythm performance and followed by a multistage frequency dividing counter chain. Output pulses from the respective stages of the counter chain are introduced into a rhythm pattern pulse encoder constructed of the known diode matrix circuit to be converted into various sets of required rhythm pattern pulses for march, rumba, tango, and so forth.

Before the start or initiation of a rhythm performance, a player selects the desired one or more of various rhythm tempos. Under this arrangement, sounds like those of Various percussion instruments such as cymbals, maracas, claves or ordinary chord or bass sounds or combinations thereof are automatically produced in accordance with the preselected rhythm pattern pulses.

Where, however, such automatic rhythm instrument is incorporated in keyboard electronic musical instruments such as an electronic organ, the rhythm sound performance goes automatically by itself and independently of the organ section performance and then the organ section for producing ordinary melody sounds or accompaniment sounds like those of the chord or bass upon selective depression of the manual and/or pedal keys of the instrument has to be so played as to meet the tempo of the automatic performance of the rhythm section.

Accordingly, it is very difficult for player other than those having an advanced skill to attain a performance on the organ section at a tempo perfectly in conformity to the tempo of the automatically produced rhythm sounds. Further rhythm sounds from the rhythm section progress regardless of musical sounds from the organ section, presenting great difficulties in stopping or terminating sounds from both sections at the same time. Therefore a keyboard electronic musical instrument provided with a conventional automatic rhythm instrument has the drawback that where a beginner desires to practise a performance on the organ section together with the automatic rhythm performance phrase by phrase or measure by measure, the rhythm performance goes ahead freely even when the player stops the performance on the organ section to repeat the exercising phrase or measure. Therefore such keyboard instrument fails to be put to such practical application.

It is accordingly the object of this invention to provide an electronic musical instrument incorporated with an automatic rhythm device which enables the tempo of the automatic rhythm performance to better meet the tempo of the organ section performance even though the organ section is played a little irregularly according to the players emotion and which is also convenient for beginners to exercise intermittently and repeatedly.

SUMMARY OF THE INVENTION

An electronic musical instrument according to a preferred embodiment of this invention comprises an organ section including playing keys for producing ordinary melody sounds or chord sounds upon selective depression of the keys on the manual keyboard and bass sounds upon selective depression of the keys on the pedal keyboard; and an automatic rhythm section including a clock pulse oscillator for generating repetitive clock pulse corresponding to the shortest beat unit of rhythm performance and followed by four stages of binary counters, a rhythm pattern pulse encoder for producing various sets of rhythm pattern pulse trains by properly combining output pulses from the counter stages, rhythm selector switches connected to the output side of the encoder and selecting out necessary pattern pulses, a plurality of rhythm tone generators selectively triggered by the selected rhythm pattern pulse trains from the slector switches, a key depression detector associated with the playing keys and generating a trigger pulse upon depression of the keys, a rhythm cycle end detector connected to the counter and generating another trigger pulse upon detection of the end of the counter cycle, and a start-stop control circuit connected to the key depression detector and the cycle end detector for receiving the trigger pulses and to the clock pulse oscillator for starting and stopping the oscillator according to the trigger pulses. The clock pulse oscillator included in the rhythm section is normally kept inoperative by the action of the start-stop control circuit, and becomes operative when a trigger signal is generated by the first depression of the manual and/or pedal keys of the organ section which flips the control circuit, thereby initiating the automatic rhythm performance. When the automatic rhythm performance comes to the end of its pattern cycle, a pulse signal indicating the end of the pattern flips the control circuit to its original state, thereby stopping the clock oscillator to terminate the automatic rhythm performance.

An electronic musical instrument according to this invention arranged as described above enables an automatic rhythm performance to be newly initiated by the play on the keyboard cycle by cycle, whereby the rhythm progression is kept in tempo with the organ progression.

The present invention can be more fully understood from the following detailed description when taken in connection with the accompanying drawings, in which:

FIG. **1** is a schematic block circuit diagram of an electronic musical instrument according to an embodiment of this invention;

FIG. **2** is a schematic block circuit diagram of a modification of FIG. **1**;

FIG. **3** is a practical circuit arrangement of a clock oscillator included in FIGS. **1** and **2**;

FIG. **4** is a practical circuit arrangement of any of the binary counters included in FIGS. **1** and **2**;

FIG. **5** is a practical circuit arrangement of the resetting circuit of FIGS. **1** and **2**; and

FIG. **6** is a practical circuit arrangement of the key depression detector, the start-stop control circuit and the rhythm cycle end detector, in combination.

An electronic musical instrument according to the preferred embodiment of this invention comprises an organ section including playing keys **1, 2** and a rhythm section including conventional portion **10** and a new portion 20 each arranged as described below. As in an ordinary rhythm instrument, the rhythm section 10 includes a clock pulse oscillator 11 of a free-running oscillation type such as an astable multivibrator which generates a repetitive basic tempo pulse train having a frequency corresponding to the shortest beat unit (e.g. a quaver or semiquaver) of the rhythm performance, the clock pulse oscillator 11 being provided with a frequency changing elements 12 consisting of, for example, a variable resistor; a multistage frequency dividing counter chain 13 formed of four stage cascade arranged binary circuits 13_1, 13_2, 13_3 and 13_4 and coupled with the clock pulse oscillator 11; a rhythm pattern pulse encoder 14 constructed of the known diode matrix circuit (as set forth in the U.S. Pat. No. 3,358,068) including a plurality of column lines L_1, L_2, . . . L_n and row lines L_{11}, L_{12}, . . . L_n and diodes D selectively connected to the intersections of said column and row lines, so as to complete various sets of required rhythm pattern pulse trains; a rhythm selection circuit 15 allowing a player to select for performance the desired one or more of the various sets or rhythm pattern pulse trains conducted from the encoder 14; and a plurality of rhythm tone generators R_1, R_2, . . . R_n for producing the preset one or more of the sounds like those derived from various percussion instruments (e.g. snare drums, bass drums and congas), ordinary chord or bass sounds or combinations thereof in response to the rhythm pattern pulses preselected by the rhythm selection circuit 15. Rhythm tone signals thus produced from the rhythm tone generators R_1 to R_n are conducted to a loud-speaker 17 through a common amplifier 16.

An electronic musical instrument according to this invention can initiate the rhythm performance by the rhythm section 10 in synchronization with the start of the musical performance on the organ section and automatically terminate the rhythm performance at the end of each cycle. The newly added portion 20 includes a plurality of pedal key switches 21 associated with the pedal keys 1 and closed upon selective depression of the keys on the pedal keyboard for regular bass performance, a plurality of manual key switches 22 closed upon selective depression of the keys on the manual keyboard for regular melody or chord performance, a start-stop control circuit 26, a rhythm cycle end detector 27, and a normally open switch. The pedal and manual key switches 21 and 22 are connected to a key depression detector 25 through the corresponding normal open switches 23 and 24 selectively closed by a player prior to performance. The key depression detector 25 is designed to produce a trigger pulse signal where the pedal and/or manual keys are selectively depressed. The above-mentioned trigger signal is supplied as a set signal to the start-stop control circuit 26, thereby rendering the clock pulse oscillator 11 operative. Accordingly, a performance is always effected under the condition where the rhythm sounds from the rhythm section start with the musical sounds from the organ section. The cycle end detector 27 is intended to detect the end of the one cycle operating period of the binary circuits 13_1 to 13_4, that is, the end of a rhythm pattern cycle defined by the period in which sixteen repetitive basic tempo pulses from the clock pulse oscillator 11 are counted. An output trigger signal from the detector 27 is supplied as a reset signal to the control circuit 26 if the normally open switch 28 is closed by a player prior to performance, thereby stopping the clock pulse oscillator 11. Where the switch 28 is kept closed, the rhythm performance stops at the end of the rhythm cycle and starts in time with organ key depression again. Where the switch 28 is kept open, the rhythm performance runs freely as in the case of an ordinary automatic rhythm instrument, until stopped by closure of gang-operated manual start-stop switches 29 and 30.

The clock pulse oscillator 11 remains inoperative by the closed switch 29 while the rhythm sounds are not to be played, and becomes operative by opening of the switch 29 when the rhythm performance is to be conducted. When the rhythm performance is to be at rest, the binary counters 13_1 to 13_4 are being reset to the orginal state by a resetting circuit 31 under the control of the switch 30 interlocking with the switch 29 (now both closed). Reference numeral 32 in FIG. 1 denotes a feedback switch provided, if required. When this switch 32 is closed, the first and second stage binary circuits 13_1 and 13_2 jointly act as a ternary circuit, thereby changing the rhythm pattern cycle from the 4-beat kind based on the period in which the clock pulse oscillator produces sixteen clock pulses in a cycle to the 3-beat kind based on the period in which twelve clock pulses are generated in a cycle.

FIG. 2 is a schematic circuit diagram of a modification of FIG. 1. In the embodiment of FIG. 1, the end of each rhythm pattern cycle was detected by an output signal from the counter chain 13. In the modification of FIG. 2, however, there is provided between the output terminal of the clock pulse oscillator 11 (i.e. the input of the counter) and the input terminal of the rhythm cycle end detector 27 a ring counter 41 having the same unit operating period as that of the counter chain 13, namely, sixteen (or twelve interchangeably) positions to count sixteen (twelve) clock pulses generated by the clock pulse oscillator 11. Obviously, the modification of FIG. 2 can be operated in the same manner and with the same effect as the embodiment of FIG. 1.

FIG. 3 shows a practical circuit arrangement of the clock pulse oscillator 11. A circuit 111 has two NPN transistor TR_1 and TR_2, the emitters of which are connected to a grounded negative power source 51, and the collectors of which are connected to a positive power source 52 via resistors R_1 and R_2. The base of the transistor TR_1 is connected to the collector of the transistor TR_2 via a capacitor C_1 and also to the positive power source 52 via the series circuit of a resistor R_3 and the variable resistor 12. The base of the transistor TR_2 is connected to the collector of the transistor TR_1 via a capacitor C_2 and also to the positive power source 52 via a resistor R_4. The collector of the transistor TR_1 is connected via a diode D_1 of the indicated polarity to the collector of a transistor TR_{42} included in a circuit 26 hereinafter shown in FIG. 6. The collector of the transistor TR_2 is connected to the trigger point of the first stage binary counter 13_1 as hereinafter shown in FIG. 4. The circuit 111 arranged as described above acts as the know astable multivibrator, and continuously produces from the collector of the transistor TR_2 clock pulse trains having a frequency or time width defined by the values of the capacitances and the resistances.

FIG. 4 is a practical circuit diagram of a given one of the binary counters 13_1 to 13_4. A circuit 131 has two

NPN transistors TR_{11} and TR_{12}. The emitter of the transistor TR_{11} is connected to the collector of a transistor TR_{22} included in the resetting circuit **311** of FIG. **5** via a line **61**, and the emitter of the transistor TR_{12} is connected to the negative power source **51**. The collectors of both transistors TR_{11} and TR_{12} are connected to the positive power source **52** via resistors R_{11} and R_{12}. The base of the transistor TR_{11} is connected to the collector of the transistor TR_{12} via a parallel circuit of a capacitor C_{11} and a resistor R_{13}. The base of the transistor TR_{12} is connected to the collector of the transistor TR_{11} via parallel connected capacitor C_{12} and resistor R_{14}. Across the collectors of both transistors TR_{11} and TR_{12} is connected a series circuit of two coupling capacitors C_{13} and C_{14}. The common junction **62** of both capacitors C_{13} and C_{14} is supplied with output pulses acting as a trigger signal from the clock pulse oscillator or a binary circuit immediately preceding the aforesaid given binary circuit. The circuit **131** acts as the known bistable multivibrator or flip-flop circuit. Under the reset condition of the circuit **131**, the transistor TR_{11} is on and the transistor TR_{12} is off, and under the released condition the transistors TR_{11} and TR_{12} are alternately turned on and off receiving pulses from the preceding circuit.

FIG. **5** is a practical arrangement of the resetting circuit. This circuit **311** includes two NPN transistors TR_{21} and TR_{22}, their emitters are connected to the negative power source **51** and their collectors are connected to the positive power source **52** via resistors R_{21} and R_{22}. The base of the transistor TR_{21} is connected to the collector of the transistor TR_{22} via a resistor R_{23} and the base of the transistor TR_{22} is connected to the collector of the transistor TR_{21} via a capacitor C_{21} and also to the positive power source **52** via a resistor R_{24}. Between the positive power source **52** and the base of the transistor TR_{21} is connected via the switch **30** a differentiation circuit **71** constructed of a grounded resistor R_{25} and a capacitor C_{22}, the circuit **71** acting as a momentary trigger path as later described. Further if required, a series circuit of a capacitor C_{23} and a resistor R_{26} is disposed across the positive and negative power sources **52** and **51**, and also a forward connected diode D_{11} is provided between the base of the transistor TR_{21} and the common connection **72** to the capacitor C_{23} and the resistor R_{26}. The circuit **311** of the aforementioned arrangement acts as the known one-shot multivibrator. While the rhythm performance is running, namely, while the switch **30** is opened, the transistor TR_{21} is kept condutive and the transistor TR_{22} is kept conductive. Accordingly, the line **61** of FIG. **4** is grounded through the conducting transistor TR_{22}, bringing the counters ready for counting operation. Each time the clock pulses are supplied to the counter, the four-stage binary circuits 13_1 to 13_4 (only one indicated in FIG. **4**) count down the pulses into halves successively. On the other hand, the moment the player closes the switch **30** to stop the rhythm sounds, the differentiation circuit **71** generates a differentiated positive going impulse which is applied as a trigger signal to the base of the transistor TR_{21} to bring the transistor TR_{21} conductive and consequently the transistor TR_{22} nonconductive. Therefore, the line **61** of FIG. **4** is brought to the potential of the positive power source **52.** Thus the binary counters are forcefully reset regardless of its condition at that time, becoming ready for the next new performance initiating from the first beat of the rhythm cycle. And after a length of time defined by a time constant derived from the product of the capacitance of the capacitor C_{21} and the resistance of the resistor R_{24}, the transistors TR_{21} and TR_{22} have the condition reversed, namely, the transistor TR_{22} is turned on and the transistor TR_{21} is turned off, coming back to the normal state.

The capacitor C_{23} and resistor R_{26} are provided to cause the base of the transistor TR_{21} to be momentarily supplied with a positive potential through the diode D_{11} at the first power switching-on of the instrument and to be released from such positive supply at the normal working state.

FIG. **6** shows a practical circuitry including the key depression detector **25,** the start-stop control circuit **26** and the rhythm cycle end detector **27.** The key depression detector **25** comprises a differentiation circuit **251** formed of a capacitor C_{31} and a resistor R_{31}. A forward polarized diode D_{21} is connected parallel to the resistor R_{31} to attain a D.C. clamping to ground. The rhythm cycle end detector **27** includes two directly coupled NPN transistors TR_{31} and TR_{32}, the emitters of which are connected to the negative power source **51,** and the collectors of which are connected to the positive power source **52** via resistors R_{41} and R_{42}. The base of the transistor TR_{31} is connected to the output line of the final stage binary counter 13_4 as shown in FIG. **4,** and the base of the transistor TR_{32} is connected to the collector of the transistor TR_{31}. The collector of the transistor TR_{32} is connected via a capacitor C_{41} to an output line **81** of the detector **27.** Between the output line **81** and the positive power source **52** is connected the diode D_{31} of the indicated polarity to attain a D.C. clamping to the positive power potential.

The start-stop control circuit **26** includes two NPN transistors TR_{41} and TR_{42}, the emitters of which are connected to the negative power source **51,** and the collectors of which are connected to the positive power source **52** via resistors R_{51} and R_{52}. The base of the transistor TR_{42} is connected to the collector of the transistor TR_{41} via a parallel circuit of a capacitor C_{51} and resistor R_{53}. Similarly, the base of the transistor TR_{41} is connected to the collector of the transistor TR_{42} via a parallel circuit of a capacitor C_{52} and resistor R_{54}, and, if required, also to the negative power source **51** via a resistor R_{55} of a large resistance. The collector of the transistor TR_{41} is connected to the output line **82** of the key depression detector **251.** The collector of the transistor TR_{42} is connected to the output line **81** of the rhythm cycle end detector **27** via the switch **28** and also to the negative power source **51** via the switch **29,** and further to the collector of the transistor TR_1 included in the clock pulse oscillator **111** of FIG. **3** via the diode D_1. Obviously. the circuit **26** of FIG. **6** arranged as described above act as a bistable circuit.

There will now be described the operation of the circuitry of FIG. **6.** When the rhythm performance is set at rest, the switch **29** is closed and therefore in the start-stop control circuit **26,** the collector-emitter path of transistor TR_{42} is shunted and transistor TR_{42} is kept in a condition ready to pass current. The transistor TR_{41} is kept in a current blocking condition in the rhythm cycle end detector **27,** the transistor TR_{31} is kept in a current blocking condition being supplied with ground potential from the transistor TR_{12} in FIG. **4,** and the transistor TR_{32} is kept in a condition to pass current. Since, in this case, the switch **29** is closed, the collector of the transistor TR_1 included in the clock pulse oscillator of FIG. 3 is connected to the grounded negative power source **51** through the now forward biased diode D_1, causing the collector-emitter path of the transistor TR_1 to be short-circuited. Accordingly, the clock pulse oscillator **111** is kept inoperative to prevent the generation of rhythm sounds.

For performance, a player opens the gang-actuated switches **29** and **30** and closes one or both of the switches **23** and **24** as a preparation for automatic performance, and then starts playing on the organ by selectively depressing the manual and and/or pedal keys. Under such arrangement, desired musical sounds consisting of either melody sounds or chord and bass sounds or combinations thereof are produced from the organ section. On the other hand, the moment the first one or ones of the pedal and/or manual keys are depressed and the associated key switches **21** and/or **22** are closed, a negative going voltage e_1 as shown in FIG. 6 is generated. The signal e_1 is applied to the differentiation circuit **251.** A negative going impulse is produced at the falling of the signal e_1 and a positive going impulse at the rising thereof. Since the positive impulse is shunted by the forward biased diode D_{21}, the output line **82** only produces the negative impulse e_2, which is applied as a trigger signal to the collector of the transistor TR_{41} included in the start-stop control circuit **26,** causing the collector-emitter path of the transistor TR_{41} to be short-circuited. Accordingly, the other transistor TR_{42} included in the control circuit **26** is rendered nonconductive and the transistor TR_{41} is rendered conductive. At this time, the diode D_1 is biased backward to release the clock pulse oscillator **111** of FIG. 3 from its dormant state, causing the rhythm section **10** automatically to produce rhythm sounds. The base of the transistor TR_{31} still remains at the ground potential. When the rhythm progression goes as far as a half of the cycle, the last counter stage 13_4 is flipped and the input to the transistor TR_{31} exhibits a positive rise as shown by the waveform e_3. In the detector **27,** therefore, the transistor TR_{31} is turned on and the transistor TR_{32} is turned off at the rising of the pulse e_3. At this time, the capacitor C_{41} connected to the collector of the transistor TR_{32} passes a positive pulse wave, which, however, is shunted to the power line **52** through the now forward biased diode D_{31} and consequently does not appear on the output line **81** of the rhythm cycle and detector **27.** As the rhythm progression goes ahead further and comes as far as to the end of the rhythm cycle, the last counter stage 13_4 is flipped back and the input to the transistor TR_{31} exhibits a negative going fall as shown by the waveform e_3. In the detector **27,** therefore, the transistor TR_{31} is turned off and the transistor TR_{32} is turned on at the falling of the pulse e_3. At this time, the capacitor C_{41} passes a negative pulse wave e_4, which backward biases the diode D_{31} and is conducted to the output line **81** of said detector **27,** and then comes out as a trigger signal to the collector of the transistor TR_{42} included in the start-stop control circuit **26,** causing the collector-emitter path of the transistor TR_{42} to be short-circuited. Accordingly, the other transistor TR_{41} of the control circuit **26** is turned off, and the transistor TR_{42} is turned on, which in turn shunts the collector and emitter of the transistor TR_1 through the forward biased diode D_1. Thus the clock pulse oscillator **111** is again brought to its stopped to cease the rhythm performance. With the switch **28** opened, the rhythm cycle end detector **27** does not flip the start-stop control circuit, so that the rhythm section **10** obviously continues the automatic rhythm performance as on the conventional automatic rhythm instrument.

What is claimed is:

1. An electronic musical instrument comprising an organ section for playing melody and accompaniment tones and including a plurality of playing keys; and an automatic rhythm section including a clock pulse oscillator generating repetitive clock pulses, counters connected to said clock pulse oscillator for counting down to submultiples of the frequency of said clock pulses from said clock pulse oscillator, a rhythm pattern pulse encoder connected to said counters for producing plural sets of rhythm pattern pulse trains, each rhythm pattern pulse train being comprised of a combination of different preset output pulses from said counters, a rhythm selection circuit coupled with said encoder to select the desired one or more of the various rhythm pattern pulse trains from said encoder, and a plurality of rhythm tone generators connected to said selection circuit and being selectively triggered by the rhythm pattern pulse train preselected by said rhythm selection circuit to produce said preset one or more rhythm sounds in exact timing with the tempo of the preselected rhythm pattern,

the improvement comprising:

a key depression detector coupled to the said playing keys and generating a trigger pulse upon depression of said keys,

a rhythm cycle end detector connected to at least one of said counters and generating another trigger pulse upon detection of the end of the counter cycle, and

a start-stop control circuit having inputs coupled to said key depression detector and to said rhythm cycle end detector for receiving said trigger pulses and having an output coupled to said clock pulse oscillator for generating a first output signal for normally maintaining said clock pulse oscillator inoperative, said start-stop control circuit including means responsive to the trigger signal from said key depression detector for generating a second output signal to render said clock pulse oscillator operative upon receipt of the trigger signal from said key depression detector, and means responsive to the trigger signal from said rhythm cycle end detector for generating said first output signal to render said clock pulse oscillator inoperative upon receipt of the trigger signal from said rhythm cycle end detector, thereby automatically ending rhythm performance at the end of each rhythm cycle.

2. An electronic musical instrument claimed in claim **1** wherein said start-stop control circuit comprises a flip-flop circuit.

3. An electronic musical instrument claimed in claim **1** further including a resetting circuit coupled to said counters for resetting said counters back to a preset original state prior to rhythm performance.

4 An electronic musical instrument claimed in claim **3** wherein said resetting circuit comprises a one shot multivibrator.

5. An electronic musical instrument claimed in claim **1** wherein said clock pulse oscillator comprises an astable multivibrator with a frequency control element.

6. An electronic musical instrument claimed in claim 1 wherein said counters comprise four stage cascade arranged binary circuits.

7. An electronic musical instrument claimed in claim 6 wherein the first and second stages of said binary circuit have a feedback loop which is selectively closed, and said first and second stage binary circuits with the closed feedback loop constitute a single ternary circuit.

8. An electronic musical instrument comprising an organ section for playing melody and accompaniment tones and including a plurality of playing keys; and an automatic rhythm section including a clock pulse oscillator generating repetitive clock pulses, counters connected to said clock pulse oscillator for counting down to submultiples of the frequency of said clock pulses from said clock pulse oscillator, a rhythm pattern pulse encoder connected to said counters for producing plural sets of rhythm pattern pulse trains, each rhythm pattern pulse train being comprised of a combinaton of different preset output pulses from said counters, a rhythm selection circuit coupled with said encoder to select the desired one or more of the various rhythm pattern pulse trains from said encoder, and a plurality of rhythm tone generators connected to said selection circuit and being selectively triggered by the rhythm pattern pulse train preselected by said rhythm selection circuit to produce said preset one or more rhythm sounds in exact timing with the tempo of the preselected rhythm pattern,

the improvement comprising:

a key depression detector coupled to the plain keys and generating a trigger pulse upon depression of said keys,

a ring counter coupled to the input of said counters and producing a signal at the end of a cycle,

a rhythm cycle end detector connected to the output of said ring counter and generating another trigger pulse upon detection of the end of the ring counter cycle, and

a start-stop control circuit having inputs coupled to said key depression detector and to said rhythm cycle end detector for receiving said trigger pulses and having an output coupled to said clock pulse oscillator for generating a first output signal for normally maintaining said clock pulse oscillator inoperative, said start-stop control circuit including means responsive to the trigger signal from said key depression detector for generating a second output signal to render said clock pulse oscillator operative upon receipt of the trigger signal from said key depression detector, and means responsive to the trigger signal from said rhythm cycle end detector for generating said first output signal to render said clock pulse oscillator inoperative upon receipt of the trigger signal from said rhythm cycle end detector, thereby automatically ending rhythm performance at the end of each rhythm cycle.

9. An electronic musical instrument claimed in claim 9 wherein said start-stop control circuit comprises a flip-flop circuit.

10. An electronic musical instrument claimed in claim 9 wherein said clock pulse oscillator ccomprises an astable multivibrator with a frequency control element.

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