

[72] Inventor **Alfred B. Freeman**
Skokie, Ill.
 [21] Appl. No. **719,474**
 [22] Filed **Apr. 8, 1968**
 [45] Patented **Dec. 15, 1970**
 [73] Assignee **Chicago Musical Instrument Co.**
Chicago, Ill.
 a corporation of Delaware

3,247,307 4/1966 Campbell 84/1.03
 3,358,068 12/1967 Campbell 84/1.01

Primary Examiner—W. E. Ray
 Attorney—Hill, Sherman, Meroni, Gross & Simpson

[54] **AUTOMATIC RHYTHM SYSTEM WITH
 SELECTABLE PLURAL MUSICAL
 ARRANGEMENTS**
 11 Claims, 9 Drawing Figs.

[52] U.S. Cl. 84/1.03,
 84/1.24, 328/75, 307/265
 [51] Int. Cl. G10f 1/00,
 G10h 1/00, G10h 5/00
 [50] Field of Search 84/1.01-
 —1.04, 1.06—1.08, 1.17, 1.24, 1.25

[56] **References Cited**

UNITED STATES PATENTS

RE26,521 2/1969 Park 84/1.03

ABSTRACT: An electronic musical rhythm-producing device includes a polystage multivibrator for producing pulse signal information at a predetermined frequency and spacing, an electronic sequencer having input terminals connected to said polystage multivibrator for receiving said pulse signal information and further having a plurality of output terminals, sound generator means, and connecting means including logic gates, a resistor matrix assembly, and a selector switch connected between certain ones of said plurality of outputs of the logic sequencer and certain ones of the outputs of the polystage multivibrator and to the sound generator means for rendering the sound generator means sequentially operative in response to the polystage multivibrator and the logic sequencer. Player operated manual switches connected to the sound generator means are also provided.

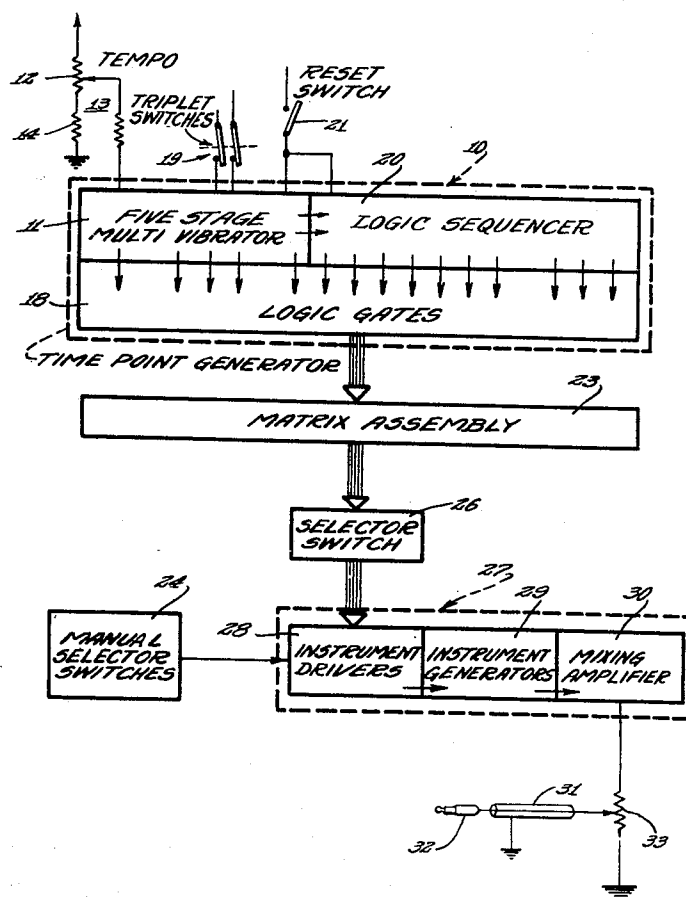
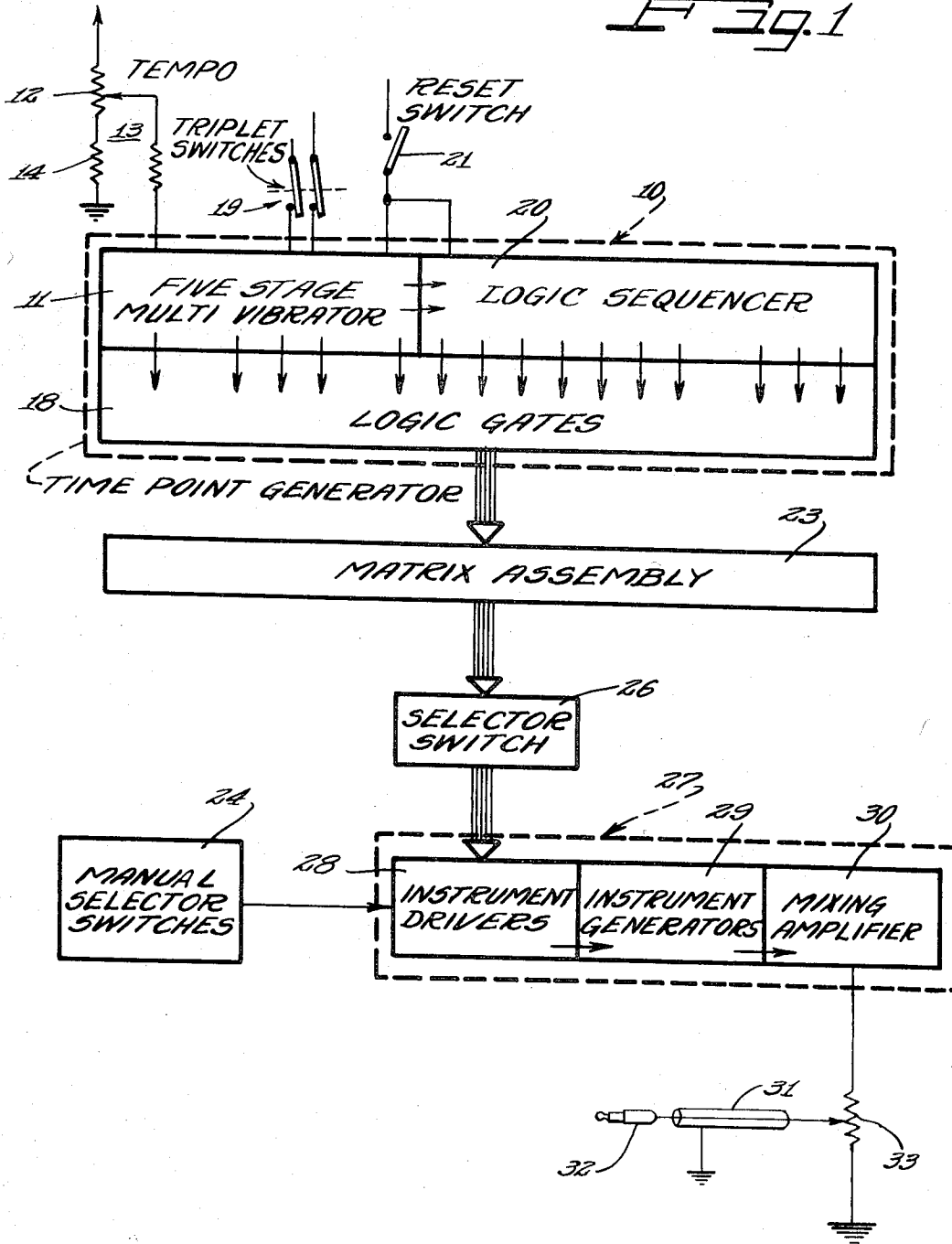


Fig. 1



INVENTOR.

Alfred B. Freeman

BY *Kill, Sherman, Morris, Goad & Smith*

ATTORNEYS

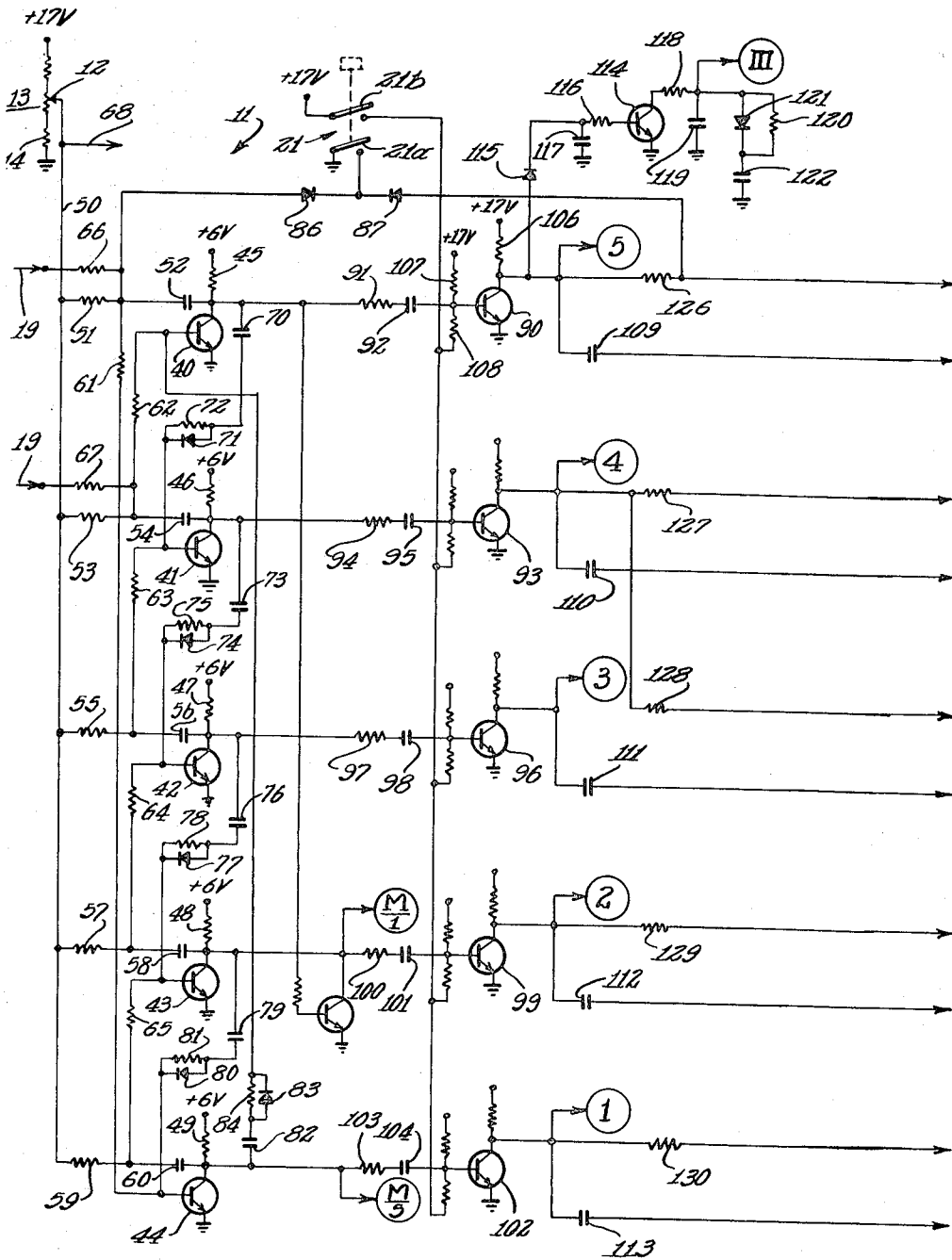


Fig. 2a

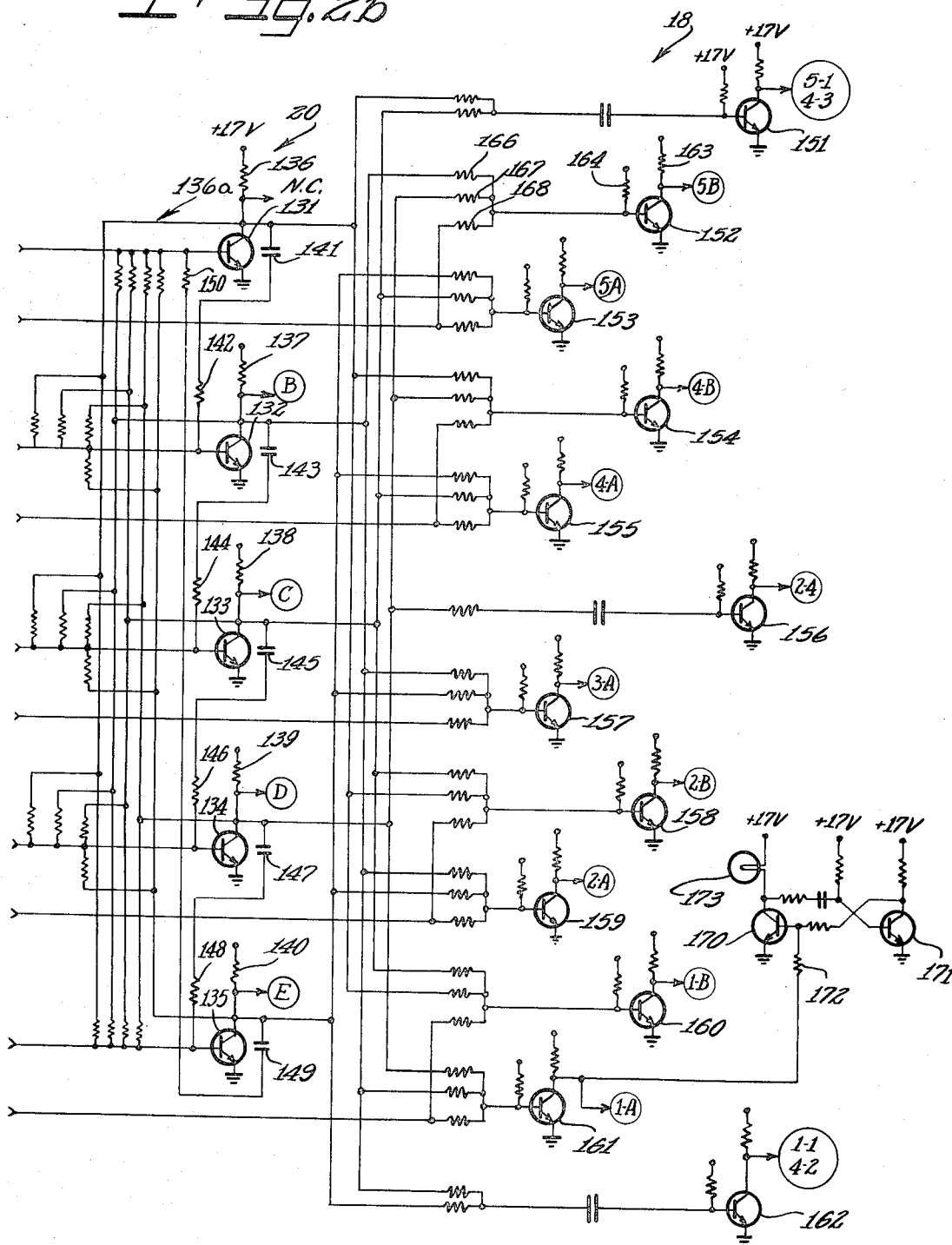
INVENTOR.

Alfred B. Freeman

By Hill, Sherman, Morris, Gross & Simpson

ATTORNEYS

Fig. 2b



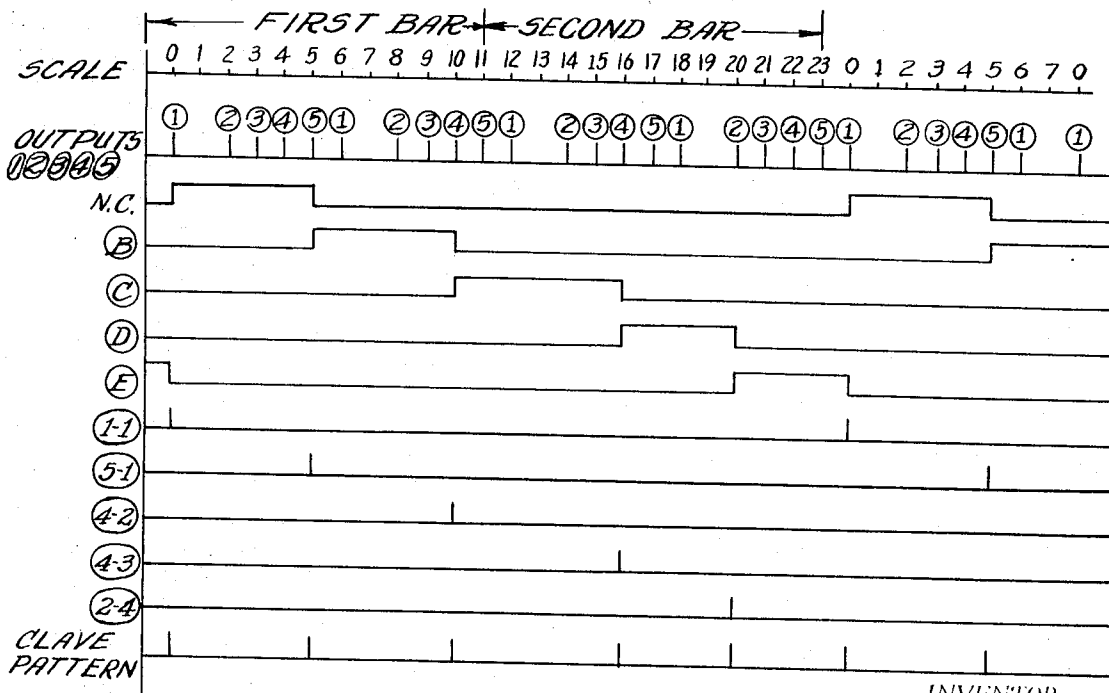
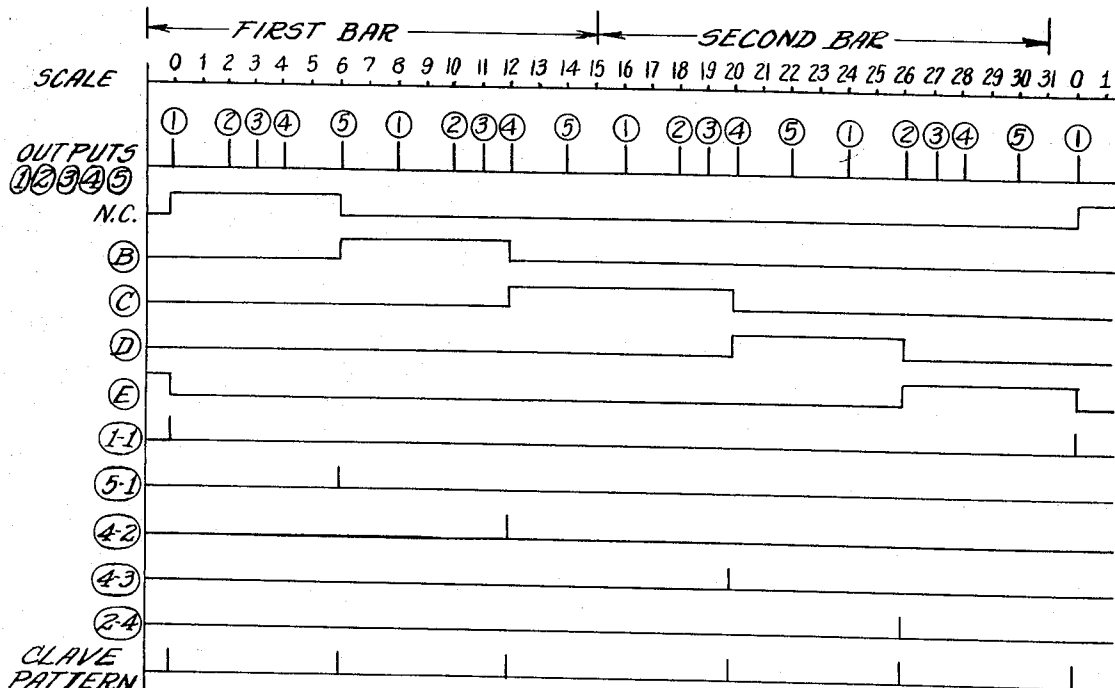
INVENTOR.

Alfred B. Freeman

BY *Hill, Thomas, Davis, Case & Smith*

ATTORNEYS

Fig. 3a



INVENTOR.

Fig. 3b Alfred B. Freeman

BY Hill, Sherman, Merri, Gross, Sander

ATTORNEYS

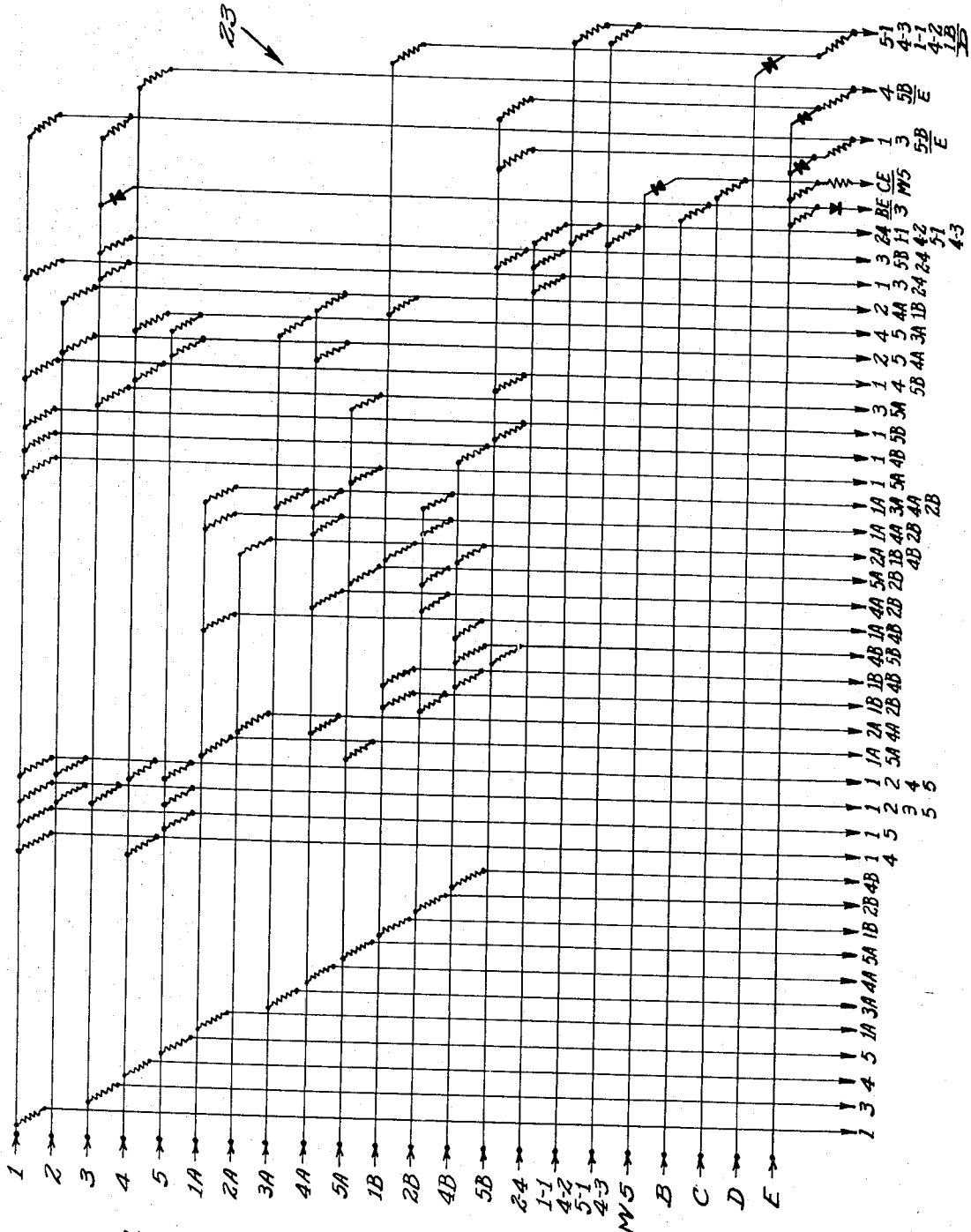
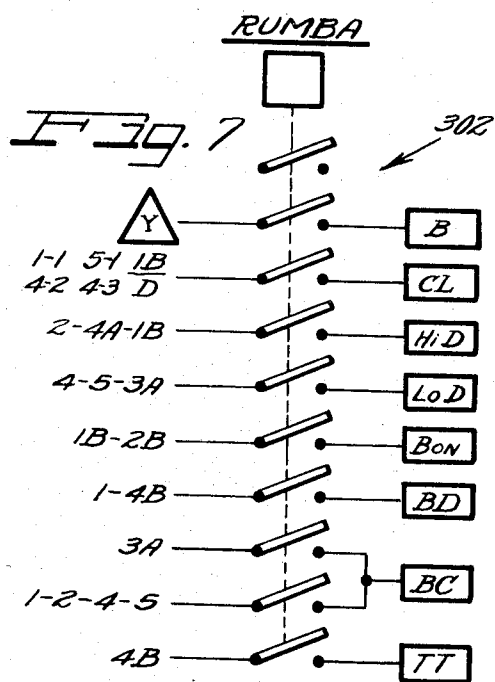
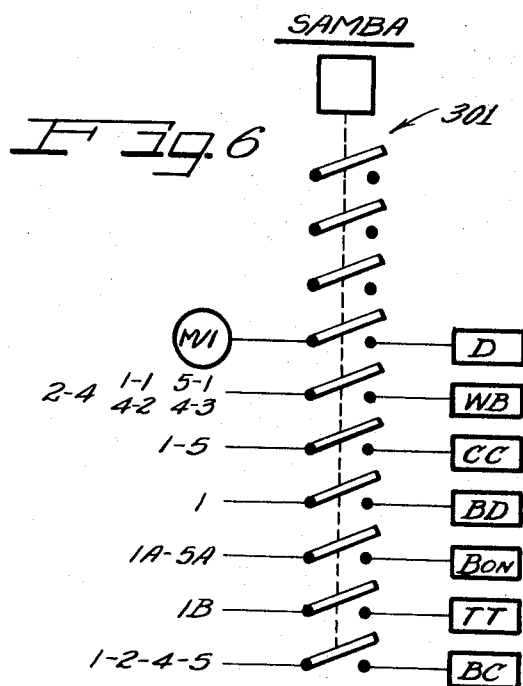
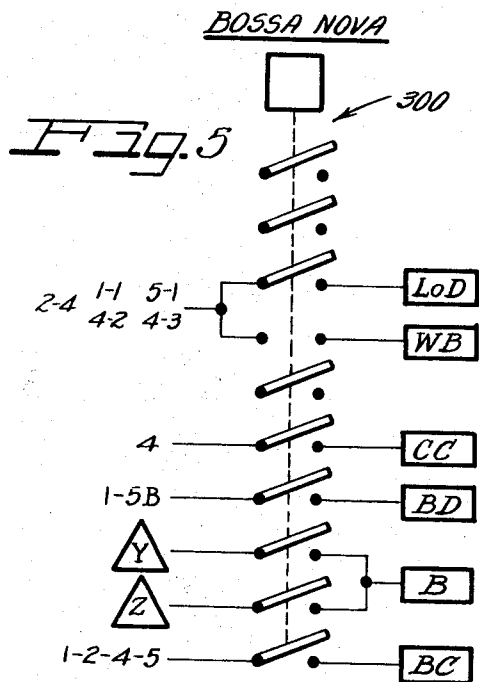


Fig. 4

INVENTOR.

Alfred B. Freeman

BY *Hill, Sherman, Messeri, Chase, Simpson* ATTORNEYS



INVENTOR.

Alfred B. Freeman

BY *Hill, Sherman, Meroni, Gross & Simpson* ATTORNEYS

AUTOMATIC RHYTHM SYSTEM WITH SELECTABLE PLURAL MUSICAL ARRANGEMENTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is directed generally to an electronic rhythm producing sound device for automatically generating sounds in rhythmic patterns for use alone or as accompaniment with other musical instruments. Specifically, the invention is directed to a new and improved pulse generating circuit arrangement for a rhythm producing sound device.

2. Description of the Prior Art

Heretofore automatic rhythm devices included electronic clock means which would produce evenly spaced pulses to drive ring or binary counters of a fixed number of stages. The proper pattern of pulses for producing rhythmic patterns were then obtained by gating the proper pulses from the chain each time the counter cycled. A large number of evenly spaced pulses had to be included in the cycle in order to permit all the desired patterns to be obtained.

SUMMARY OF THE INVENTION

Accordingly, the present invention decreases the number of pulses necessary to operate a rhythm producing sound device by providing selector means to change the pulse spacing for particular musical arrangements. In so doing, the gating and logic circuitry required to obtain the desired pulse pattern is greatly simplified. In addition to the simplification resulting from using few pulses and which pulses more closely fit the time spacing of the musical arrangement to be produced, the present invention also uses more economical resistors matrix instead of the diode matrices of prior art devices.

The device includes a time-point generator, a direct current coupled matrix and an instrument generator. The time-point generator comprises a multistage multivibrator which generates pulses to control the rate and time-points of the rhythm device. The frequency and time spacing of the output pulses of the multistage multivibrator are adjustable.

The output of the multistage multivibrator is delivered to a logic sequencer through a plurality of pulse amplifiers and to certain ones of a plurality of logic gate circuits. The logic sequencer is a five-stage device with feedback from the last stage to the first stage to repeat the cycle.

The pulses derived from the foregoing are delivered to the matrix assembly where they are combined to form subpatterns as required by the various musical arrangements. There are a plurality of patterns or arrangements which can be selected by a selector switch, and each of the patterns is derived from its prescribed subpattern or matrix output. In musical arrangements where more than one instrument sound is to be played during the same time-points the matrix producing that particular subpattern is duplicated so that there are separate but identical drive pulses for each sound generator.

The rhythm device of the present invention is energized by a direct current voltage power supply which produces, for example, 6 and 17 volts for the operation of the transistor circuitry. The power supply is preferably voltage regulated with zener diodes to maintain the voltage within the prescribed limits while variations from 90 to 130 volts AC may occur at the input line.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing generally the circuit arrangement of a rhythm sound producing device constructed in accordance with principles of this invention;

FIG. 2 is divided into two segments designated FIGS. 2a and 2b and shows a detailed schematic diagram of the circuit arrangement of the time-point generator and logic gate of FIG. 1;

FIG. 3a is a graphical representation of a time-point pulse pattern produced by the time-point generator of FIG. 2;

FIG. 3b is a graphical representation of an alternate time-point pulse pattern which may be obtained by the time-point generator of FIG. 2 when the triplet switch is closed;

FIG. 4 is a detailed schematic diagram of the resistor matrix used to connect the output of the time-point generator of FIG. 2 to the input of the sound generators of FIG. 3; and

FIGS. 5, 6 and 7 illustrate some of the switching arrangement used for selectively connecting certain portions of the matrix of FIG. 4 to certain input terminals of the sound generators of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Seen in FIG. 1 is a rhythm sound producing device constructed according to this invention and includes a time-point generator 10 which produces a plurality of sequential spaced apart pulses which may correspond to the sequential spacing of a line or bar of written music. The time-point generator 10 includes a five-stage multivibrator 11 the frequency of which is selectively variable by a potentiometer 12. The potentiometer 12 together with a resistor 14 forms a voltage divider network 13.

The output of the five-stage multivibrator 11 is delivered to a logic sequencer 20 and to certain ones of a plurality of logic gate circuits designated generally by reference numeral 18. A switch 19 is connected to the five-stage multivibrator 11 to selectively change the voltage applied to a portion of the multivibrator 11 thereby changing the dimensioning of the multivibrator 11 to cause different pulse width to be generated from certain stages thereof. The output of the five-stage multivibrator 11 is delivered to certain ones of the plurality of logic gate circuits 18 and to the input of the logic sequencer 20.

The five-stage multivibrator 11 forms a clock generator which controls the function of the rhythm device. A clock generator so formed in accordance with this invention can selectively produce evenly or unevenly spaced pulse signals to provide a plurality of different kinds of pulse patterns corresponding to the different kinds of musical arrangements.

Also, according to the present invention, the logic sequencer 20 is a direct-coupled self-biasing circuit which, in the preferred embodiment has five stages. The multistage multivibrator and/or the logic sequencer of the present invention may have more or less than five stages.

The logic sequencer 20 is biased such that four of the five stages are conducting in the saturated mode of operation and one of the stages is nonconductive. Pulses from the five-stage multivibrator 11 will cause the nonconductive stage to become conductive and the next preceding stage to become nonconductive. Connected to the five-stage multivibrator and to the logic sequencer 20 is a reset switch 21.

The output pulses produced by the logic gate circuits 18 together with pulses from the multivibrator 11 and logic sequencer 20 are delivered to a matrix assembly 23. The matrix assembly 23 consists primarily of resistors which are direct current coupled to the output circuits of the time point generator 10.

The output of the matrix assembly 23 is connected to a selector switch assembly 26 and therefrom to an instrument sound generator 27. The selector switch 26 provides means to connect the proper points of the matrix assembly 23 to selective ones of a plurality of instrument drive circuits 28 of the instrument sound generator 27. The instrument drive circuits 28 are connected to one or more of a plurality of instrument sound generator circuits 29 to activate the generator circuits to produce the sound corresponding to the frequency and wave-shape generated by the instrument generators. The output of the instrument generators are then applied to a mixing amplifier designated generally by reference numeral 30.

Also associated with the instrument drive circuits 28 are manual selector switches 24 which comprise a plurality of individually selectable switches to actuate the instrument sound generators 29 associated with the switches 24. Therefore, in addition to generating a plurality of different rhythmic sounds in accordance with the output of the time-point generator 10, sounds may be produced by a player operating the manual selector switches 24.

The output of the mixing amplifier 30 is connected to a suitable audio amplifier and speaker system (not shown) by

means of a cable 31 which has a phone-jack 32 connected at one end thereof. The other end of the cable 31 is connected to a potentiometer 33 which serves as a volume control.

FIG. 2 is a detailed schematic diagram of the time-point generator 10, of FIG. 1, and is divided into two segments, FIG. 2a and FIG. 2b. The five-stage multivibrator 11 includes five transistors 40, 41, 42, 43, and 44. Connected to the collector electrode of each of the transistors 40, 41, 42, 43, and 44 are resistors 45, 46, 47, 48 and 49 respectively. The emitter electrode of each of the transistors 40—44 is connected to ground potential.

The movable contactor of potentiometer 12 is connected to a line 50, which, in turn, is connected to the collector electrode of transistor 40 through a resistor 51 and a capacitor 52. Also connected to line 50 is the collector electrode of transistor 41 through a resistor 53 and a capacitor 54, while the collector electrode of transistor 42 is connected to line 50 through a resistor 55 and a capacitor 56. Similarly, the collector electrode of transistor 43 is connected to line 50 through a resistor 57 and a capacitor 58 while the collector electrode of transistor 44 is connected to line 50 through a resistor 59 and a capacitor 60. A resistor 61 has one end thereof connected between the junction of resistor 51 and capacitor 52 and the other end thereof connected to the base electrode of transistor 44. A resistor 62 has one end thereof connected between the junction of resistor 53 and capacitor 54 and the other end thereof connected to the base electrode of transistor 40. A resistor 63 has one end thereof connected between the junction of resistor 55 and the capacitor 56 and the other end thereof connected to the base electrode of transistor 41. Similarly, a resistor 64 has one end thereof connected between the junction of resistor 57 and capacitor 58 and the other end thereof connected to the base electrode of transistor 42, and a resistor 65 has one end thereof connected to the junction of resistor 59 and capacitor 60 and the other end thereof connected to the base electrode of transistor 43. Therefore, the output of each of the transistors 40—43 is resistor capacitor coupled to the input, or base electrode, of the next stage of the five-stage multivibrator. Also, resistors 61—65 are connected to line 50 through resistors 51, 53, 55, 57, and 59 to apply the proper operating bias on the base electrodes of transistors 40—44.

The triple switch 19 includes a pair of switch blades which are connected to resistors 66 and 67. A lead line 68 is connected to line 50 to supply B+ for the triplet timing of the five-stage multivibrator 11. In operation, when triplet switch 19 is in the closed position a positive voltage is applied through resistors 66 and 67 to change the bias at certain points of the five-stage multivibrator thereby changing the pulse dimensioning produced by the vibrator.

A cross coupling and threshold circuit is connected between the output of transistor 40 and the input of transistor 41 and includes a capacitor 70 connected in series with a diode 71 and a resistor 72 which are connected in parallel. Similarly, a cross coupling and threshold circuit is connected between the output of transistor 41 and the input of transistor 42 and includes a capacitor 73 connected in series with a diode 74 connected in parallel with a resistor 75. The output of transistor 42 is connected to the input of transistor 43 through a capacitor 76 which is connected in series with a diode 77 connected in series with a resistor 78. Similarly, the output of transistor 43 is connected to the input of transistor 44 through a capacitor 79 connected in series with a diode 80 which, in turn, is connected in series with a resistor 81. The output of transistor 44 is connected to the input of transistor 40 through the cross coupling threshold circuit comprising capacitor 82 connected in series with a diode 83 which, in turn, is connected in parallel with a resistor 84. The cross coupling and threshold circuits connected between each of the five-stages of the five-stage multivibrator provides the proper cross-coupling feedback and operating characteristic of each of the stages. For example, each of the diodes 71, 74, 77, 80, and 83 is preferably a germanium diode having a low threshold.

The reset switch 21 includes a pair of contactors 21a and 21b. The contactor 21a is connected to ground potential while the contactor 21b is connected to a positive 17 volt source. When the reset switch 21 is closed, ground potential is applied to the cathodes of a pair of diodes 86 and 87 connected end to end. This action will apply ground potential to the junction of resistor 51 and capacitor 52 which action will reset the five-stage multivibrator to a predetermined condition, for example, transistor 44 nonconductive while transistors 40—43 remain conductive.

The five-stage multivibrator 11 is a free running multivibrator operating such that the output of one stage is coupled to the input of the next succeeding stage and so on. Accordingly, the five-stage multivibrator 11 of the present invention provides a unique and novel means for generating pulse signal information at predetermined time-points to control the operation of the rhythm producing sound device of the present invention.

The output of transistor 40 of the five-stage multivibrator 11 is coupled to a pulse amplifier 90 through a resistor 91 and a capacitor 92. Similarly, the output of transistor 41 is coupled to a pulse amplifier 93 through a resistor 94 and a capacitor 95, and the output of transistor 42 is coupled to a pulse amplifier 96 through a resistor 97 and a capacitor 98. Similarly, the output of transistor 43 is coupled to a pulse amplifier 99 through a resistor 100 and a capacitor 101 while the output of transistor 44 is coupled to a pulse amplifier 102 through a resistor 103 and a capacitor 104. All of the pulse amplifiers 90, 93, 96, 99, and 102 are constructed in a similar manner and, therefore, a description of only pulse amplifier 90 will be given.

The collector electrode of transistor 90 is connected to a positive voltage source through a resistor 106 while the base electrode thereof is connected to the positive voltage source through a resistor 107. Also connected to the base electrode of transistor 90 is the positive potential from reset contactor 21b through a resistor 108. The resistor 107 has a resistance value greater than the resistor 108 thereby affording a different value of bias to the base electrode of transistor 90 than would be applied to the base electrode of transistor 90 when reset switch 21 is closed. For example, the resistor 107 may have a value four times greater than resistor 108. When the reset switch 21 is closed each of the transistors 90, 93, 96, 99, and 102 are rendered conductive in the saturated mode of operation thereby applying substantially ground potential to the output of each of the pulse amplifiers.

The output of pulse amplifiers 90, 93, 96, 99, and 102 is applied to certain ones of the terminals of the matrix assembly 23, as will be more fully described hereinbelow. The outputs 1, 2, 3, 4, and 5 enclosed in circles correspond to similarly marked terminals at the input of the matrix assembly 23. Therefore, the output of the pulse amplifiers is direct current coupled to the matrix assembly 23. Also connected to the output of pulse amplifiers 90, 93, 96, 99, and 102 are capacitors 109, 110, 111, 112, and 113 respectively. The capacitor coupled pulses from the output of the pulse amplifiers are delivered to certain ones of the logic gate circuits 18, of FIG. 1. The outputs of pulse amplifiers 90, 93, 99, and 102 are direct current coupled to the inputs of the logic sequencer 20. It will be noted that no direct current coupling is provided between pulse amplifier 96 and the logic sequencer 20.

A cymbol decay control circuit is connected to the pulse amplifier 90 and includes a transistor 114 having the base electrode thereof connected to the pulse amplifier 90 through a diode 115 and a resistor 116. Connected between the junction of diode 115 and resistor 116 is a capacitor 117. The collector electrode of transistor 114 is connected to an output lead, indicated by III positioned within a circle, through a resistor 118. Also connected to resistor 118 is capacitor 119, a resistor 120 and a diode 121. The resistor 120 and diode 121 are connected in parallel and in series with a capacitor 122 which, in turn, is connected to ground potential.

The DC coupling from pulse amplifiers 90, 93, 99, and 102 are direct current coupled to the logic sequencer 20 through resistors 126, 127, 128, 129, and 130. It will be noted that resistors 127 and 128 are connected together to the common output of pulse amplifier 93.

Resistors 126, 127, 128, 129, and 130 are connected to the base electrode of transistors 131, 132, 133, 134, and 135 respectively. Also connected to resistors 126—130 is a resistor coupling and biasing network 136a which provides means for interconnecting selected outputs of transistors 131—135 to selected inputs of the same transistors to provide proper interaction between transistors 131—135 to function as a logic sequencer.

Transistor 131 has the collector electrode thereof connected to a positive voltage source through a resistor 136, while transistor 132 has the collector electrode thereof connected to the positive voltage source through a resistor 137. Similarly, transistor 133 has the collector electrode thereof connected to the positive voltage source through a resistor 138, and the transistor 134 has the collector electrode thereof connected to the positive voltage source through a resistor 139 while the collector electrode of transistor 135 is connected to the positive voltage source through a resistor 140. The output pulse of transistor 131 is connected to certain ones of the logic gate circuits 18 and to the base electrode of transistor 132 through a capacitor 141 and a resistor 142. The output pulse of transistor 132 is connected to certain ones of the logic gate circuits 18 and to the base electrode of transistor 133 through a capacitor 143 and a resistor 144. The output pulse of transistor 133 is connected to certain ones of the logic gate circuit 18 and to the base electrode of transistor 134 through a capacitor 145 and a resistor 146. The output pulse of transistor 134 is delivered to certain ones of the logic gate circuits 18 and to the base electrode of transistor 135 through a capacitor 147 and a resistor 148. The last stage, transistor 135, is connected to the first stage, transistor 131, through a capacitor 149 and a resistor 150. Therefore, the logic sequencer 20 will continue to repeat the cycle of operation each time transistor 135 produces an output pulse. All but one of the transistors 131—135 are conductive in the saturated mode of operation. A pulse from one of the pulse amplifiers 90, 93, 99, and 102 will render the nonconductive transistor of the logic sequencer 20 conductive and, while the nonconductive transistor is becoming conductive, it will produce a pulse which will render the next succeeding transistor of the sequencer nonconductive.

The output of logic sequencer 20 is delivered to certain ones of the logic gate circuits 18. The logic gate circuits 18 comprise a plurality of transistors 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, and 162 which have the base electrodes thereof direct current coupled to the outputs of the logic sequencer 20 and capacitive coupled to the outputs of the pulse amplifiers 90, 93, 96, 99, and 102.

All of the logic gate circuit transistors 151—162 operate in the same manner and, therefore, only one transistor stage will be described. The transistor 152 has the collector electrode thereof connected to a 17 volt positive source through a resistor 163 and the base electrode thereof connected to the positive voltage source through a resistor 164. The emitter electrode of each of the transistors 151—162 is connected to ground potential. Also connected to the base electrode of transistor 152 is a plurality of resistors 166, 167, and 168. Resistor 166 is connected to the collector electrode of transistor 132 of logic sequencer 20 while resistor 167 is connected to the collector electrode of transistor 134 of logic sequencer 20. Resistor 168 is connected to the output of pulse amplifier 90 through capacitor 109.

The logic transistor 152 operates as an AND logic requiring either transistor 132 or transistor 134 of the ring counter to be conductive and a pulse from the pulse amplifier 90. Only the transistors 152, 153, 154, 155, 157, 158, 159, and 160 operate as AND gates requiring a pulse from the ring counter and a pulse from one of the pulse amplifiers. Transistor 156 of the

logic circuit operates as a pulser in response to a negative signal at the output of transistor 134 of the ring counter 20. Transistors 151 and 162 of the logic gate circuits 18 operate as OR logic requiring a signal at either one or the other of the pair of transistors connected between the base electrode thereof and the ring counter 20.

According to the present invention each of the pulse amplifiers 90, 93, 96, 99, and 102 as well as each of the conducting stages of the logic sequencer and the transistors of the logic gate circuits 18 are operated in the saturated mode of operation and produce output signals when the transistors are cut off for a short period of time. Furthermore, by operating the transistors in the saturated mode of operation direct current coupling between stages is possible thereby simplifying the circuit arrangement and reducing the number of components necessary for the operation thereof. Additionally, the present invention provides cross-coupling means between the stages of the five-stage multivibrator 11 which includes a capacitor and a diode resistor network to insure that each transistor will be cut off quickly when the next succeeding transistor in the stage is rendered conductive.

A downbeat circuit is provided and connected to the output of transistor 161 of the logic gate circuits 18. The downbeat circuit includes a pair of transistors 170 and 171 which operate as a oneshot multivibrator with transistor 170 normally nonconductive and transistor 171 conductive. A pulse from transistor 161 through a resistor 172 will render transistor 170 conductive thereby energizing an indicating lamp 173. The downbeat circuit will cause the indicating lamp to become deenergized automatically in response to the operation of the oneshot multivibrator. The lamp 173 is used as a downbeat indicator for a person who is using the rhythm sound device for accompaniment.

Seen in FIG. 3a is a time point pulse pattern of the various output signals developed at the output terminals of the time point generator 18 of FIGS. 2a and 2b. The horizontal direction of the wave pattern represents time and is divided into a two bar pattern. The scale near the top of the FIG. divides the two bar pattern into 32 notes which are represented by the number series 0—31. Therefore, each bar is divided into 16 evenly spaced notes. However, as shown by the output signals from outputs ① ② ③ ④ and ⑤ the time point pulses are generated only at certain times corresponding to selected notes of each bar.

The output N.C. is a gate pulse which is initiated by output ① and terminated by output ⑤. Although the gate pulse N.C. is not used for the particular musical arrangements described herein, the logic pulses 1-1 and 5-1 are used. The gate pulse N.C. can be used, when desired, for other musical arrangements. At the of gate pulse N.C., the gate pulse ① is initiated and, pulse ② is terminated by the second ④ pulse. At the termination of gate pulse ② pulse ③ is initiated which, in turn, is terminated by the third ④ pulse. Termination of gate pulse ③ will initiate gate pulse ④ and the fourth ② pulse will terminate this gate. Finally, termination of gate pulse ④ will initiate gate pulse ⑤ which, in turn, is terminated by the first ① pulse and the cycle of the logic sequencer is repeated.

Developed at the outputs of the logic gates 18 are the pulses 1-1, 5-1, 4-2, 4-3 and 2-4. As seen in FIG. 2b, output pulses 5-1 and 4-3 are developed at the output of transistor 151 and, outputs 1-1 and 4-2 are developed at transistor 162. Transistor 156 develops the output 2-4. The nomenclature 1-1 means the first pulse ① during the first cycle of the five-stage multivibrator 11. The nomenclature 5-1 means the fifth pulse ⑤ during the first cycle of the multivibrator 11, and so on.

A novel feature of the present invention is that the combined pulse pattern of pulses 1-1, 5-1, 4-2, 4-3, and 2-4 produces the clave pattern which is shown at the bottom of FIG. 3a. This clave pattern is

obtained directly without the use of special or added logic circuits which would have no other function. The clave pattern is used in the production of many Latin rhythms and other musical arrangements and, therefore, is very desirable.

Seen in FIG. 3b is the time point pulse pattern obtained from the output of the time point generator 10 when the triplet switch 19 is closed. Closure of switch 19 decreases the time spacing between the ④ and ⑤ pulses of the five-stage multivibrator. Therefore, each bar of music is divided into a 12 musical note scale indicated by the series of numbers 0—11 and 12—23. As mentioned with regard to FIG. 3a, there are four cycles of the five-stage multivibrator for each cycle of the logic sequencer 20, the only difference being the time spacing between certain pulses. Accordingly, the novel circuit arrangement of the time point generator 20 of the present invention provides means for obtaining different time point pulse patterns without requiring additional circuitry.

Seen in FIG. 4 is the detailed arrangement of the matrix assembly 23. The vertical row of terminals is arranged for connection to the circuit points which have the same number designation on the time-point generator of FIG. 2 and, the horizontal row of terminals is arranged for connection to terminal points of the sound generator 27 of FIG. 1 through the selector switches 26. For example, a signal at terminal ① of the vertical row of terminals will produce a corresponding pulse at a plurality of terminals indicated by the number ① in the horizontal row of terminals.

Also, it will be noted that the matrix assembly 23 of FIG. 4 has relatively few diodes associated therewith thereby decreasing the relative cost of the matrix as well as the complexity thereof. This is accomplished by the fact that the output of the time-point generator is operated in a saturated mode of operation.

Seen in FIG. 5 is one switch arrangement for selecting a predetermined number of terminal points from the horizontal row of terminals of the matrix of FIG. 4 for connecting these terminal points to the desired input terminals of the sound generator 27 of FIG. 1. FIG. 4 shows the preferred switch arrangement for Bossa Nova sound. A switch 300 includes a plurality of ganged together contactors having certain ones thereof connected to the selected terminals of the horizontal row of terminals of FIG. 4. The output terminals of the switch 300 are connected to terminals of the sound generator 27 having the same letter designation.

FIG. 6 illustrates a switching arrangement between the horizontal row of terminals of the matrix of FIG. 4 and the sound generator 27 of FIG. 1 and includes a switch assembly 301. The switch assembly 301 is connected to selected terminals of the horizontal row of terminals of the matrix of FIG. 4 and to selected terminals of the sound generator 27 so as to produce a Samba rhythm. Similarly, the input terminals of switch 301 are connected to the terminals of the horizontal row of terminals of FIG. 4 having the same designation.

FIG. 7 shows still a further switching arrangement for producing a Rhumba sound from the automatic rhythm device of the present invention. The switch arrangements shown in FIGS. 5, 6, and 7 are just a few of the switch arrangements of the selector switch 26 of FIG. 1. Furthermore, it will be understood that the triplet switch 19, of FIGS. 1 and 2a, is associated with certain ones of the switches of the selector switch assembly 26 to change the spacing of the time point pulse pattern produced by the time point generator 10. For example, selector switches for developing the SLOW FOX, SWING and DIXIE musical arrangements would also include switch contacts similar to switch 19 to apply B+ to the five-stage multivibrator through resistors 66 and 67. The closing of switch 19 would change the time point pulse pattern from that shown in FIG. 3a to that shown in FIG. 3b.

A detailed description of the matrix assembly of FIG. 4 as well as the switch arrangements of FIG. 5, 6, and 7 is not given as it is believed that the circuit arrangement illustrated is self-explanatory and teaches those skilled in the art how to practice the invention.

Accordingly, the automatic rhythm producing device of the present invention provides unique and novel means for

generating clock pulses at predetermined time-points in a simple and straightforward manner. Accordingly, variations and modifications may be effected without departing from the spirit and scope of the novel concepts of this invention.

I claim:

1. A rhythm producing sound device comprising: a polystage multivibrator for producing pulse signal information at a predetermined frequency and spacing; an electronic logic sequencer having input terminals connected to said polystage multivibrator for receiving said pulse signal information and further having a plurality of output terminals; sound generator means; and connecting means connected between certain ones of said plurality of outputs of said logic sequencer and certain ones of the outputs of said polystage multivibrator and to said sound generators means for rendering said sound generator means sequentially operative in response to said polystage multivibrator and said logic sequencer.

2. A rhythm producing sound device according to claim 1 wherein said connecting means includes a plurality of logic gate circuits each having an input connected to certain ones of said outputs of said logic sequencer and to certain outputs of said polystage multivibrator.

3. A rhythm producing sound device according to claim 1 wherein said polystage multivibrator is a five-stage multivibrator.

4. A rhythm producing sound device according to claim 1 further including a cross-coupling network connected between the output of each stage of said polystage multivibrator to the next succeeding input thereof, said cross-coupling network consisting of a capacitor connected in series with a resistor and a diode connected in parallel with said resistor.

5. A rhythm producing sound device according to claim 1 further including a pulse amplifier circuit connected between each output stage of said polystage multivibrator and the input of each stage of said logic sequencer.

6. A rhythm producing sound device according to claim 3 wherein said logic sequencer is a five-stage logic sequencer and each stage thereof has an input terminal connected to the stages of said five-stage multivibrator.

7. A rhythm producing sound device comprising: a polystage multivibrator for producing pulse signal information at a predetermined frequency and time spacing; a logic sequencer having input terminals thereof connected to said polystage multivibrator for receiving said pulse signal information and further having a plurality of outputs; a sound generator means; connecting means connecting the outputs of said logic sequencer and the outputs of said polystage multivibrator to said sound generator means to sequentially operate said sound generator means in response to the outputs of said logic sequencer and said pulse signal information from said polystage multivibrator; and means connected to said polystage multivibrator for changing the time spacing of at least some of the pulses from said polystage multivibrator.

8. A rhythm producing device according to claim 7 wherein said polystage multivibrator is a five-stage multivibrator.

9. A rhythm producing device according to claim 8 further including pulse amplifier means connected to each of the five-stages of said five-stage multivibrator and to the input terminals of said logic sequencer.

10. A rhythm producing device according to claim 7 wherein each stage of said polystage multivibrator includes a cross coupling network from the output of each stage to the input of the next succeeding stage, said cross-coupling network consisting of a capacitor connected in series with a resistor and a diode connected in parallel with said resistor.

11. A rhythm producing sound device comprising: a multivibrator having at least three stages for producing a plurality of pulse signals of a predetermined frequency and spacing; a logic sequencer having input terminals connected to said multivibrator for receiving said plurality of pulse signals and further having output terminals; sound generator means; and connecting means for connecting the output of said multivibrator and said logic sequencer to said sound generator means to produce a musical rhythm.