United States Patent

[11] **3,549,778**

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[54] **ELECTRONIC ORGAN WITH ALTERNATE REITERATION BY THREE-NOTE GROUPS**
17 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **84/1.03,** 84/1.19, 84/1.24
[51] **Int. Cl.** **G10h 1/02,** G10h 5/00
[50] **Field of Search** ..... 84/1.01, 1.03, 1.04, 1.19, 1.24, 1.25(A, F, O, S)

[56] **References Cited**

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3,272,906	9/1966	DeVries et al.	84/1.25
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3,476,864	11/1969	Munch et al.	84/1.03

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ABSTRACT: System for sounding electronic organ tones reiteratively in alternation by groups of three adjacent notes. Several embodiments are provided as follows:

1. Tone signals from alternate three-note groups are collected in two common headers for separate filtering followed by alternate reiteration and conversion to sound.

2. Tone signals from alternate three-note groups are collected in two common headers for alternate reiteration, then filtering in common and conversion to sound.

3. Tone signals from alternate three-note groups are separately filtered, then collected in two separate headers for alternate reiteration and conversion to sound.

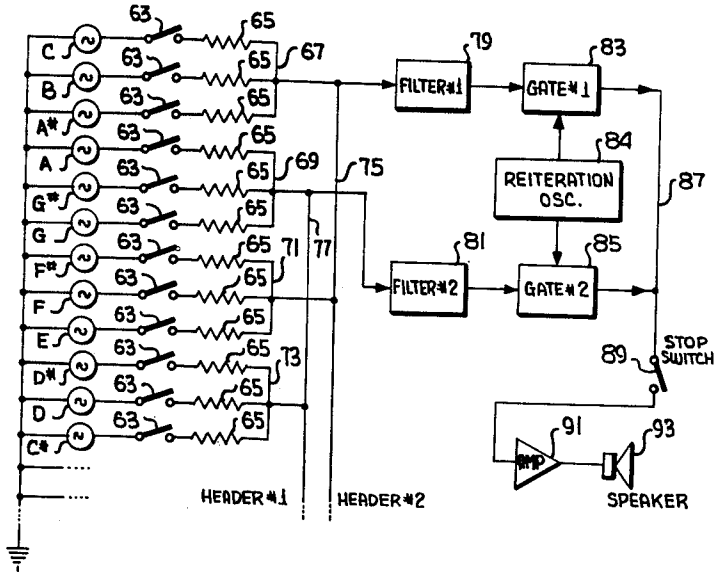


FIG. 1a.
(PRIOR ART)

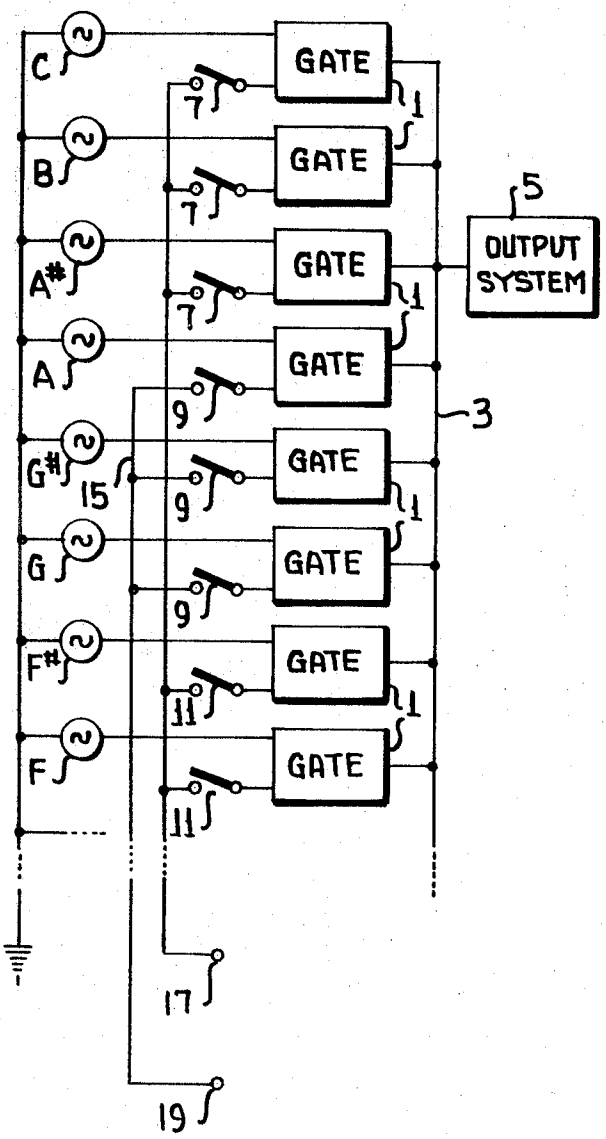


FIG. 1b
(PRIOR ART)

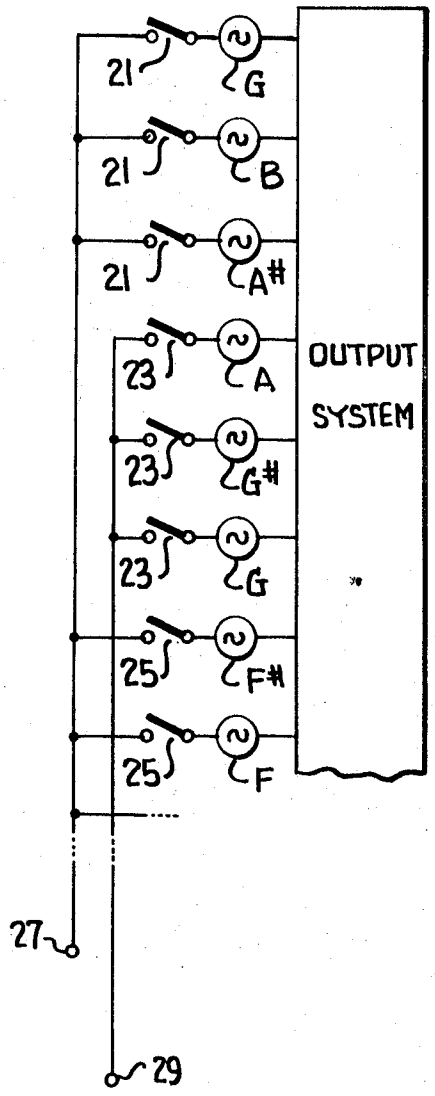
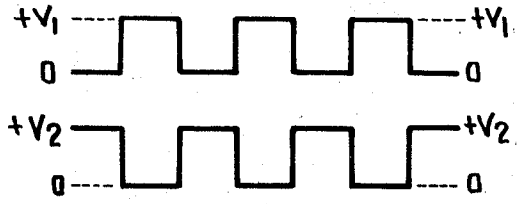


FIG. 1c



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FIG. 2

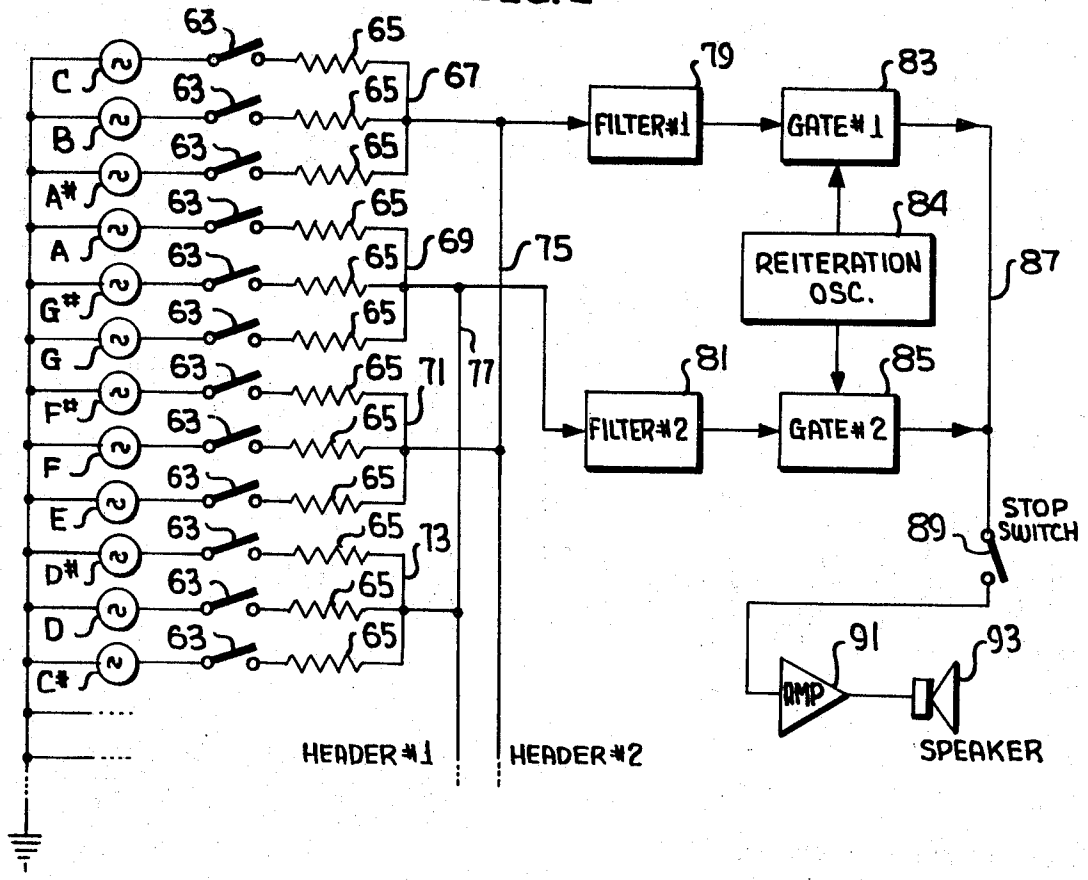
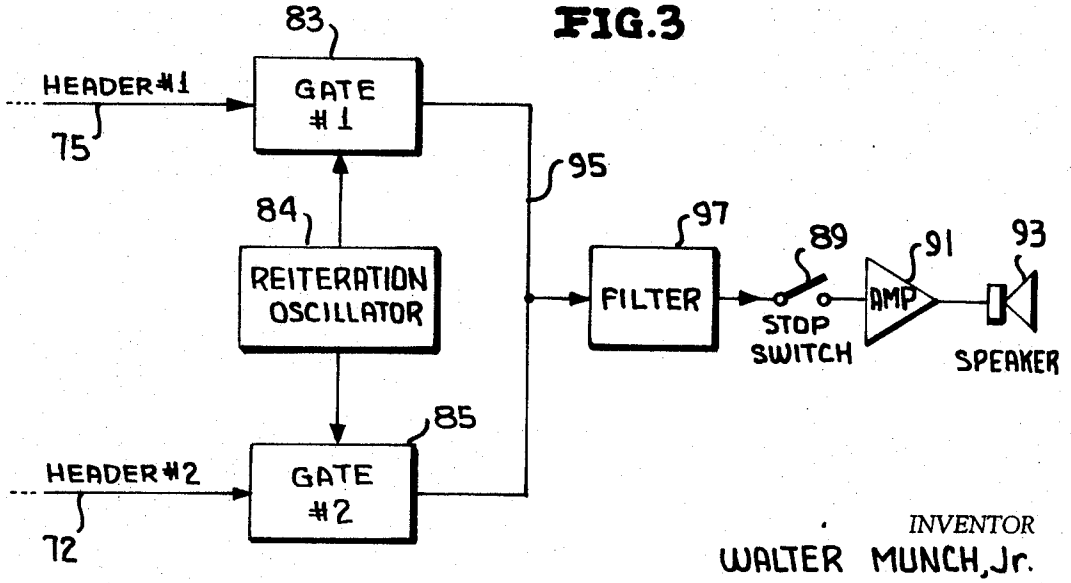


FIG. 3



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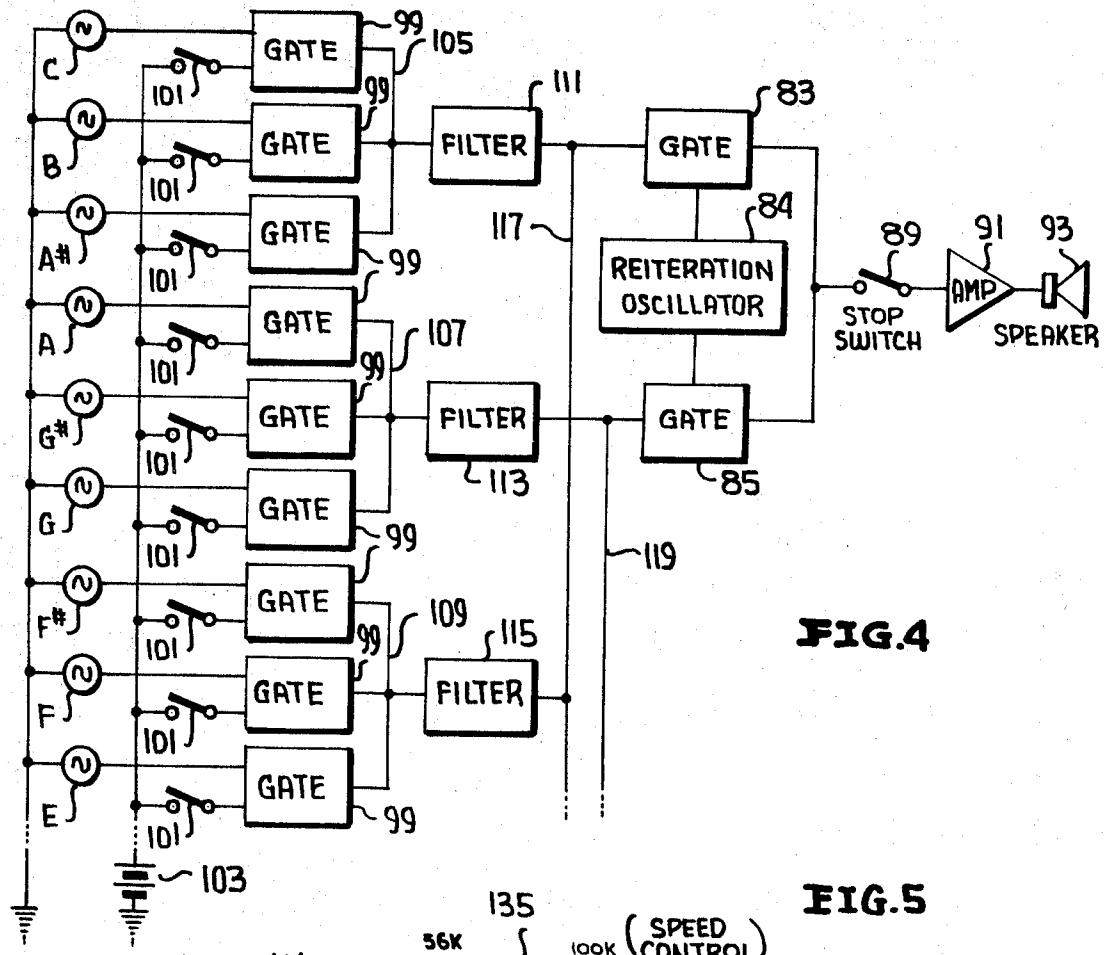


FIG.4

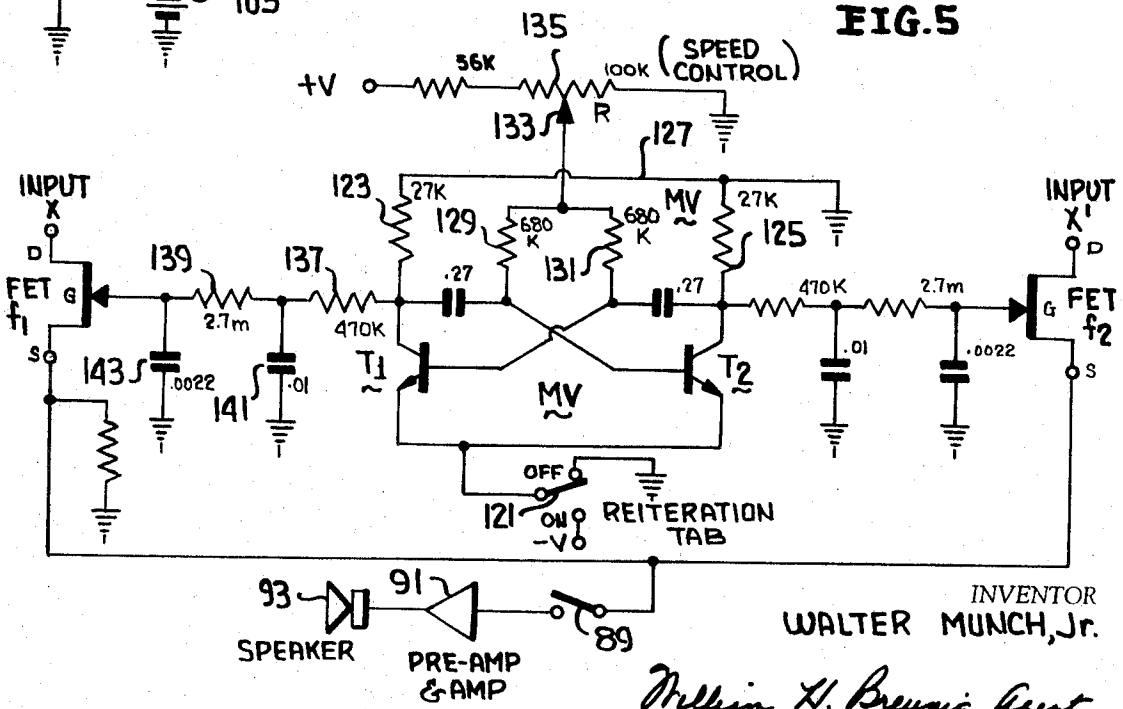


FIG.5

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ELECTRONIC ORGAN WITH ALTERNATE REITERATION BY THREE-NOTE GROUPS

BACKGROUND OF THE INVENTION

It is well known to provide iterative sounding of tones derived from electronic organs. U.S. Pat. No. 1,901,986 to Ranger is an early example. Later circuits are to be found in the following U.S. Pat. Nos. 2,342,338 to Hanert, 2,916,957 to Hanert, 3,039,347 to Krauss et al. and 3,235,650 to Cutler et al. Also, some commercially available instruments employ two out-of-phase, direct-current actuating voltages for alternate groups of three adjacent keyed-on oscillators or keyed-on gates from continuously running sources. These instruments are productive of desirable musical effects, simulating the alternate playing of two separate notes of a xylophone with a stick in each hand. However, the reiteration of the tones of the commercially available instruments stops immediately upon key release. Therefore, it is a primary object of the preferred embodiment of the present invention to provide an alternating reiteration system in which the decay portion of the tones is reiterated as well as the steady-state portion.

SUMMARY OF THE INVENTION

Continuously available tone signals are either keyed directly or gated into collectors for each group of three adjacent-pitched notes. Alternate collectors may then be connected to a pair of headers for separate filtering and reiteration alternatively in gates which are actuated by the output of a reiteration oscillator and converted to sound; or the pair of headers may each be gated in separate gates in alternating reiterative fashion for subsequent tone color filtering and conversion to sound. Further, the output of each of the three-signal collectors may be separately filtered and collected alternately into two headers having each a gate actuated alternately by a reiteration oscillator for subsequent conversion to sound.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1*a* is a block diagram of a three-note reiteration system of a type known in the art;

FIG. 1*b* is a block diagram of another three-note reiteration system of a type known in the art;

FIG. 1*c* is a graphical representation of the wave form of voltages applicable to the systems of FIGS. 1*b* and 1*c*;

FIG. 2 is a partially-block, partially-schematic diagram of a first embodiment of this present invention;

FIG. 3 is a block diagram of a portion of a further embodiment of this invention.

FIG. 4 is a block diagram of a preferred embodiment of the present invention; and

FIG. 5 is a schematic diagram of a bistable gate which may be used in the systems of FIGS. 2—4.

DETAILED DESCRIPTION OF THE DRAWINGS

In FIG. 1*a* is illustrated a prior art system wherein continuously running sources from C down to F within a selected octave are connected respectively to corresponding keying gates 1, usually of a solid-state diode type. The gates 1 are connected as shown to a collector 3 and to an output system 5 inclusive of tone-coloring, switching, amplification and loudspeaker means. Some of the gates 1 have connections as shown via key switches 7 and 11 and bus 13 to a source (not shown) of voltage $+V_1$ connected to a first terminal 17. Other gates 1 are connected as shown via other key switches 9 and others (not shown) to a second bus 15, connected to a second source (not shown) of voltage $+V_2$ connected to a second terminal 19. When the voltages V_1 and V_2, whose wave shapes are illustrated in FIG. 1*c*, are applied to terminals 17 and 19, respectively, notes such as, for example, C and A, are caused to sound, if their corresponding key switches 7 and 9 are closed. Since the positive portions of V_1 and V_2 are out of phase with each other, the notes C and A will sound in alternation reiteratively. This effect simulates finger keying notes C and A in alternation. Or the result is similar to that of a xylophonist who taps C and A in alternation with separate sticks.

A similar effect is achieved by another prior art system (see FIG. 1*b*), wherein the corresponding sources C and A (normally off) are keyed into oscillation by key switches 21 and 23, for example, there being similar voltages $+V_1$ and $+V_2$ connected at terminals 27 and 29. Signals from the chosen sources C and A will sound in the output system, inclusive of appropriate tone coloring, switching and amplification.

According to the present invention, referring to FIG. 2, a gamut of continuous sources C down to C# (from one octave) have respective key switches 63 connected thereto, followed by isolating resistors 65. The right-hand terminals of the respective resistors 65 are connected in groups of three, as shown, to collectors 67, 69, 71 and 73. Alternate collectors 67 and 71 are connected to a first header 75, while alternate collectors 69 and 73 are joined by a second header 77. Headers 75 and 77 are respectively connected to a first filter 79 and a second filter 81, which are respectively connected to gates 83 and 85. A reiteration oscillator 84 of a type to be disclosed hereinafter has its two outputs connected respectively to gates 83 and 85, the outputs of which are shown passing through a bus 87, stop switch 89 and an amplifier 91 to an appropriate loudspeaker 93.

In operation, by selecting key switches 63 (FIG. 2) for sources C and A, signals corresponding thereto pass via collectors 67 and 69, respectively, and headers 75 and 77, respectively, to filters 79 and 81, respectively. After filtering therein, signals C and A enter gates 83 and 85, respectively, and are gated in alternation by reiteration oscillator 84. The alternately reiterating signals are joined in bus 87 and pass, upon closure of stop switch 89, to amplifier 91, whose amplified output is converted to sound in loudspeaker 93.

An alternative embodiment of this invention is illustrated in part in FIG. 3, wherein the system is similar to FIG. 2 up to the headers 75 and 77 whose idicia correspond (as do some of the others hereinafter) to those of FIG. 2. However, headers 75 and 72 connect to the gates 83 and 85 directly, which gates are connected to the reiteration oscillator 84. The output leads of the gates 83 and 85 join in a bus 95 which is connected in tandem to a single filter 97, stop switch 89, amplifier 91 and loudspeaker 93.

It will be obvious to one skilled in the art that in the system of FIG. 3, the alternate reiteration occurs before filtering by virtue of tone signals in headers 75 and 72, respectively, being alternately reiterated in gates 83 and 85, the timing voltages being supplied by reiteration oscillator 84. Filtering may be accomplished in a single filter 97 and sound may be produced in the speaker 93 by closure of stop switch 89, amplification being accomplished in the amplifier 91.

A preferred embodiment of the present invention is illustrated in FIG. 4, wherein exemplary continuous sources C down E (within an octave) have direct connections with a plurality of gates 99, which may be of the solid-state type illustrated, for example, in U.S. Pat. No. 3,233,031, in the names of Walter Munch, Jr. and Robert C. Scherer, issued Feb. 1, 1966. The gates 99 have connections via key switches 101 to source 103 of direct current. The output leads from the gates 99 are connected in three-note groups to collectors 105, 107 and 109 which, in turn, are connected to separate filters 111, 113 and 115, respectively. Headers 117 and 119 are connected to the filters 111, 113 and 115 as shown, the dashed-line extensions of the former indicating that the system may be extended for additional sources, key switches, gates and collectors. The headers 117 and 119 may be connected respectively to gates 83 and 85, with connections therefrom to the reiteration oscillator 84. The gates 83 and 85 then have connections to a stop switch 89, which is in cascade with amplifier 91 and loudspeaker 93.

In operation, the gates 99 (of FIG. 4) gate the signals from sources C down to E when actuated via switches 101 by direct

current from the source **103**. Collectors **105**, **107**, **109** channel signals by three-note groups to the filters **111**, **113**, **115** for tone-coloring thereby. The collected signals are alternately reiterated in gates **83** and **85** as timed by reiteration oscillator **84**. Closure of stop switch **89** directs the played signals via amplifier **91** for conversion to sound in loudspeaker **93**. An advantage of the system of FIG. **4** is that more adequate filtering may be achieved by filtering each three-note group separately. Obviously this requires more filtering components, so a compromise may be achieved by filtering the output from alternate collectors, such as **105** and **109**. This would require a wide-pass band filter to handle the wider pitch spread (of nine semitones).

The details of gates **83** and **85** and reiteration oscillator **84** are illustrated in FIG. **5**. Two transistors T_1 and T_2 are employed in the multivibrator MV and two FET's, F_1 and F_2, as gates. The multivibrator MV employs NPN transistors having emitters which can be selectively connected, via ON-OFF switch **121**, to ground or to $-V$. The collectors are connected by equal resistors **123**, **125** to ground via lead **127**.

Accordingly, when switch **121** is in OFF position, the multivibrator MV is inoperative, and when connected in the ON position to $-V$, it oscillates.

The bases of transistor T_1 and T_2 are connected via resistors **129** and **131** to the slider **133** of a voltage divider **135**. Position of the slider established DC bias of T_1 and T_2 and therefore frequency of oscillation, which may be variable in the range of 3 to 13 Hz., for example only. The collector of T_1 is capacitively coupled to the base of T_2, and the collector of T_2 to the base of T_1, in conventional fashion, to provide oscillations. The collectors of T_1 and T_2 then provide control points which proceed in alternation from ground to negative potential as MV oscillates. The FET's, F_1 and F_2 are conductive when their gates are referenced to ground. When switch **121** is in OFF condition, both gates are referenced to ground, both FET's are conductive, and continuous signals pass on to an output system through gates F_1 and F_2, which correspond to gates such as **83** and **85** in FIG. **4**.

The collectors of transistors T_1 and T_2 are shown connected to ground via resistors **123**, **137** and **139**, and filter capacitors **141** and **143** are provided for smoothing purposes. The drain terminal D of FET F_1 is connected to filter **111**, in FIG. **4**, for example, and drain terminal D of FET F_2 to filter **113**. The source terminals S are jointly connected to the output, that is, stop switch **89**, amplifier **91** and loudspeaker **93**, for example.

A distinct advantage of the embodiment of FIG. **4** is that each tone is reiterated during decay, as well as during the steady-state portion thereof. This is not true of the prior art shown above.

I claim:

1. In an electronic musical instrument having a plurality of sources of tone signals corresponding to notes of a musical scale and an output system, the combination comprising:
- a plurality of keying means respectively corresponding to said sources and respectively coupled thereto;
- at least two collectors each coupled to a group of at least two adjacent keying means;
- at least two parallel paths respectively between alternate ones of said collecting means and said output system, each of said paths containing in cascade:
  - a first tone color filter; and
  - a reiterative gate means, one of said gate means reiterating alternately with another of said gate means.

2. The combination according to claim **1**, wherein each of said tone color filters is next to one of said collectors.

3. The combination according to claim **1**, wherein each of said reiterative gate means is next to one of said collectors.

4. The combination according to claim **1**, including a reiteration oscillator coupled between two of said reiterative gate means.

5. The combination according to claim **2**, including a reiteration oscillator coupled between two of said reiterative gate means.

6. The combination according to claim **3**, including a reiteration oscillator coupled between two of said reiterative gate means.

7. The combination according to claim **2**, including:
- a further tone color filter coupled to at least one of said collectors not having one of said first tone color filters connected thereto; and
- a header having one connection to the junction between one of said first tone color filters and one of said reiterative gate means and another connection with said further tone color filter.

8. The combination according to claim **3**, wherein said first tone color filter is common to said at least two parallel paths.

9. In an electronic musical instrument having a plurality of sources of tone signals corresponding to notes of a musical scale and an output system, the combination comprising:
- a plurality of keying means respectively corresponding to said sources and respectively coupled thereto;
- at least two collectors each coupled to a group of at least two adjacent ones of said keying means,
- a pair of headers each coupled to alternate ones of said collectors;
- a pair of tone color filters respectively coupled to said headers; and
- a pair of reiterative gates coupled respectively between said filters and said output system.

10. The combination according to claim **9**, including a reiteration oscillator coupled between said gates.

11. The combination according to claim **10**, wherein said output system comprises in cascade:
- a stop switch;
- an amplifier; and
- a loudspeaker.

12. In an electronic musical instrument having a plurality of sources of tone signals corresponding to notes of a musical scale and an output system, the combination comprising:
- a plurality of keying means respectively corresponding to said sources and respectively coupled thereto;
- at least two collectors each coupled to a group of at least two adjacent ones of said keying means;
- a pair of headers each coupled to alternate ones of said collectors;
- a pair of reiterative gates respectively coupled to said headers; and
- a tone color filter coupled between said gates and said output system.

13. The combination according to claim **12**, including a reiteration oscillator coupled between said gates.

14. The combination according to claim **13**, wherein said output system comprises in cascade:
- a stop switch;
- an amplifier; and
- a loudspeaker.

15. In an electronic musical instrument having a plurality of sources of tone signals corresponding to notes of a musical scale and an output system, the combination comprising:
- a plurality of keying means respectively corresponding to said sources and respectively coupled thereto;
- a plurality of collectors each coupled to a different group of three adjacent ones of said keying means;
- a plurality of filters respectively coupled to said collectors;
- a pair of headers each coupled to alternate ones of said filters; and
- a pair of reiterative gates coupled respectively between said headers and said output system.

16. The combination according to claim **15**, including a reiteration oscillator coupled between said gates.

17. The combination according to claim **16**, wherein said output system comprises:
- a stop switch;
- an amplifier; and
- a loudspeaker.