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[45] Patented **Jan. 5, 1971**
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[54] **ELECTRONIC ORGAN HAVING PLURAL TONE SOURCES AND LOUDSPEAKERS WITH ALTERNATE REITERATIVE GATING, CROSS GATING, AND METHOD**
10 Claims, 7 Drawing Figs.

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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

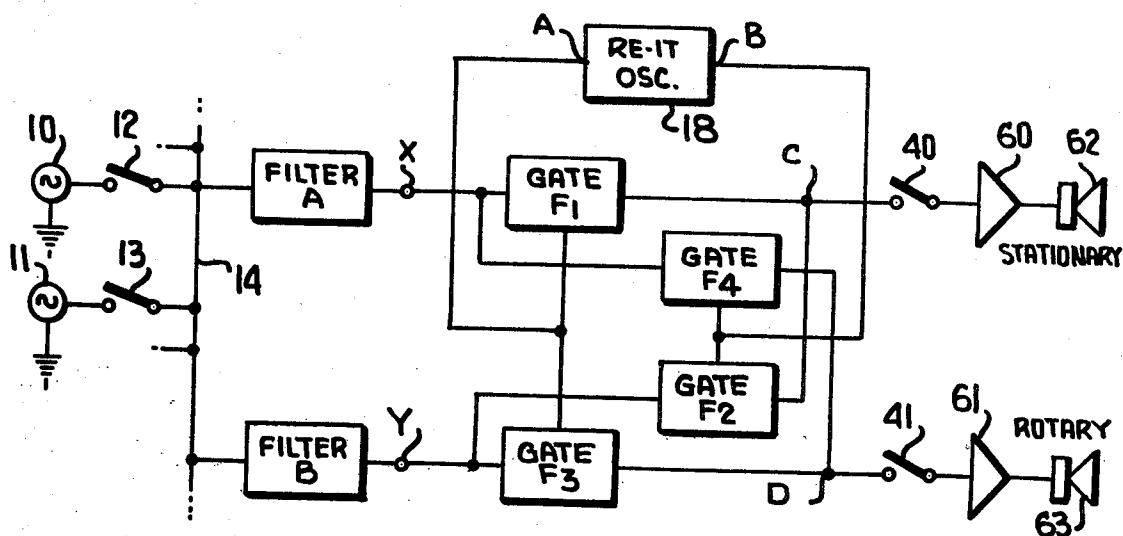
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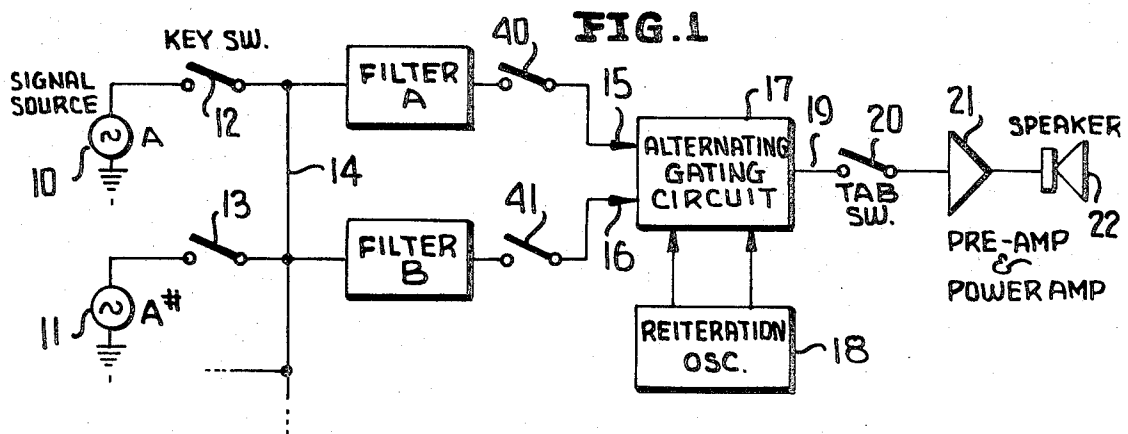
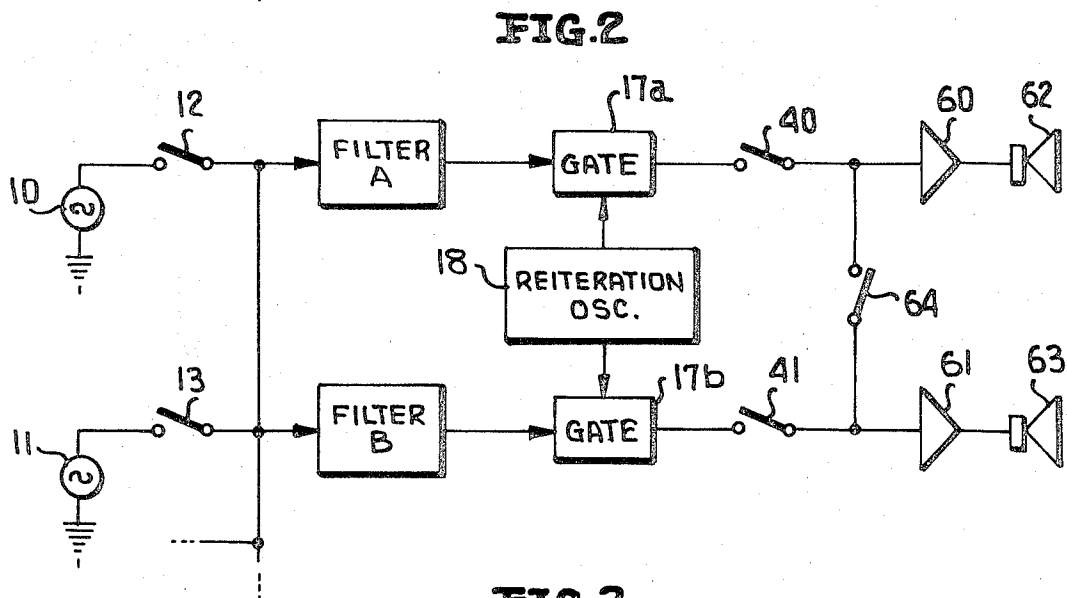
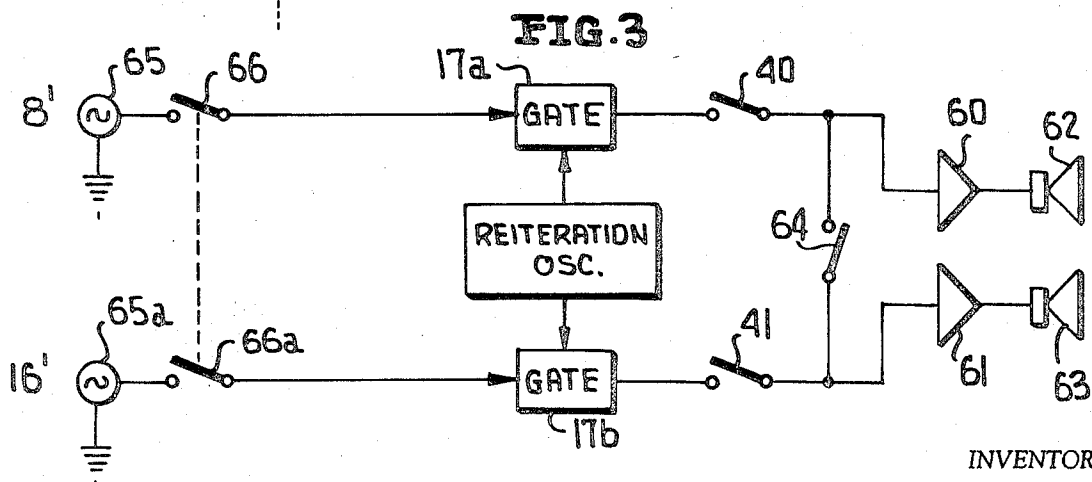
ABSTRACT: In an electronic organ, a first means for producing musical tone signals is connected via a first field effect transistor (FET) gate to a first loudspeaker; a second means for producing musical tone signals different in characteristics with respect to pitch and/or tone color is connected via a second FET gate to a second loudspeaker; the first means is also connected to the second loudspeaker via a third FET gate; and the second means is connected via a fourth FET gate to the first loudspeaker. Three pairs of means are disclosed:

1. The first means comprises a tone signal source in series with a key switch and a first tone color filter, while the second means comprises the same signal source in series with the same key switch and a second tone color filter different from the first filter.

2. The first means comprises a first tone signal source in series with a first key switch and a first tone color filter, while the second means comprises a second, octavely related tone signal source in series with a second key switch and a second tone color filter which is different in characteristics from the first tone color filter.

3. Same as 2, except that the first and second filters are similar.





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FIG. 4

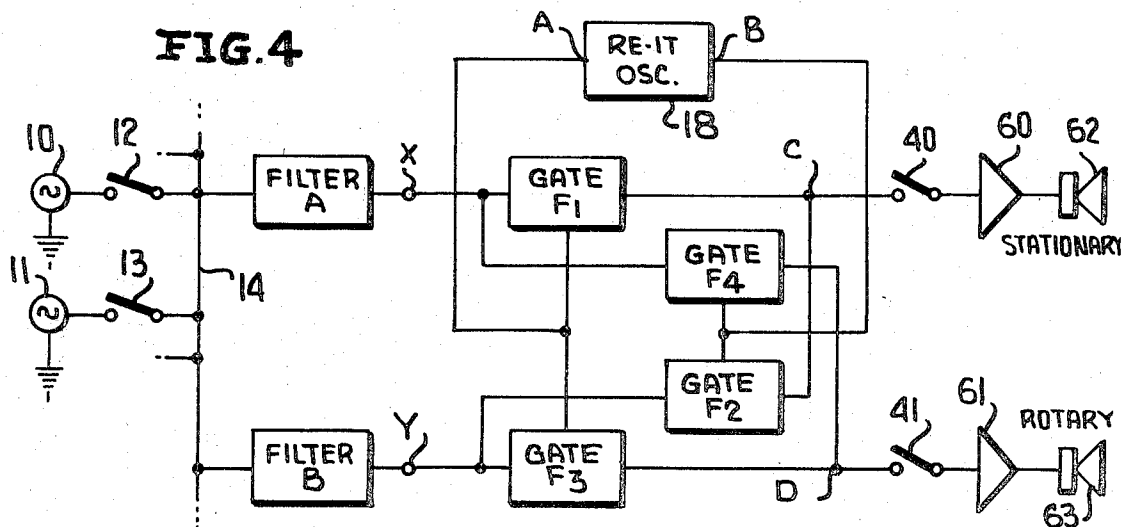


FIG. 5

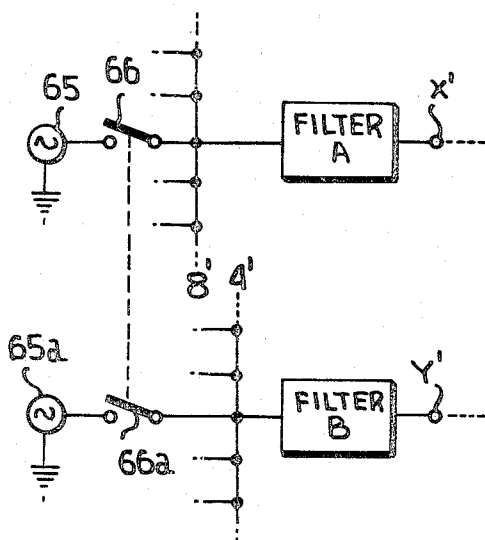
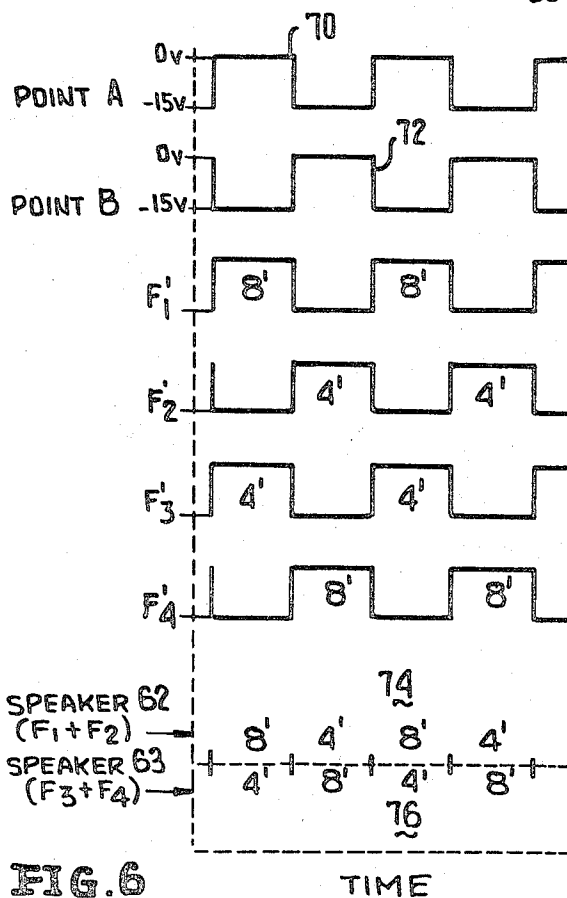
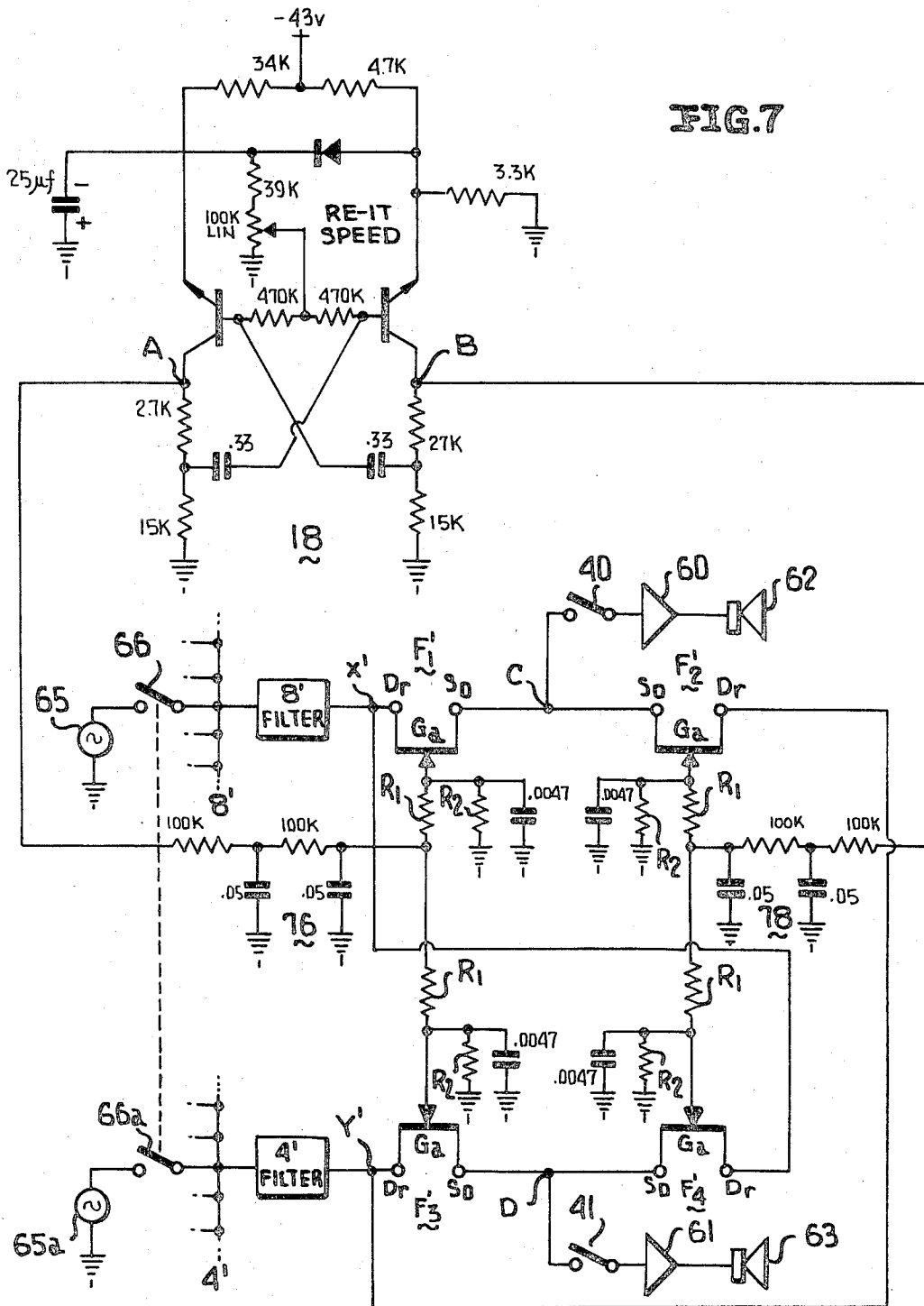


FIG. 6

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ELECTRONIC ORGAN HAVING PLURAL TONE SOURCES AND LOUDSPEAKERS WITH ALTERNATE REITERATIVE GATING, CROSS GATING, AND METHOD

BACKGROUND OF THE INVENTION

In a copending application of the present inventor, Ser. No. 664,745 (entitled Automatic Sequential Voicing and filed Aug. 31, 1967), of which this application is a continuation-in-part, there is disclosed a system for sounding two organ voices and/or footages reiteratively in alternation. Several embodiments are provided in the referenced application, those most pertinent to the present invention being as follows:

1. Tone signal is applied via a key switch to two dissimilar tone color filters in parallel, and the outputs of the filters are applied in alternation to a loudspeaker or to separate loudspeakers.

2. Two footages are applied to distinct tone color filters and the outputs of these are applied reiteratively in alternation to a loudspeaker or to separate loudspeakers.

3. Two footages of the same tone color are applied reiteratively in alternation to a loudspeaker or to separate loudspeakers.

In those above embodiments which employ two gates and two loudspeakers, the result being an alternation of signal between one speaker and the other, a first signal is heard from the first loudspeaker (while the second is silent); then a second signal (having different characteristics with respect to pitch and/or tone color) is heard from the second loudspeaker while the first is silent.

According to the present invention, a second pair of gates is employed (as disclosed in the Abstract in such a way that one loudspeaker receives different signals from the other loudspeaker at the same instant, but at the next instant (based on the reiteration rate) the signals are reversed between the speakers. Thus, acoustically both signals are combined to double the acoustic output, the stereo alternation between speakers being at the reiteration rate. The present invention is particularly useful in simulating a marimba.

SUMMARY OF THE INVENTION

At least two musical tone signals having different characteristics as to pitch and/or tone color are fed respectively to a first pair of gates which are rendered conductive concurrently and reiteratively by a reiteration means which also renders a second pair of gates conductive to the tone signals concurrently and reiteratively but 180° out of phase with the first pair of gates. The output of the gates is converted to sound in a pair of loudspeakers so that at any instant, each speaker converts one or the other of the signals to sound. Thus, each speaker converts to sound the plurality of signals in alternation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 and 2 are block diagrams of basic circuits disclosed in the parent application (Ser. No. 664,745).

FIG. 3 is a block diagram of a slightly modified form from that of the parent application.

FIG. 4 is a block diagram of a basic circuit according to the present invention.

FIG. 5 is a block diagram of a modified portion of the circuit of FIG. 4.

FIG. 6 illustrates the waveform output of the reiteration oscillator and of the signal gates in FIG. 5.

FIG. 7 is a schematic circuit diagram of the preferred embodiment of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Identical parts in the several FIGS. are identified by the same reference numerals, to obviate repetitious description.

In FIG. 1, 10 is a tone oscillator and 11 is another tone oscillator, these being of the same footage. Key switches 12 and 13 connect oscillators 10 and 11 to a common bus 14, which is connected jointly to tone color filters A and B. For example,

filter A may provide a tibia voice and filter B a saxophone voice. Or filter A may provide a clarinet voice, and filter B an oboe voice. Filters A and B are connected to alternate inputs 15, 16 of an alternating gate circuit 17, which is controlled by a flip-flop reiteration oscillator 18, which provides gating signals to cause tones from filters A and B to appear in alternation at output bus 19. That bus is connected by tab switch 20 to amplifiers 21 (preamplifier and power amplifier) and loudspeakers 22.

On actuating key switch 12, for example, and assuming oscillator 10 to generate an A tone, this tone might sound reiteratively as a tibia and as a saxophone, in alternation.

FIG. 2 parallels FIG. 1 except that the outputs of gates A and B proceed, respectively, to separate amplifiers 60, 61 and loudspeakers 62, 63. Accordingly, tones of diverse color sound via different loudspeakers, providing a stereophonic effect. Single filters may be disabled by stop tabs 40, 41 at will, and the gating circuit 17 is illustrated as two distinct gates 17a, 17b, for purposes of clarity.

By providing a coupling between the input of amplifiers 60, 61, via switch 64, the speakers are employed together for both tones, and the system of FIG. 2 is then operatively that of FIG. 1.

In the system of FIG. 3, which is modified from FIG. 8 of the parent case to the extent that (1) a frequency divider between switch 66 and gate 17b is omitted and (2) source 65a with key switch 66a are added; source 65a is an octave below (16') the frequency of source 65. Thus is provided alternate reiteration of tones of different footages, and tone filtering may be interposed following gates 17a and 17b, which may provide the same or different tone colors for the two gate conditions.

In FIG. 4, the portions of the circuit to the left of points X and Y and to the right of points C and D are similar to FIG. 2 with the omission of switch 64. It could be said that gates F₁ and F₃ correspond to gates 17a and 17b of FIG. 2. However, according to this invention, additional gates F₂ and F₄ are connected, as shown, between points X and D, and between Y and C, respectively. The reiteration oscillator 18 being a flip-flop, the output waves at points A and B occur as illustrated at 70 and 72 in FIG. 6. Thus, for examination of the diagram of FIG. 4, it will be seen that if gates F₁ and F₃ are conductive, gates F₂ and F₄ will be concurrently nonconductive. During the next half cycle of each wave, the opposite will be true. Thus, both of the speakers 62, 63 will be productive of some output at all times in spite of the alternation between speakers. This is perhaps better illustrated for the arrangement according to FIG. 5, wherein the portion of the circuit to the right of points X' and Y' is the same as that of FIG. 4 to the right of points X and Y. To the left of points X' and Y' lies circuitry similar to corresponding portions of FIG. 3, except for the inclusion of 4' and 8' buses, plus filters A and B. Thus will 4' and 8' input to the gates at points X' and Y' be as illustrated in the solid lines at F₁', F₂', F₃', and F₄' of FIG. 6. The outputs of the gates will have envelopes of similar configuration as indicated by the 4' and 8' regions of the wave forms of FIG. 6. Thus, it will be seen that since the outputs of F₁' and F₂' are added at C (FIGS. 5 and 7), speaker 62 will convert to tone first 8' then 4' reiteratively. (See portion 74 of FIG. 6). Concurrently at D, outputs of F₃' and F₄' will be added for conversion to sound by speaker 63 (which, incidentally, may be rotary, if desired) to produce first 4' and then 8' reiteratively, but in phase opposite to that of speaker 62, as illustrated at 76 in FIG. 6.

In FIG. 7 the reiteration oscillator 18 is a flip-flop modified so as to be self-starting. As in FIG. 5, the outputs of tone signal sources 65, 65a are keyable at 66 and 66a, respectively, into 8' and 4' collectors for modification as to tone color in the 8' and 4' filters, respectively. From point X' connection is made to the drain terminals of both FETS F₁' and F₄', while from point 4' connection is made to drain terminals of both FETS F₃' and F₂'. Each of the FETS has its own percussive envelope shaping RC network in connection with its gate terminal as shown. The gate terminals of F₁' and F₃' are coupled as shown to the terminal A of flip-flop 18 via a common highpass filter

76, which rounds off the corners of the square wave output of 18. Similarly, gate terminals of F_2' and F_4' are coupled to the terminal B of flip-flop 18. The source terminals of F_1' , F_2' and $2'$ are connected via point C to the series group comprising switch 40, amplifier 60 and loudspeaker 62. Similarly, the source terminals of F_3' and F_4' are connected to switch 41, amplifier 61 and loudspeaker 63.

In operation, as output from point A of 18 renders F_1' and F_3' conductive, signal passes from the 8' filter to speaker 62, provided switch 40 is closed. During this interval (see portion 70 in FIG. 6), 8' signal is heard in speaker 62 and 4' signal in speaker 63. However, during the next interval (see portion 72 of FIG. 6), 4' signal is heard in speaker 62 and 8' signal in speaker 63. Thus, different outputs are heard from the speakers at all times, although the 4' and 8' are switched from one to the other in a stereo reiteration effect.

I claim:

1. In an electronic organ system having a first and a second loudspeaker, the combination comprising:

first means supplying a first tone signal;
second means supplying a second tone signal having characteristics different from said first tone signal;

a first gate coupled between said first means and said first loudspeaker;

a second gate coupled between said second means and said second loudspeaker;

a third gate coupled between said first means and said second loudspeaker;

a fourth gate coupled between said second means and said first loudspeaker; and

additional means for rendering said first gate and said third gate conductively concurrently and reiteratively and for rendering said second gate and said fourth gate conductive concurrently and reiteratively but 180° out of reiteration phase with respect to first and third gates.

2. The combination according to claim 1, wherein said first means comprises in series:

a first tone signal source;

a first tone color means and wherein said second means comprises in series a second tone signal source; and

a second tone color means.

3. The combination according to claim 1, wherein said first means comprises in series:

a first tone signal source;

a first tone color means and wherein said second means comprises in series;

a second tone signal source; and

a second tone color means different from said first tone color means, said second tone signal source being harmonically related to said first tone signal source.

4. The combination according to claim 1, wherein said first means comprises in series:

a first tone signal source;

a first tone color means and wherein said second means comprises in series;

a second tone signal source; and

a second tone color means similar to said first tone color means, said second tone signal source being harmonically related to said first tone signal source.

5. In an electronic organ system having at least two sources of octavely related tone signals and two loudspeakers, the combination comprising:

a first pair of gates coupled respectively between said sources and said loudspeakers;

a second pair of gates coupled respectively between said sources and said loudspeakers so that the higher frequency signal gate in said first pair is coupled to the same loudspeaker as the lower frequency signal gate in said second pair, and so that the lower frequency signal gate in said first pair is coupled to the same loudspeaker as the higher frequency signal gate in said second pair; and

means for rendering said first pair of gates conductive concurrently and reiteratively and for rendering said second pair of gates conductive concurrently and reiteratively but reiteratively 180° out of phase with said first pair of gates with respect to the higher and lower frequency signals.

6. The combination according to claim 5, wherein is provided:

a first tone color circuit between one of said at least two sources and said first pair of gates, and wherein is provided; and

a second tone color circuit between another of said at least two sources and said second pair of gates.

7. The method of reiteratively sounding musical tones which comprises:

providing at least two tone signals of different characteristics;

first gating said signals separately but concurrently and reiteratively;

further gating said signals separately but concurrently and reiteratively 180° out of phase with the first gated signals; and

converting all the gated signals to sound.

8. The method set forth in claim 7, wherein said providing

includes the steps of:

generating said at least two signals in the same source; and tone coloring said at least two signals separately and differently.

9. The method set forth in claim 7 wherein said providing includes the steps of:

generating said at least two signals at harmonically related frequencies; and

tone coloring said at least two signals separately and similarly.

10. The method set forth in claim 7 wherein said providing includes the steps of:

generating said at least two signals at harmonically related frequencies; and

tone coloring said at least two signals separately and differently.

60

65

70

75