

July 2, 1968

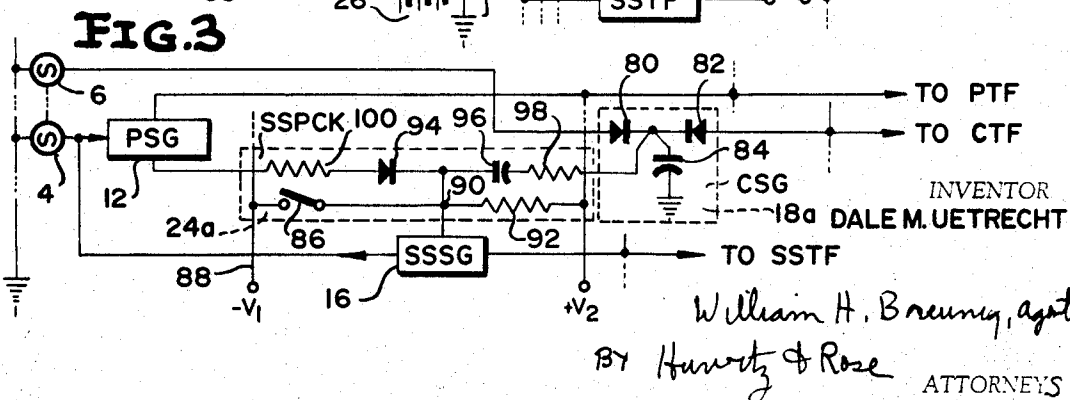
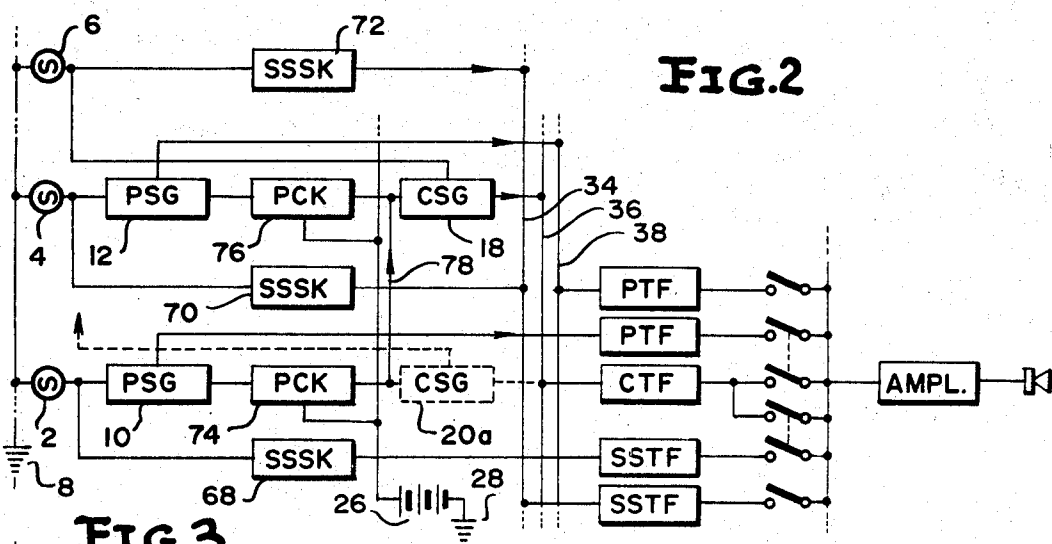
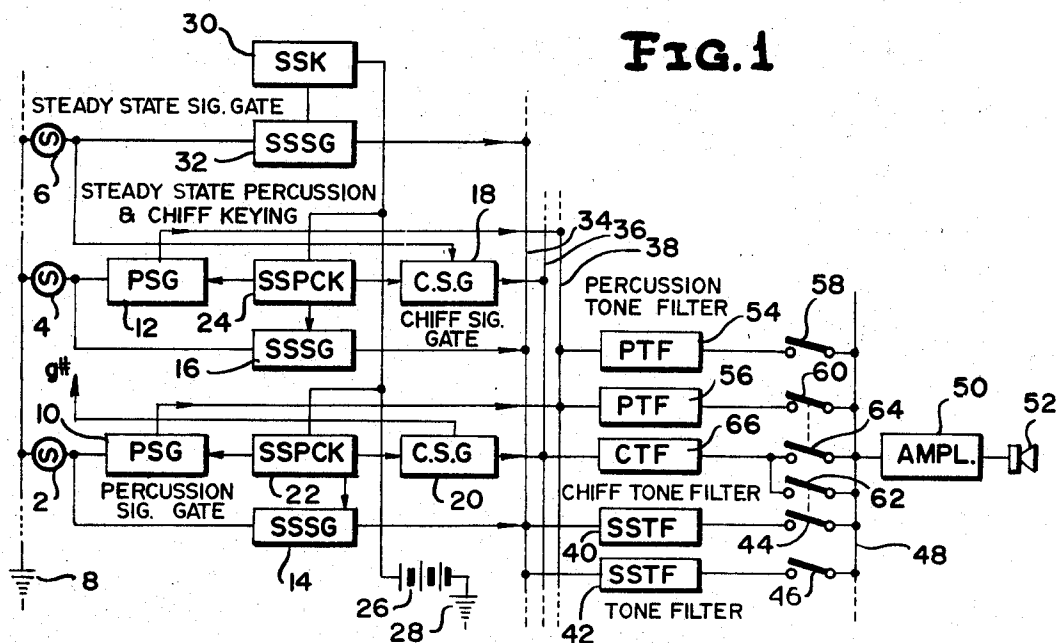
D. M. UETRECHT

3,391,240

CHIFF SYSTEM FOR ELECTRONIC ORGANS

Filed July 15, 1965

3 Sheets-Sheet 1



July 2, 1968

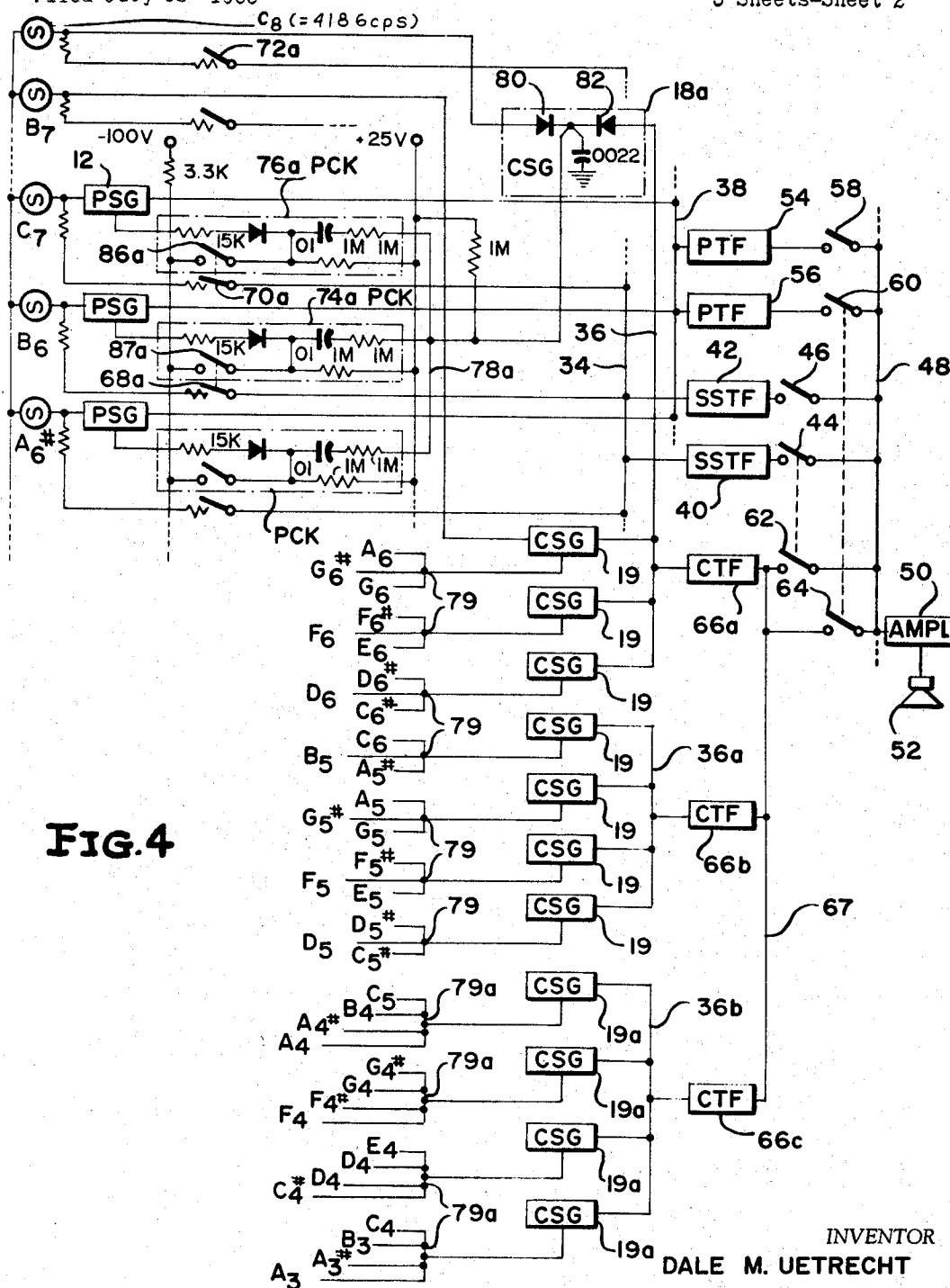
D. M. UETRECHT

3,391,240

CHIFF SYSTEM FOR ELECTRONIC ORGANS

Filed July 15 1965

3 Sheets-Sheet 2



INVENTOR

DALE M. UETRECHT

William H. Breunig, Agent

BY Hurwitz & Rose

ATTORNEYS

July 2, 1968

D. M. UETRECHT

3,391,240

CHIFF SYSTEM FOR ELECTRONIC ORGANS

Filed July 15, 1965

3 Sheets-Sheet 3

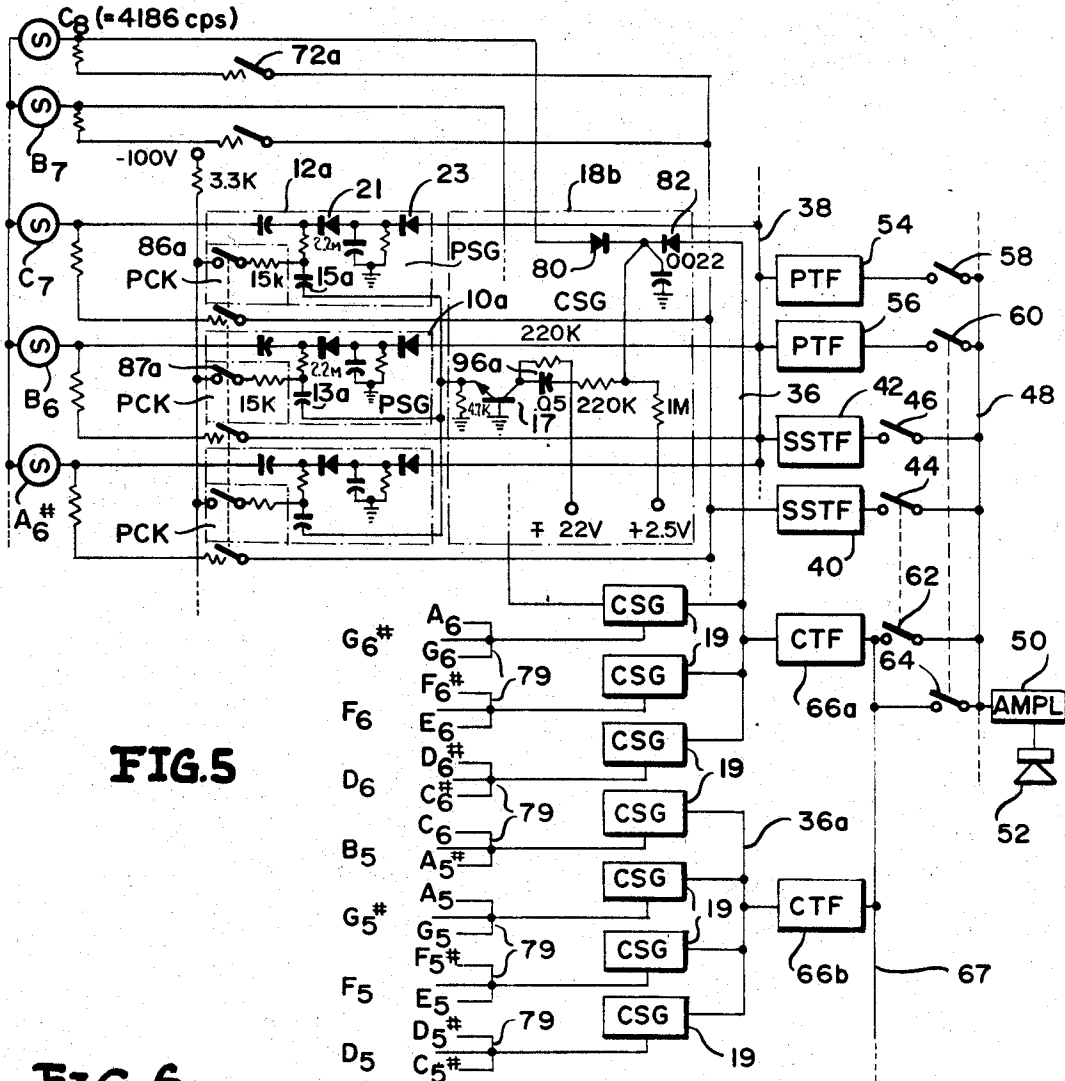
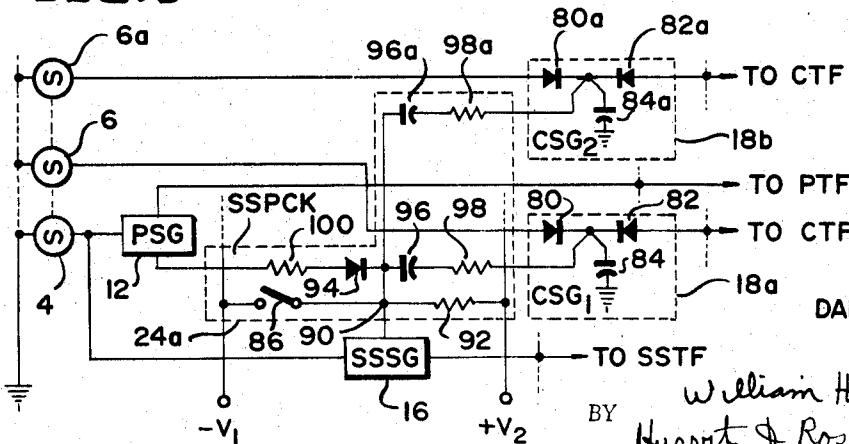


FIG. 6



INVENTOR
DALE M. UETRECHT

BY

William H. Breunig, Agent
Hurwitz & Rose
ATTORNEYS

1

3,391,240

CHIFF SYSTEM FOR ELECTRONIC ORGANS

Dale M. Uetrecht, Cincinnati, Ohio, assignor to D. H. Baldwin Company, Cincinnati, Ohio, a corporation of Ohio

Filed July 15, 1965, Ser. No. 472,200
15 Claims. (Cl. 84-1.01)

The present invention relates generally to systems for economically producing organ tones accompanied by chiff sounds and the like, and more particularly to systems for concurrently gating tones from tone generators to acoustic radiators and transiently gating chiff signals to the acoustic radiators, the total number of chiff signal sources being far smaller than the number of tone sources.

In accordance with the invention, a series of tone oscillators is coupled via normally non-conductive gates to a common acoustic radiation system. The gates are selectively rendered conductive by applying gating voltages thereto, in response to depression of keys. Such systems are conventional and well known. A small number, for example twelve, of chiff oscillators is provided, each connected via a normally non-conductive gate to the acoustic radiation system. Each gate is provided with a gating voltage input bus, which is selectively provided with gating voltage in response to actuation of a plurality of, say three or four, different keys. The connection of each key switch to a chiff gate is accomplished via a blocking capacitor, so that application of gating voltage to the chiff gates is transient, regardless of how long the key is depressed and occurs only on initiation of a tone. Chiff frequencies can be so chosen that an appropriate value is available for every tone oscillator, despite the fact that there are many more tone oscillators than there are chiff oscillators. The reason is that the frequency or frequencies present in chiff are not precisely related to the frequencies of a tone. Chiff can be higher or lower in frequency than the fundamental of a tone with which it is associated, depending upon tone color. Usually, chiff frequency lies between the fifth and sixth partials of a tone, and the precise location depends on make or design of the organ, in the case of pipe organs. It is this lack of precise frequency relation between tone partial frequency and chiff frequency which makes it possible to utilize only twelve chiff oscillators and chiff gates, in conjunction with an entire manual or with plural manuals of an organ.

Additionally, the use of transiently gated chiff permits complex chiff to be generated, i.e., chiff derived from plural oscillators at once. The gating circuits may be designed to produce desired envelopes of gated through signal, and need not all have the same time constants. It follows that a chiff component can be produced from two harmonic rich oscillator outputs, gated through gates which have, respectively, different build up and/or decay time constants, and thus a particularly rich chiff partial can be produced, having a very complex envelope, and in which some frequencies occur simultaneously, others persist for a time and still others decay rapidly.

Perfection in electronic organs subsists in the minds of some musicians in the duplication of total characteristics of pipe organs. Pipe organs inherently generate certain transient sound effects, especially at the initiation of each tone. These effects involve (1) a build up and

2

decay of a spectrum of harmonics, constituting a steady-state tone, (2) an audible tonal content occurring only at initiation of a tone, and which may be harmonically or inharmonically related to the steady-state spectral components, but which does not derive from the tonal build up, having its own frequencies and its own envelope shape. The latter effect is called chiff.

Similarly, in electronic organs having percussion-simulating voices, it is desirable to duplicate the transient components of tones characteristic of xylophones, orchestra bells and the like. These are sometimes referred to in the art as "strike" components or "strike" tones. Hereinafter, the term "chiff" will be used generally to include "strike" tone transient components.

Since chiff generation involves production of tonal components inharmonically related to the accompanied tone, as well as a different wave envelope, the problem of incorporating chiff into electronic organs on economic basis involves utilizing to the maximum extent organ components which are present in any case for tone production, so that the addition of chiff does not add unduly to the cost of the organ. It is entirely possible, for example, to provide chiff circuits which are separate and apart from the organ tone circuits and to key these by means of separate keys and key switches. In view of the large number of tones in an electronic organ of sufficient sophistication to justify the inclusion of chiff at all, such an expedient is not economically practical.

Markowitz, in his U.S. Patent 3,037,413, taught, in a keyed-on-with-D.C. oscillator system, the use of a diode in series with a capacitor to develop, in a tone oscillator doing double-duty as a chiff source, a brief transient oscillation simulating chiff. Wayne, in a copending application, Ser. No. 46,704, assigned to the same assignee as the present application, teaches the dual use of a continuously running source, normally used for steady-state tones, as the chiff source. The chiff signal is gated to the output system by a separate switch concurrently operated with the one used for the steady-state portion of a composite tone. Brombaugh, in a copending application Ser. No. 313,205, now Patent No. 3,333,042, assigned to the same assignee as the present application, uses a common key switch for simultaneously gating, from continuously running sources, the chiff and steady-state tone components. Brombaugh uses a separate source for each chiff component, except in the extreme upper end of the scale, where doubling up of a chiff source for two consecutive semi-tones was effected so as not to increase the number of signal sources. He pointed out that the ear cannot easily detect the difference in high-pitched chiff components of tones.

On the other hand, in the present invention, it was found that chiff may be simulated throughout an extensive keyboard range of an organ by using the top-octave of continuously running sources for a gamut of forty notes with chiff in an organ of medium price range, where economy of component-use is essential. As a matter of fact, the present invention also teaches the use of higher-frequency, continuously running sources already in the instrument for simulating the "strike" component of percussive voices. Thus, the present invention has for a primary object and feature the provision in an electronic organ of means for obtaining both chiff and strike component tones either separately or simultaneously.

As in the Brombaugh and Wayne applications, this invention has for an important object the provision of chiff and the like by the use of continuously running tone signal sources already serving as sources for steady-state tones or for steady-state components of chiff-type or strike-type complex tones.

An important further object, as intimated by the general disclosure above, is the provision of an economical chiff and the like system wherein a tone source used for chiff purposes serves for several adjacent semi-tones of steady-state components. Additionally the attack transient of the chiff component can be compromised to work with the normal attack characteristics of the gradual contact key switch rather than with an elaborate modification of the steady-state attack characteristics.

Briefly describing a preferred embodiment of the invention, the tone generators of the organ are in the form of square wave oscillators. The square waves provide an array of harmonic frequencies associated with each tone, suitable for filtering to form the various tone colors of an organ. Should the array of harmonics prove insufficient because of the symmetrical wave shape of the generator outputs, the square waves may be added in appropriate frequency and amplitude relations to form triangular waves, and these can be used as basic tone materials. It is further conventional, especially in sophisticated organs, to transfer the basic wave shapes provided by the oscillators to collectors through keying and/or gating circuits keyed on and off by means of key switches. In accordance with a first aspect of the present invention, a common keying circuit for each note is incorporated, in electronic organs, for actuating three gating circuits—one for the steady-state component of a tone, one for a chiff or strike component of a tone and one for a percussive type of tone, the latter being the type obtained with a gradual decay following staccato playing of the keys, as in the manner taught by Munch in U.S. Patent 2,918,576. (In this patent, a percussive gate is employed for each of a series of tone signal sources, control being provided for different decay rates.) This first aspect of the present invention uses a given signal source, preferably in the lower range in the instrument, for the steady-state and percussive gate input, while the chiff gate input is fed its signal from a separate tone-signal source, preferably a higher-frequency oscillator already present in the instrument. Since the organ uses continuously running oscillators, preferably frequency dividers, the signals from which are all gated into their respective collectors—that is, one for steady-state components, one for percussing voices and one for chiff or strike components—each of a gamut of keys may, by means of a single pair of contacts, control simultaneously the three gates for each key. By means of this system, not only is the cost and complexity of switching maintained at a minimum, but no possibility exists of mistiming the chiff or strike signals with respect to the steady-state or percussive components of complex tones. In order to simulate chiff successfully the chiff signal must be heard before the steady-state or percussive tone is heard and there must be time overlap of the chiff with the steady-state or percussive components of complex tones, during the rise time of such components.

In accordance with another aspect of the present invention, a common keying circuit for each note is incorporated for actuating two gating circuits—one for the percussive type of tone and one for the chiff or strike component of a tone. The steady-state tones or components thereof, are derived by means of gradual-contact, or variable-resistance, key swithes as taught by Kock and Jordan in U.S. Patent 2,215,124. In this second aspect of the invention, there is no chance of mistiming of the strike component with the percussive component of a complex tone, because they are both derived by a common keying circuit. However, the timing of the chiff and steady-state components will depend upon proper closing

of the two pairs of switch contacts. But this is not so critical as the timing of the strike with percussive components, because the rise time of the steady-state components of a tone is comparatively slow. Thus, the second aspect of the invention is a compromise so far as timing is concerned. However, one may prefer to gain the advantages of touch control and economy of the gradual-contact contact switch over the double-diode gate system of Brombaugh U.S. Patent 3,179,855.

Thus, it is a further object of this invention to provide a chiff system for an electronic organ wherein there is either no chance of mistiming the chiff with respect to other components of a tone or else the chance is reduced to a minimum.

The above and still further features and objects of the invention will become clear upon consideration of the following detailed description of various embodiments of the invention, especially when taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a block diagram of an organ system, according to a first aspect of the invention;

FIGURE 2 is a block diagram of an organ system, according to a second aspect of the invention;

FIGURE 3 is a partially block, partially schematic diagram of the details of a keying circuit and a chiff gating circuit of the embodiment of FIGURE 1;

FIGURE 4 is partially block, partially schematic diagram of the details of an organ system according to a second aspect of the invention;

FIGURE 5 is a partially block, partially schematic diagram of the details of a second embodiment of an organ system according to a second aspect of the invention; and

FIGURE 6 is a partially block, partially schematic diagram of a variation in the embodiment of FIGURE 3.

Referring to FIGURE 1, a plurality of tone-signal sources 2, 4, 6 represent, respectively, two adjacent-semi-tone oscillators and a high-pitched oscillator in a gamut thereof for a complete organ. The oscillators may be from chains of flip-flops having master oscillators for the top octave series. If of the square-wave generating type, provision would preferably be made after the generators to combine the signals, as mentioned above, to obtain simulated saw-tooths. Or, the sources may be of the type illustrated in Jones U.S. Patent 2,555,038, which generate saw-tooths directly. One terminal of each source 2, 4, 6 is connected to a common-return path indicated at 8 as ground. Sources 2 and 4 are respectively connected to blocks 10 and 12, labeled PSG, an abbreviation for percussion signal gate. These gates are preferably, but not necessarily, of the type disclosed in the aforementioned Brombaugh Patent 3,179,855. The same sources 2 and 4 are respectively connected also as shown in FIGURE 1 to blocks 14 and 16, labeled SSSG, an abbreviation for steady-state signal gate. The source 6 is shown connected to a block 18, labeled CSG, an abbreviation for chiff signal gate. The source 9, not shown, is indicated by the arrow head as being connected to a block 20, also labeled CSG for the same reason. To these two sets of three gates each—i.e. gates 10, 14 and 20 on the one hand, and gates 12, 16 and 18 on the other—are two blocks 22 and 24, labeled SSPCK, an abbreviation for steady-state percussion and chiff keying. The circuit for the keying block SSPCK will be described in detail in connection with FIGURE 3. To the blocks 22 and 24 are made connections from a direct current source 26 having a connection to ground at 28. Also having connection, as shown, to the source 26 is a steady-state keying circuit 30 having a connection with steady-state signal gate 32 coupled in turn to the source 6, previously mentioned. Collector 34 is connected as shown to gates 14, 16 and 32; collector 36 is couple to gates 18 and 20; and collector 38 collects signals from gates 10 and 12, as shown.

5

To the collector 34 is connected a pair of steady-state tone filters 40 and 42 of a suitable type known in the art—for instance, high-pass and low-pass. These in turn are connected via stop switches 44 and 46, respectively, to a common output collector 48 having connection with an appropriate electroacoustic system comprising an audio amplifier 50 and loudspeaker 52. Similarly, percussion tone filters 54 and 56 connect collector 38 via stop switches 58 and 60, respectively, to the collector 48, amplifier 50 and loudspeaker 52. Stop switches 44 and 60, however, are shown mechanically ganged, respectively, to switches 62 and 64, both of which are connected as shown between the output bus 48 and the chiff tone filter 66, which in turn is shown connected to collector 36.

In operation, the signal continuously generated by the source 2, for example, appears at percussion signal and steady-state signal gates 10 and 14, respectively, waiting to be actuated by the keying circuit 22 as charged by the direct-current source 26. At the same time the chiff gate 20 also waits to be actuated. Upon depression of the key (not shown) actuating the keying circuit 22, the gates 10, 14 and 20 are simultaneously activated by direct-current, and their respective outputs are available at collectors 38, 34 and 36. These signals, together with any others which may be gated into the same collectors, are filtered in accordance with the characteristics of the percussion tone filters 54 and 56, the steady-state tone filters 40 and 42, and the chiff tone filter 66. If the steady-state stop switch 46 is closed, only a steady-state tone without chiff is heard in the loudspeaker 52, energized via the collector 48 and amplifier 50. However, if the stop switch 44 is closed, stop switch 62 is necessarily closed concurrently, and a chiff component of tone is present along with the steady-state tone component. Similarly, if the percussion stop switch 58 is closed, only a percussive-type tone will be heard in the loudspeaker 52. But if switch 60 is closed, chiff stop switch 64 is necessarily concurrently closed, and a strike component is passed to the loudspeaker 52 along with the percussive component passed by filter 56. A separate chiff filter may be inserted between the collector 36 and the switch 62, if one desires a differently shaped chiff wave form for the steady-state component as against the percussive component. Also, the chiff signal gate 20 may be omitted and the keying circuit 22 may be connected to chiff signal gate 18, as indicated in FIGURE 2, if one desires to "double up" on chiff signals. That is, if a single given chiff frequency can be tolerated for two or more adjacent semi-tones. It has been found that as many as four adjacent steady-state or percussive components can use the same chiff frequency without undue loss of fidelity. The details of such a system will be set forth in connection with the discussion of FIGURE 4.

FIGURE 2, which shows the above-mentioned second aspect of the invention, wherein a separate audio key switch is employed for steady-state tones or components thereof. To simplify the discussion similar parts of the system are similarly designated. The obvious difference is the connection to sources 2, 4 and 6 of blocks 68, 70 and 72, labeled SSSK, an abbreviation for steady-state signal keying. These components are shown connected to collector 34, with filters, stop switches and output systems similar to FIGURE 1. To the gates 10 and 20a is connected, as shown, a keying circuit 74, while to gates 12 and 18 is connected a keying circuit 76, both keying circuits being also labeled PCK, an abbreviation for percussion and chiff keying. The block 20a, corresponding to block 20 in FIGURE 1, is in dashed lines, along with connections thereto, indicating that it may be used, if desired, in the place of the connection 78, if separate chiff frequencies are desired rather than the sharing plan previously mentioned.

The operation of the system of FIGURE 2 is similar to that of FIGURE 1, except that audio signals from the

6

sources 2, 4 and 6 are keyed directly by variable-resistance key switches of the Kock-Jordan type, or preferably by switches of the type disclosed in a copending application Ser. No. 233,529 in the name of Gregory, assigned to the same assignee as the present application. The Gregory switches use a conductive elastomer as the variable-resistance element.

In FIGURE 3 are given the details of a preferred embodiment of keying circuits for actuating the three gates (steady-state, percussion and chiff) of FIGURE 1, like elements having been designated as in FIGURE 1. However, the chiff gate 18a is illustrated in detail as comprising a pair of solid-state diodes 80, 82 preferably of a selenium type, packaged in accordance with the teachings of the aforementioned Brombaugh patent, having a bypass capacitor 84. Typical values for this capacitor and the components of the keying circuit are given in FIGURE 4. The keying circuit 24a comprises a key switch 86 connected between a direct-current line 88 (from a source of voltage $-V_1$) and a common point 90, to which are connected a resistor 92, another solid-state diode 94 and a capacitor 96, the latter being shown connected in series with another resistor 98 to the junction between the diodes 80 and 82. The diode 94 is shown in FIGURE 3 as being in series with another resistor 100 to the percussion gate 12. The resistor 92 is also connected to a second source of direct voltage $+V_2$. In the interest of simplicity the output system—filters, collectors, stop switches, amplifier and loudspeaker—has been omitted, it being understood that it could be of the type illustrated in FIGURES 1 and 2, or in detail, as in FIGURE 4.

In operation, upon closure of key switch 86 (of FIGURE 3) a relatively high D.C. voltage is applied to the diode 94, rendering it conductive for actuation of percussion signal gate 12, the resistor 100 affecting the charging rate of the storage capacitor in the gate 12. Concurrently, the same negative D.C. voltage charges capacitor 96 with series resistor 98 determining the rate, because the conductive impedance of the diodes 80 and 82, which are rendered conductive by the charging voltage, is relatively low compared with resistor 98. Since the drop across the diodes 80, 82 is relatively low, the capacitor 84 does not get a chance to charge up to a high level; it serves principally as a by-pass impedance for the chiff gate, having a relatively high impedance compared to the conductive impedance of the diodes but relatively low impedance with respect to the nonconductive impedance of the diodes 80, 82. As soon as the capacitor 96 becomes sufficiently charged, the diodes 80, 82 are cut off and chiff envelope decays to zero. Upon release of the key operating the switch 86, the charge on capacitor 96 leaks off through resistor 92 to low D.C. level $+V_2$, so the chiff can be repeated quickly. The diode 94 is necessary to allow the rapid discharge of capacitor 96.

Referring to FIGURE 4 for an organ system based on the so-called second aspect of the invention, the signal sources B_6 , C_7 and C_8 correspond, respectively, to sources 2, 4 and 6 of FIGURE 2. From them, variable-resistance key switches 68a, 70a and 72a key steady-state signals to collector 34 for filtering by steady-state tone filters 40 and 42, the filtered signals being made available in the output system via stop switches 44 and 46, as in FIGURE 2. Percussion signal gates 10 and 12 are similar to and correspond to those of FIGURE 2 and their gated signals are carried to the output system similarly. However, the percussion and chiff keying circuits are shown with actual values on the components, resistors being in ohms and capacitors in microfarads. Otherwise, they correspond exactly to those of FIGURE 3, except for the omission of the connection to the steady-state gate. The steady-state switches 68a and 70a are shown, respectively, ganged to their direct-current switch counterparts 87a and 86a. The presence of the third percussion and chiff keying circuit (connected to the percussion gate fed

by source $A_6\#$) points up the fact that it shares the chiff signal gate 18a with the other two circuits (for B_6 and C_7). The collector 78a, for this purpose, corresponds to the connection 78 of FIGURE 3. Similar connections 79 serve the same purpose for the remaining chiff signal gates 19 down through the range of the organ, the remaining sources, gates and keying circuits having been omitted in the interests of simplicity in the drawings. Collectors 79a indicate that the gates 19a are shared by four semi-tones instead of three. It will also be noted that collectors 36a and 36b collect chiff signals on a range basis for chiff filters 66b and 66c, so that the harmonic content in each range can be somewhat equal. It will be understood that similar range filtering could also be effected for the percussion and steady-state signals, but this is not considered a novel development herein.

The operation of FIGURE 4 will not be explained in detail, because it is believed that it will be readily apparent after the description of the operation of the preceding figures. Suffice it to say that steady-state signal key switches 68a and 70a, ganged with D.C. switches 87a and 86a concurrently cause signals, directly or indirectly, to appear in the output system, wherein the chiff signals are filtered by ranges in the chiff tone filters 66a, 66b and 66c, for combination in the collector 67.

In FIGURE 5 an alternate chiff gate is shown, together with the details of percussion signal gates of the type disclosed in the aforementioned Brombaugh patent. Otherwise, FIGURE 5 duplicates the upper part of FIGURE 4, and like elements are given like indicia. In general, the alternate chiff gate uses a gating voltage which is transmitted via the percussion signal gate instead of being carried direct to the gate from the keying circuit. Referring to FIGURE 5, the percussion and chiff keying circuit PCK comprises only D.C. key switches, for example 86a and 87a, plus the 15K resistor. The details of the percussion signal gates 10a and 12a are shown inside the dot-dash lines so labeled. Instead of the decay capacitors, for examples 13a and 15a, being grounded directly, as shown in the Brombaugh patent, a common 4.7K resistor, shown in the alternate chiff signal gate 18a containing a grounded-base transistor, is inserted between ground and the decay capacitors 13a and 15a. The collector of the transistor 17 is fed +22 volts via a 220K resistor as shown. The collector is also connected to the double-diode portion of the gate 18b via a .05 microfarad capacitor 96a and 220K resistor in series, the latter two elements corresponding to the capacitor 96 and resistor 98 of keying circuits 24a of FIGURE 3. A common 1M resistor is shown connected from the double-diode junction to the +2.5 volt bias point as in the circuit of FIGURES 3 and 4. A .0022 microfarad by-pass capacitor is shown between ground and the junction point between the diodes 80, 82 of gate 18b, corresponding to element 84 of FIGURE 3.

In operation, closing a key switch 86a, for example, charges up capacitor 15a and renders diodes 21, 23 conductive, permitting signal from source C_7 to pass to the output system via collector 38. At the same time, the charging current for capacitor 15a, flowing via the 4.7K resistor biases the emitter of the transistor 17 for conduction. The input signal to the transistor is sufficient to result in saturation, and the collector swings to a sufficiently low voltage to result in conduction of the diodes 80, 82. However, as the capacitor 96a becomes charged, the voltage at the junction of the diodes 80, 82 rises and the chiff signal is cut off as in the case of FIGURES 3 and 4.

The principal advantage of the system of FIGURE 5 over that of FIGURE 4 is that twelve transistors can be substituted for forty silicon diodes (in the specific system of this application). In other words certain functions of the keying circuits (of which there are forty) have been transferred to the chiff gates (of which there are only twelve).

Referring to FIGURE 6, portions and components similar to FIGURE 3 are similarly designated. However, there is an additional chiff signal gate CSG_2 , supplementing the regular one CSG_1 , which are also labeled, respectively 18b and 18a. The gate 18b is fed from an addition to the keying circuit, which comprises capacitor 96a and a resistor 98a, serving the same function for the new gate 18b that capacitor 96 and resistor 98 do for the gate 18a. In other words, there are two concurrently operated chiff gates 18a and 18b which may have different characteristics—taken together with their respective R-C circuits 96, 98 and 96a—so as to achieve different chiff envelopes. Also, the gate 18b is shown connected to a different tone signal source 6a, which is so desired, may be a different frequency from that of source 6. Or, if so desired, the gate 18b may be connected also to gate 6 to have the same chiff frequency but different chiff envelope from that derived from gate 18a. Thus, a complex chiff signal, composed of a composite of two separate signals, may be achieved.

While specific embodiments of this invention have been described and illustrated, it will be clear that other variations of details of construction which are specifically illustrated and described may be resorted to without departing from the true spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. In an electronic organ, the combination comprising:
 - a gamut of continuously-running sources of tone signals corresponding in fundamental frequencies to notes of a musical scale,
 - an output system,
 - a first plurality of keying means respectively connecting said sources to said output system and arranged to provide a gradual onset to steady-state tones created by said tone signals in said output system,
 - a plurality of chiff gating means fewer in number than said first plurality, respectively connecting at least some of said sources of tone signals to said output system,
 - a second plurality of keying means operatively associated respectively with said first plurality of keying means, a plurality of said second plurality of keying means being connected to each of said chiff gating means for deriving chiff signals during said onset of said tone signals, whereby said chiff gating means are shared by said second plurality of keying means.
2. The combination claimed in claim 1, including percussion gating means coupled respectively between at least some of said continuously-running sources and said output system, said second plurality of keying means being respectively connected also to said percussion gating means in such relation that chiff signals may be made to occur at the beginning of percussion tone signals.
3. The combination according to claim 2, said output system including
 - an amplifier,
 - a plurality of collectors fewer in number than said second plurality of keying means each connected one to a plurality of said keying means,
 - a first plurality of chiff gating means equal in number to said plurality of collectors respectively connected to said collectors,
 - at least one chiff filter means coupled to said chiff gating means, and
 - first stop switch means coupled between said chiff filter means and said amplifier.
4. The combination according to claim 3, including percussion filter means coupled to said percussion gating means,
 - second stop switch means coupled between said percussion filter means and said amplifier, and
 - means coupling said first and second stop switch means for concurrent operation thereof, whereby chiff sig-

nals are derived concurrently with percussive tone signals in said output system.

5. The combination according to claim 4, including steady-state tone filter means coupled to said first keying means,

third stop switch means coupled between said steady-state tone filter means and said amplifier,

fourth stop switch means between said chiff filter means and said amplifier, and

means connecting said third and fourth stop switch means for concurrent operation thereof, whereby chiff signals are derived concurrently with steady-state tone signals in said output system.

6. In an electronic organ, the combination comprising: a plurality of continuously-running sources of tone signals,

a plurality of percussion gates respectively coupled to at least some of said sources,

a plurality of chiff gates respectively coupled to other ones of said sources,

a direct-current source,

a plurality of gate-actuating circuits coupled between said direct-current source and said plurality of percussion gates and between said direct-current source and said plurality of chiff gates, whereby said chiff gates provide chiff signals at the start of percussion signals.

7. In an electronic organ, the combination comprising: a plurality of continuously-running tone signal sources, an electroacoustic translating device,

a plurality of steady-state tone-keying circuits,

at least one steady-state tone filter coupled to said tone-keying circuits,

a steady-state stop switch coupled between said steady-state tone filter and said electroacoustic translating device,

a plurality of chiff-gating circuits coupled to relatively high frequency ones of said signal sources,

a plurality of gate-actuating means coupled to said chiff-gating circuits,

at least one chiff filter means coupled to said chiff gating circuits,

at least one chiff stop-switch coupled between said chiff filter means and said electroacoustic translating device, and

means connecting said steady-state stop switch and said chiff stop switch for concurrent operation thereof, whereby chiff signals may be derived concurrently with steady-state tone signals.

8. The combination according to claim 7, including a plurality of percussion gating circuits respectively coupled to said plurality of continuously-running tone-signal sources,

means coupling said gate-actuating means to said percussion gating circuits,

at least one percussion-filter means coupled to said percussion gating circuits,

at least one percussion stop switch coupling said percussion filter circuits to said electroacoustic translating device,

a second chiff stop switch,

means connecting said percussive stop switch and said second chiff stop switch for concurrent actuation thereof, whereby chiff signals may be derived concurrently with percussion tone signals.

9. The combination according to claim 7, wherein said plurality of chiff-gating circuits is fewer in number than said continuously-running sources, whereby each chiff frequency is employed for more than one steady-state tone signal, and wherein said chiff filter means comprises

a plurality of separate filter circuits connected each to several of said plurality of chiff-gating circuits.

10. The combination according to claim 8, wherein each of said gate-actuating means includes:

a direct-current source,

a key switch in series with said direct-current source, a first direct-current path from said key switch to said percussion-gating circuit,

a second direct-current path from said key switch to said chiff-gating circuit, and wherein each of said chiff gating circuit comprises

a pair of back-to-back diodes, and

a by-pass impedance connected at a point between said diodes, said second direct-current path being connected at said point between said diodes.

11. The combination according to claim 8, wherein said chiff gating circuit comprises:

a pair of back-to-back diodes,

a by-pass impedance connected at a point between said diodes, and

a grounded base transistor circuit coupled between said percussion gating circuit and said point between said diodes.

12. In an electronic organ, the combination comprising:

a plurality of continuously-running sources of tone signals,

a plurality of steady-state signal gates respectively coupled to said sources,

a plurality of percussion signal gates respectively coupled to at least some of said sources,

a plurality of chiff signal gates respectively coupled to other ones of said sources,

a direct current source,

a plurality of gate-actuating circuits coupled between said direct-current source and said plurality of steady-state signal gates, between said direct-current source and said plurality of percussion signal gates, and between said direct-current source and said plurality of chiff signal tone gates, whereby said chiff signal gates can provide chiff signals at the start of steady-state signals and at the start of percussion signals.

13. The combination according to claim 11, including: an electroacoustic translating system,

at least two steady-state tone filters coupled to said steady-state signal gates,

at least two percussion tone filters coupled to said percussion signal gates,

a chiff tone filter coupled to said chiff signal gates,

at least two steady-state stop switches coupled respectively between said at least two steady-state tone filters and said translating system,

at least two percussion stop switches coupled respectively between said percussion tone filters and said translating system,

at least two chiff stop switches coupled between said chiff tone filter and said translating system,

means connecting one of said steady-state stop switches with one of said chiff stop switches for concurrent actuation thereof,

means connecting one of said percussion stop switches with one of said chiff stop switches for concurrent actuation thereof, whereby chiff signals may be heard at the beginning of steady-state signals and at the beginning of percussion signals.

14. In an electronic organ, the combination comprising: three continuously-running tone signal sources, one of which is in a comparatively low register and two of which are in a comparatively high register,

a steady-state signal gate coupled to said tone signal source in a low register,

a percussion signal gate coupled to said tone signal source in a low register,

two chiff signal gates coupled respectively to said tone signal sources in a high register,

a steady-state, percussion and chiff keying circuit coupled to said steady-state gate, said percussion gate and said chiff signal gates, and

an output system coupled to all said gates.

11

15. The combination according to claim 14, wherein said keying circuit comprises:

- a common point,
- a diode and a first resistor coupled between said common point and said percussion gate,
- a first capacitor and a second resistor coupled between said common point and one of said chiff signal gates,
- a second capacitor and a third resistor coupled between said common point and the other of said chiff signal gates,

12

- a source of low positive voltage,
- a fourth resistor coupled between said common point and said source of low positive voltage,
- a source of comparatively-high negative voltage, and
- a switch coupled between said common point and said source of comparatively-high negative voltage.

No references cited.

ARTHUR GAUSS, *Primary Examiner.*

S. MILLER, *Assistant Examiner.*