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ELECTRONIC ORGAN HAVING UPBEAT PERCUSSION GATE

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3 Sheets-Sheet 1

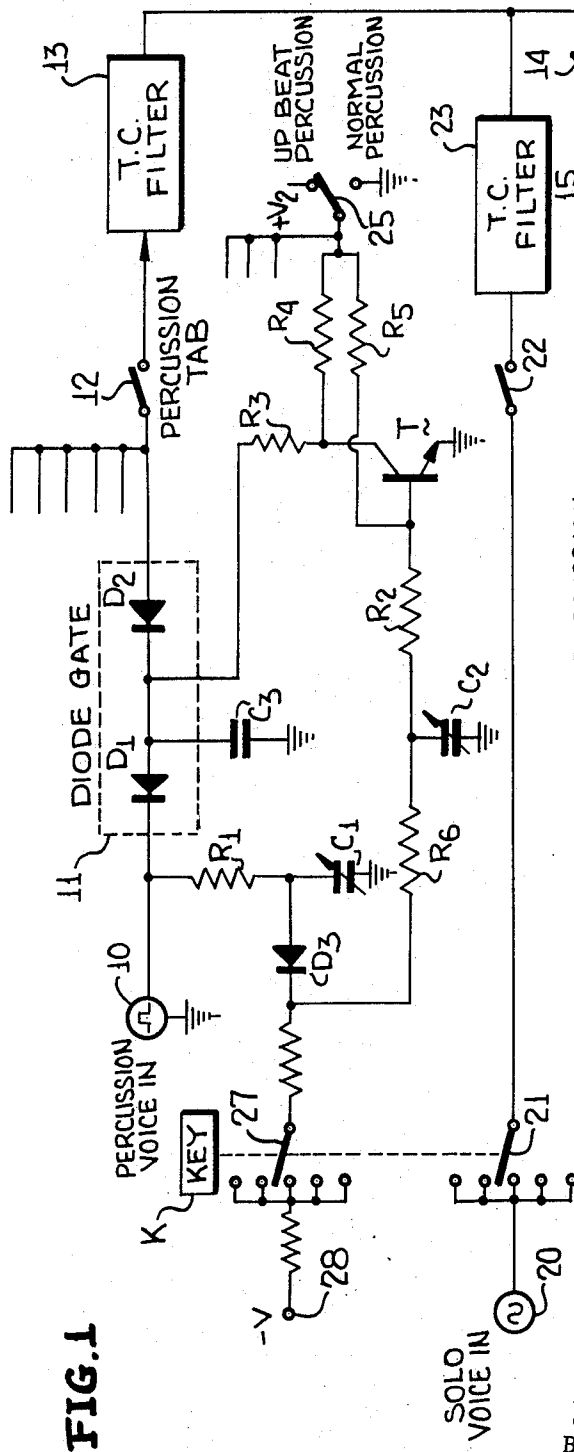


FIG. 1

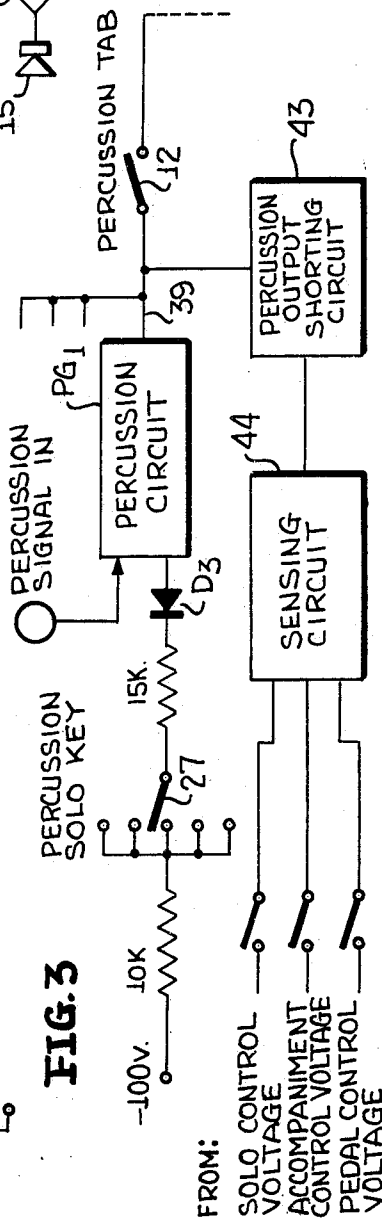


FIG. 3

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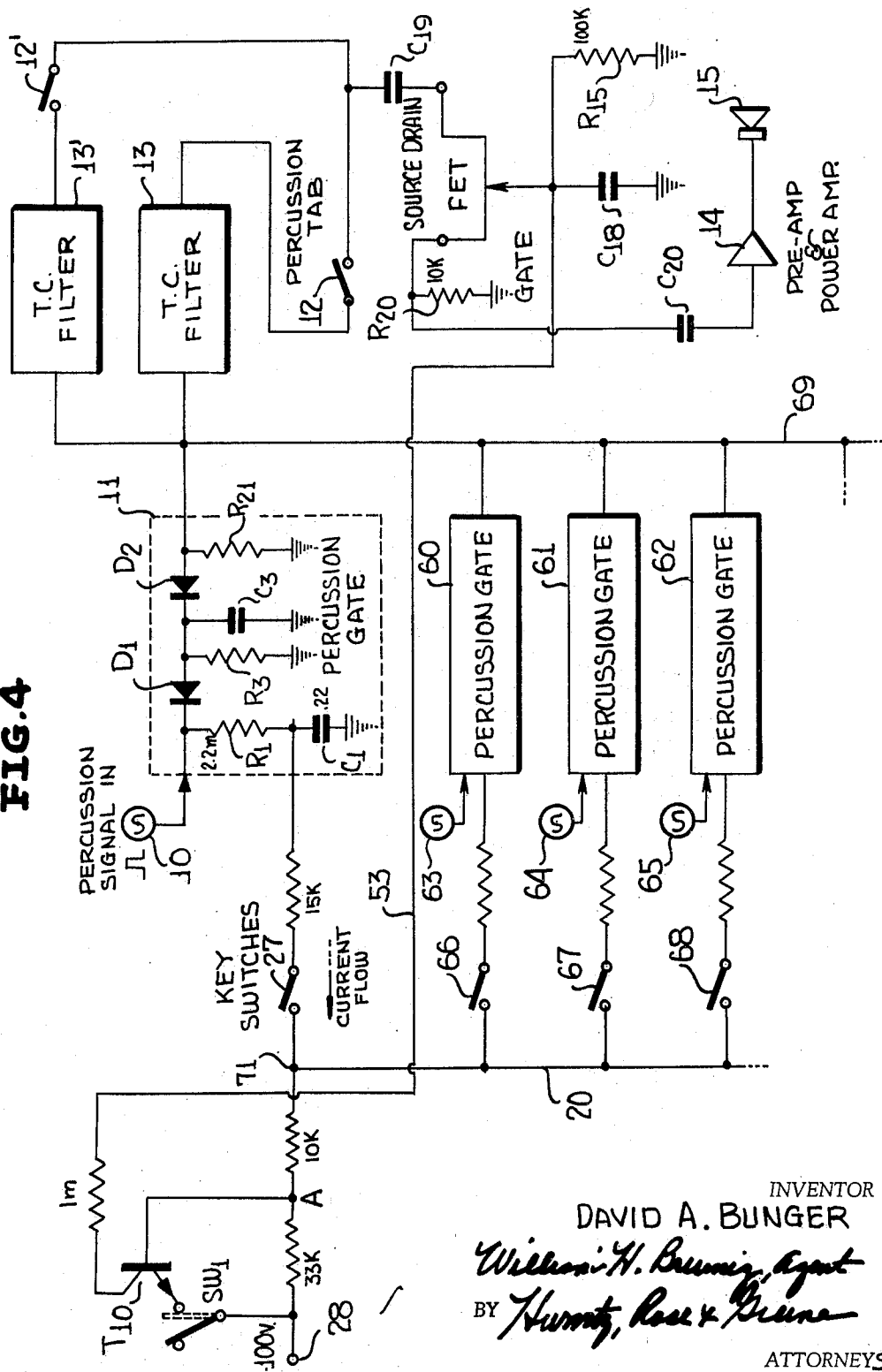
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3 Sheets-Sheet 3

FIG. 4



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ELECTRONIC ORGAN HAVING UPBEAT PERCUSSION GATE

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19 Claims

ABSTRACT OF THE DISCLOSURE

An electronic organ has steady tone stops and percussive tone stops, which are selected by tone color tabs. When a steady tone tab and a percussive tone tab are both depressed, and a key then actuated, the steady tone alone is heard while the key is actuated and the percussive tone only on release of the key. Pursuant to variants of the system, the percussion tone can sound both on key actuation and on key release, but not in the intermediate part of the note.

A tone channel is provided which includes in series a tone signal source, a normally non-conductive diode gate, a voltage controlled normally conductive switch, and a load. On closure of a key switch, voltage is applied to the gate which renders same conductive, but voltage is also applied to the switch to render same non-conductive. Therefore, no tone signal passes to the load, i.e. the tone channel is blocked. The gate includes a sustain capacitor which is charged when the key switch is closed. On opening the key switch, the voltage controlled switch is rendered conductive, while the decaying voltage on the sustain capacitor continues the conductivity of the gate, on a decaying basis as a function of time.

BACKGROUND OF THE INVENTION

In the electronic organ art percussive diode gates are conventionally employed which are rendered conductive to a tone signal when a manual or pedal key is actuated, and which sustain the tone signal, after the key is released, in a decaying pattern suitable to simulate a percussive effect. According to the present invention, a percussive voice will not sound, when a key is actuated, but only on its release. The same key may actuate plural key switches, one of which may then call forth a steady tone while it is actuated and cut off the tone when it is released. Another key switch, actuated by the same key, may call forth a percussive voice, distinguishable from the steady note, but only on termination of the steady tone, i.e. on release of the key. Since a given organ may provide a wide variety of steady voices as well as a wide variety of percussive voices, manipulation of tone color tabs enables many combinations of steady and percussive voices to be heard, in response to actuation of one key.

Time delays can be introduced to produce a percussive effect both when a key is actuated and when it is released.

An overriding control voltage which maintains the tone signal channel non-conductive during actuation of a key may be developed by the key which calls forth a

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steady tone. It may also be developed simultaneously in response to actuation of any one or more of a plurality of keys, no percussive termination being heard until the last of the keys is released. It is also feasible to arrange delays in the circuit so that the overriding disabling voltage is not applied until slightly after a key is actuated. Thereby the generated tone sound initially with a percussive accompaniment, thereafter as a steady tone, and after termination of the steady tone as a percussive termination or upbeat percussion. The initial percussion is sometimes called a downbeat percussion.

SUMMARY OF THE INVENTION

A normally non-conductive diode gate composed of two diodes in a series, identically poled, is provided in cascade between a source of percussive tone signal and the filters, amplifiers and loudspeakers of an electronic organ. In normal operation of such gates, actuation of a key provides application of an on gating DC voltage to a control point of the diodes, whereupon the tone signal passes. This voltage also charges a sustain capacitor, connected to the control point. On release of the key the DC on gating voltage is removed, but the gate continues to pass tone signal until the sustain capacitor is discharged. The above represents one mode of operation of the present system, but a mode which is per se conventional.

According to the inventive component of the system, provision can be made for adding an overriding gate disabling circuit to maintain the gate non-conductive or to short out its input, or to block the tone signal channel, despite the fact that a key switch is closed. The disability is removed on release of the key, whereupon the gate proceeds to pass tone signal to a load under control of the sustain capacitor.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic circuit diagram of a system arranged according to the invention;

FIGURE 2 is a schematic circuit diagram of a modification of the system of FIGURE 1, wherein on actuation of plural keys only release of the last of these produces an upbeat percussive effect;

FIGURE 3 is a largely schematic circuit diagram of a further modification of the invention, illustrating a generalization of the systems of FIGURES 1 and 2; and

FIGURE 4 is a largely schematic circuit diagram of still another modification of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGURE 1, 10 is a first continuously operating tone source, which may be a typical one of the plural tone sources of an electronic organ. The tone signal provided by tone source 10 is applied through gate 11 to a stop selection switch 12, which in turn proceeds to a tone color filter 13, an amplifier 14 and a loudspeaker 15, all in cascade. The diode gate is normally non-conductive of tone signal, because of the poling of its diodes in relation to signal polarity, so that no tone can be transferred to the output of the organ, regardless of the condition of stop selection switch 12.

A typical solo, accompaniment of pedal tone signal is provided by tone source 20. The latter can proceed via key switch 21, stop switch 22, and tone color filter 23 to the input of amplifier 14.

The tone signal provided by source 10 goes only positive with respect to ground so that gate 11 does not pass the tone signal when no manual key is actuated. Assume mode selector switch 25 in ground position. This grounds the base of transistor T1 through resistance R5, and the collector through resistance R4, and the transistor T is therefore switched off, effectively.

On actuation of key K, and consequent closure of manual key switch 27, a negative voltage $-V_1$, from terminal 28, is applied via switch 27, diode D3, and resistance R1 (over 1M) to the cathode of diode D1, and via diode D1 to the cathode of diode D2, of gate 11. The diodes D1 and D2 then become conductive to the tone signal provided by source 10, and remain conductive so long as manual key switch 27 is actuated, and tone is heard at loudspeaker 15 if percussion tab actuated switch 12 is closed. Capacitor C1 is charged to voltage $-V_1$ at this time. Capacitor C3, connected from the cathode of D2 to ground, represents an impedance or reactance, low relative to the series gate impedance while the gate 11 is non-conductive, but high while the gate 11 is conductive. Thereby leakage through the gate is reduced. Capacitor C3 also reduces noise, acting as a high frequency filter.

On release of manual key switch 27, the charge on capacitor C1 leaks off relatively slowly, via R1, to ground, and the signal level at speaker 15 accordingly decays percussively to zero.

On placing the switch 25 in the upbeat percussion position, $+V_2$ is applied via R4 to the collector of T and $+V_2$ to the base of T via R5. Transistor T then saturates, grounding R3. On closure of manual key switch 27 voltage $-V_1$ is applied to charge C1 to voltage $-V_1$, which tends to render gate 11 conductive. However, voltage $-V_1$ is also applied to the base of T rendering same non-conductive. Thereby, voltage $+V_2$ is applied via R4, R3 in series to the cathode of diode D2, and $+V_2$ is selected to be adequate to maintain diode D2 non-conductive despite application of voltage $-V_1$ to the cathode of diode D1. Gate 11 thereby remains non-conductive and no tone derived from tone source 10 can sound despite the fact that manual key switch 27 is actuated. However, manual key switch 21 is actuated simultaneously with manual key switch 27, when key K is actuated, and tone deriving from solo (or accompaniment or pedal) tone source 20 can be heard if tab switch 22 is closed.

On release of key K, tone from tone source 20 ceases promptly. Opening of manual key switch 27 removes bias from the base of T, and T becomes saturated, grounding resistance R3, so that no positive voltage exists at the cathode of diode D2. The negative charge on capacitor C1 is blocked from the base of T by diode D3, and hence cannot hold T non-conductive. However, the voltage on capacitor C1 is applied to the base of diode D1 and maintains the gate 11 conductive percussively as the charge on capacitor C1 leaks away via timing resistance R1.

Accordingly, the solo voice sounds while key K is actuated and the percussive voice only on release of key K. These voices may be different, and may be selected from a wide range of available voices by selection of tone color filters (not illustrated).

The capacitance of C1 may be made adjustable, to enable adjustment of the time constant of R1C1.

The cathode of diode D3 is connected to the base of transistor T via a filter, composed of series resistance R2, R6 and shunt capacitor C2. These can be designed to have negligible time constant or an appreciable time constant. In the latter case, on closure of manual key switch 27 application of $-V_1$ to the base of transistor T is delayed, and gate 11 can therefore conduct until transistor T be-

comes non-conductive. In this case, actuation of key K results in the transient sounding of a percussive tone, concurrently with initiation of a solo tone, (down beat percussion), the former dying rapidly away. The percussive tone is again heard on release of key K (upbeat percussion).

The system of FIGURE 1 employs a disabling voltage applied to a gate, which supercedes an enabling voltage for the gate. Both are applied when a key is actuated, but only the latter voltage is removed when a key is released. Clearly the specific character of the gate can be varied, and in fact many forms of diode gates are presently employed for gating through organ tone signals.

In the system of FIGURE 2, a plurality of percussion gates have their outputs connected in parallel to a common output channel, and this channel is grounded when any one or more key switches is actuated. Grounding is one form of disablement, and other forms may be employed. The crucial point is that if plural keys are actuated and are not released together, only release of the last key will call forth a percussive upbeat.

The system of FIGURE 2 is more economical than the system of FIGURE 1, in that the latter requires a transistor T for each gate, plus associated components, while the system of FIGURE 2 does not.

Corresponding elements of FIGURES 1 and 2 are not further described. In FIGURE 2, the gate 11 is considered to be in a channel 39 extending between tone source 10 and a load, including filter 13. This channel is disabled by a transistor T2, which is normally off, and then represents an open switch. Transistor T1 is conductive, when switch 25 is in the upbeat percussion position, since then $+22$ v. is applied to the collector of T1 via resistance R6 (of only 100K) and that same voltage to the base of T1 via resistance R7 of 1M. On closure of any one or more of switches 27 or 27a, -100 v. from terminal 28 is applied via one or more of resistances R8 to the base of T1. As a result T1 blocks and T2 saturates since its base is returned to $+22$ v. via R6.

One typical percussion gate is illustrated at PG1, in schematic form, and a second at PG2 in block form, but it will be clear that a gate will be provided for each key switch, all proceeding via leads 40 to channel 39, and all providing disabling voltage to bus 41, when one or more of key switches 27 are closed.

The system of FIGURE 2 can be generalized so that availability of upbeat percussion derives from switches in the solo manual alone, or the pedal manual alone, or in any combination of these. For example, upbeat percussion may be called forth from the solo manual and steady notes from the accompaniment manual, with disablement of the percussion channel provided from key switches of the accompaniment manual. Thereby, if a solo key and accompaniment keys are actuated together, the latter may provide steady tones until the last one of these is released, whereupon a solo upbeat percussion tone will sound, or vice versa, the solo note may be steady and the accompaniment provide the upbeat percussion.

Referring now to FIGURE 3 of the accompanying drawings, a system if schematically illustrated which corresponds with the suggestion of the next preceding paragraph. Here a typical percussion circuit PG1 is illustrated, which is controlled by solo key 27, and is contained in a channel 39. The latter is shorted by a shorting circuit 43 (circuit of T2 of FIGURE 2), which is controlled by a sensing circuit 44 (circuit T1 of FIGURE 2, which is controlled at will from any one of the manuals of the organ, or from any combination of these).

The source of percussion tone in FIGURES 1-3 is illustrated as a positively going waveform, such as derives from organ tone oscillators, and are controlled by key switches. However, continuously connected sources, such as those simulating brush, clave, temple block, etc. may be substituted. In such case percussion keys or key switches are not required.

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In FIGURE 4 of the accompanying drawings, 11 is a percussive gate to which tone signal is applied from a source 10. The tone signal is positively going with respect to ground, and the gate 11 includes two diodes D1 and D2, identically poled and connected with cathodes in proximity to the tone signal source 10, so that the gate 11 is normally non-conductive of the tone signal. The gate 11 can be rendered conductive by application of a negative gating voltage to the cathode of diode D1 and thereby to the cathode of D2. C3 with R3 provides filtering action for noise, and in addition provides a shunt impedance to ground which is of low impedance relative to series gate impedance when the gate is non-conductive but of high impedance relative to series gate impedance when the gate is conductive. Thereby leakage is minimized of tone signal through the gate while the gate is non-conductive. The gate 11 leads to a tone color filter 13, a percussion tab switch 12, a capacitor C19, a field effect transistor FET, and a preamplifier 14 and loudspeaker 15. The FET is normally conductive and is rendered non-conductive in response to a negative control voltage connected to its gate. Resistor R20, connected between the source terminal of the FET and ground, and series capacitor C20, are shown separately but would normally be included in preamplifier 14.

On closure of key switch 27, DC current flows from ground, through R21, through the diodes D2, D1, resistance R1, to negative terminal 28. The gate 11 is rendered conductive of the tone signal deriving from tone signal source 10. Capacitor C19 blocks DC voltage across R20, but tone signal develops thereacross, and tone is heard, assuming tab switch 12 is closed. The gate of the FET is referenced to ground through R15, and the FET is conductive so long as its gate is at ground potential. C18 acts to suppress transients.

The system then operates to provide normal percussion as follows: so long as key switch 27 is closed, tone is heard. On opening of key switch 27, the negative voltage on C1 maintains the gate 11 conductive, but that voltage decays, via R1, and the tone is percussive or sustained following opening of key switch 27.

Assume switch SW1 actuated to its dotted position, and key switch 27 closed. A circuit exists from ground via R21, D1, D2, R1 key switch 27, to terminal 28, and point A assumes a positive voltage with respect to point 28.

Transistor T10 has its emitter connected via SW1 to point 28, and its base connected to point A. T10 therefore is rendered conductive, and current flows from ground through R15, and via lead 53, to the collector of T10. The gate of the FET then goes negative and the FET is cut-off, and no tone signal proceeds to preamplifier 14.

The last described condition subsists so long as key switch 27 is closed. On opening key switch 27, point A and terminal 28 are at the same voltage, and T10 becomes non-conductive, removing negative bias from the gate of the FET, which becomes conductive. Tone signal then passes, in percussive mode, as the voltage across C1 decays.

The FET may be considered a selective disabling and enabling device for the tone signal channel, operative to disable the channel while, and only while, a key switch is closed, but otherwise conductive.

Percussion gates 60, 61, 62 having tone sources 63, 64, 65, respectively, and key switches 66, 67, 68, respectively, have outputs leading to bus 69, which proceeds to the input of tone color filter 13.

One terminal of each of switches 66, 67, 68 proceeds via bus 20 to point 71, to which is connected a terminal of switch 27.

Any one or more of key switches 27, 66, 67, 68 may be simultaneously actuated, to provide a rise in voltage at point A, and consequent application of a negative voltage to the gate of the FET. The FET remains non-conductive so long as any key switch remains actuated, and becomes conductive when the last actuated key switch is released.

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The upbeat percussive notes which may be heard depend on the relative timing of key switch openings. If all key switches are opened together, all corresponding upbeat percussive notes will be heard simultaneously. If they are released sequentially some of the gates may become wholly or partially non-conductive before the FET is rendered conductive, the single FET being common to all the gates.

While I have described and illustrated one specific embodiment of the invention, it will be clear that variations of the 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 organ system,
a source of tone signal,
a load,
a gate in cascade between said source of tone signal and said load,
said gate being normally non-conductive to said tone signal,
at least one key switch,

means responsive to closure of said at least one key switch and operative while said at least one key switch is closed for preventing transfer of said tone signal from said source of tone signal to said load,

means responsive to closure of said at least one key switch for applying a voltage to said gate tending to render said gate conductive, and
means sustaining said voltage following opening of said at least one key switch.

2. The combination according to claim 1 wherein said means for preventing transfer of said tone signal from said source of tone signal to said load is a means for applying a disabling gate voltage to said gate.

3. The combination according to claim 1 wherein is provided:

a channel including said gate, and
wherein said means for preventing transfer of said tone signal from said source of tone signal to said load is a means for grounding a point of said channel.

4. The combination according to claim 1 wherein said means responsive to closure of said at least one key switch for applying a voltage to said gate tending to render said gate conductive includes a timing circuit comprising a capacitor connected in on gating relation to said gate and arranged to be charged by said voltage.

5. A gating circuit for passing a signal on opening of a switch, comprising:

a source of said signal,
a channel comprising a gate connected in cascade with said source of said signal,
a load connected in said channel in cascade with said gate,
said gate having a control point,
a sustain circuit including a capacitor connected to said control point,

means responsive to closure of said switch for transferring a voltage to said capacitor of such polarity and amplitude as to tend to render said gate conductive, and
means for disabling said channel during closure of said switch despite presence of said voltage across said capacitor.

6. The combination according to claim 5 wherein is provided means for at will disabling said means for disabling.

7. A gating circuit comprising:

a source of signal,
a load,
a source of gating voltage,
a channel including a gate connected between said source of signal and said load,

a sustain circuit including a sustain capacitor connected to said gate,
 means operative to disable said channel,
 means responsive to application of said gating voltage to said gate for charging said capacitor in such sense as to tend to render said gate conductive and for causing operation of said means operative to disable said channel.

8. In an organ system,
 a source of tone signal,
 a gate in cascade with said source of tone signal, said gate being normally non-conductive to said tone signal,
 a key switch,
 means responsive to closure of said key switch for applying to said gate for controlling the conductivity of said gate a first voltage tending to maintain said gate conductive and a second voltage tending to maintain said gate non-conductive,
 said first voltage having a value with respect to said second voltage such that said gate remains non-conductive on simultaneous application of said first and second voltage, and
 means responsive to opening of said key switch for disabling only said second voltage whereby said first voltage renders said gate conductive, and
 means operative only on opening of said key switch for initiating timed decay of said first voltage, whereby said gate is rendered progressively less conductive as a function of time after said opening of said key switch.

9. In an organ system,
 a key,
 means responsive to actuation of said key for calling forth a steady tone only while said key is actuated,
 a source of percussive tone,
 a gate in cascade with said source of percussive tone,
 a load connected in cascade with said gate,
 said load including a loudspeaker,
 said gate being normally non-conductive,
 means responsive to actuation of said key for maintaining said gate non-conductive, and
 means responsive to release of said key for calling forth said percussive tone.

10. In an organ system,
 a source of tone signal,
 a normally non-conductive percussive gate connected in cascade with said source of tone signal,
 a load connected in cascade with said percussive gate,
 a plurality of keys,
 means operable in response to actuation and release of any plurality of said keys for rendering said percussive gate conductive only in response to release of the last of the actuated keys and for preventing transfer of said tone signal to said load via said percussive gate while any one of said keys is actuated.

11. In an organ system,
 a source of tone signal,
 a normally non-conductive percussive gating circuit connected in cascade with said source of tone signal,
 a load connected in cascade with said percussive gating circuit,
 a plurality of keys, and
 means operable in response to an actuation and a following release of any one of said keys for rendering said percussive gating circuit conductive only in response to said release of said any one of said keys and for preventing transfer of said tone signal to said load via said percussive gating circuit while said any one of said keys is actuated.

12. In an electronic organ,
 a source of tone signal,
 a load,
 a key,

means operable in response to actuation and subsequent release of said key for effecting transfer of said tone signal to said load only in response to said release of said key and not during said actuation, and
 means providing a percussive decay of the transferred tone signal.

13. In an electronic organ,
 a source of tone signal,
 a load,
 a plurality of keys,
 means operable in response to actuation and subsequent release of a plurality of said keys for effecting transfer of said tone signal to said load only in response to said release of the last one of the actuated ones of said keys and not in response to or during said actuation, and
 means providing a percussive decay of the transferred tone signal.

14. A gating circuit for passing a signal on opening a switch, comprising:
 a source of said signal,
 a channel comprising a gate connected in cascade with said source of said signal,
 a load connected in said channel in cascade with said gate,
 said gate having a control point,
 a sustain circuit including a capacitor connected to said control point,
 means responsive to closure of said switch for transferring a voltage to said capacitor of such polarity and amplitude as to tend to render said gate conductive,
 means for disabling said channel during closure of said switch despite presence of said voltage across said capacitor,
 said channel including a field effect transistor, said field effect transistor being normally conductive, and
 means responsive to closure of said switch for rendering said field effect transistor non-conductive.

15. In an electronic organ, a tone channel including:
 a source of tone signal,
 a diode gate circuit, said diode gate circuit being normally non-conductive,
 a tone color filter,
 a field effect transistor, said field effect transistor being normally conductive,
 a key switch,
 means responsive to closure of said key switch for applying a bias voltage to said diode gate circuit for rendering said diode gate circuit conductive and concurrently completing a circuit for energizing said field effect transistor and for rendering said field effect transistor non-conductive,
 a sustain capacitor connected to said diode gate circuit for sustaining said bias voltage, and
 means responsive to opening of said key switch for rendering said field effect transistor conductive.

16. In an electronic organ, a tone channel including in series,
 a source of tone signal,
 a voltage responsive gate rendered conductive by said voltage,
 said gate being normally non-conductive,
 a load,
 a sustain capacitor connected to said gate for sustaining said voltage,
 a voltage controlled switch operative when closed to disable said tone channel,
 said switch being normally conductive,
 a normally open key switch,
 means responsive to closure of said normally open key switch for applying gating voltage to said gate and

said sustain capacitor and for closing and maintaining closed said voltage controlled switch only while said key switch is closed,

wherein said tone channel is conductive only in response to opening of said key switch and while voltage subsists on said sustain capacitor.

17. The combination according to claim 16, wherein said voltage controlled switch is a semi-conductor device.

18. The combination according to claim 16, wherein said voltage controlled switch is a semi-conductor device.

19. The combination according to claim 16, wherein is provided means for maintaining said voltage responsive switch conductive during closure of said key switch.

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U.S. Cl. X.R.

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