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TRANSIENT TONE SIGNAL CIRCUITS

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Fig. 1

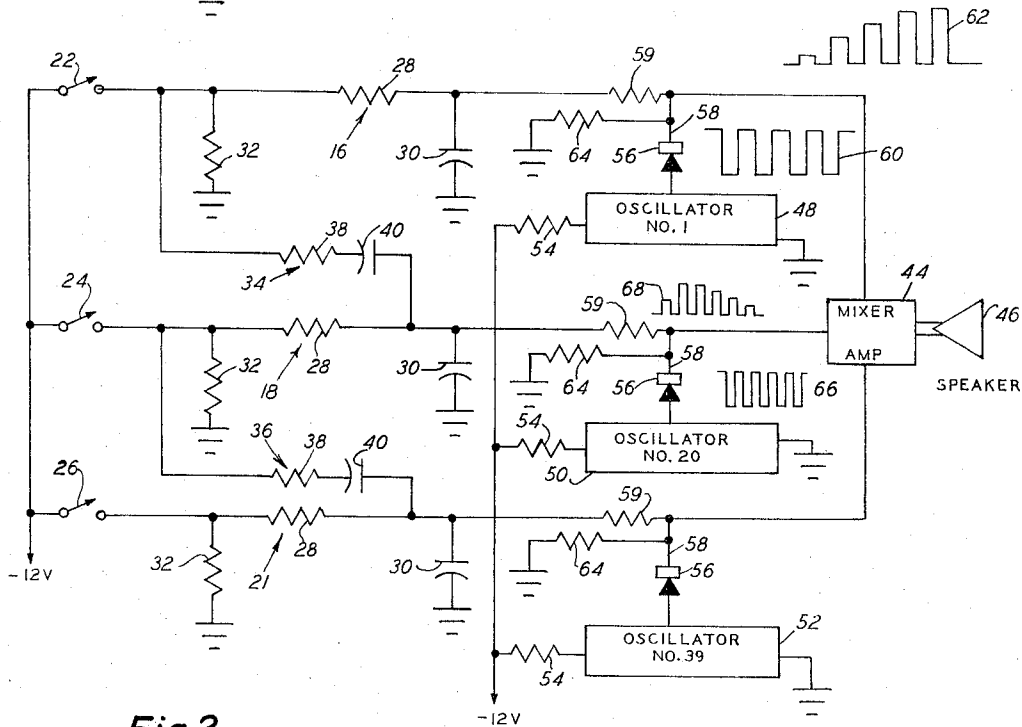
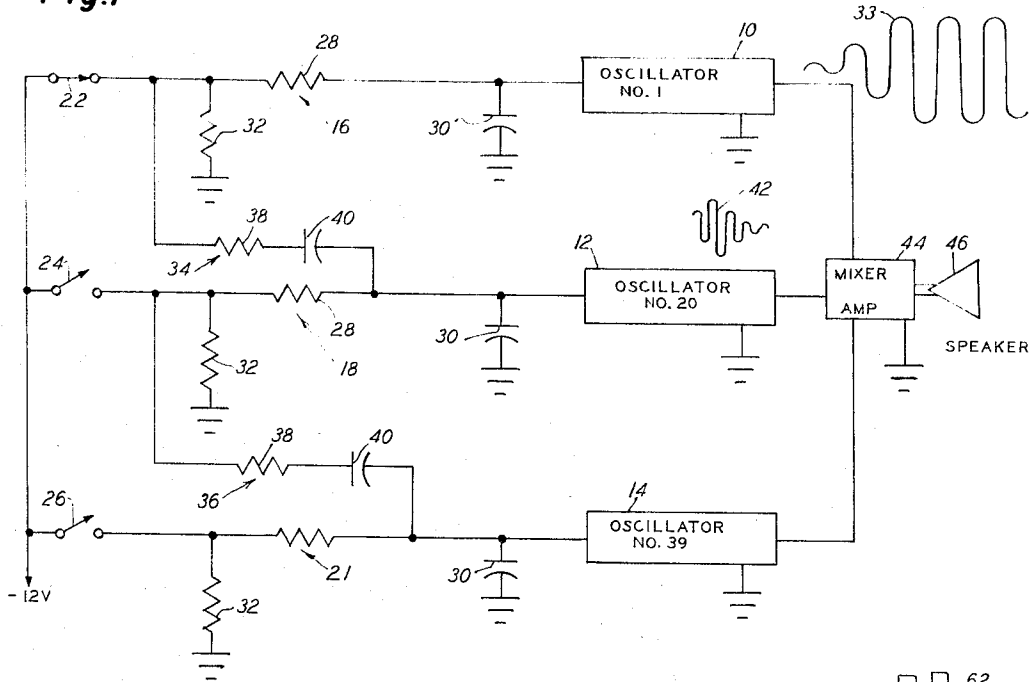


Fig. 2

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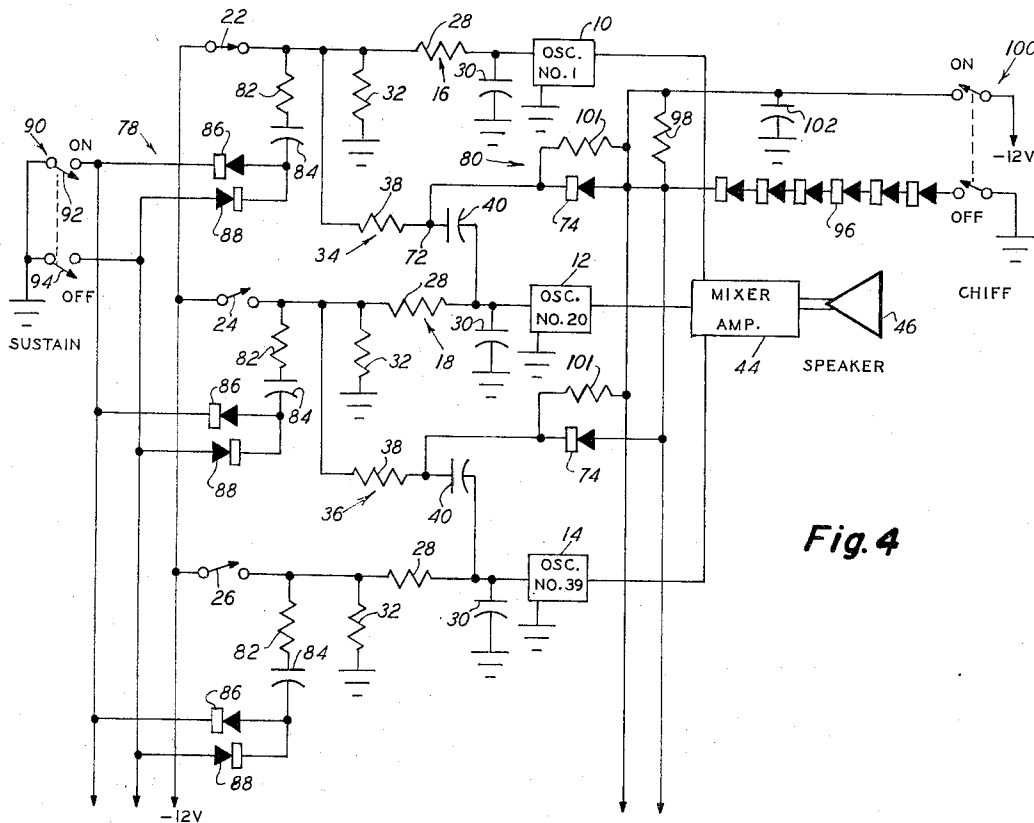
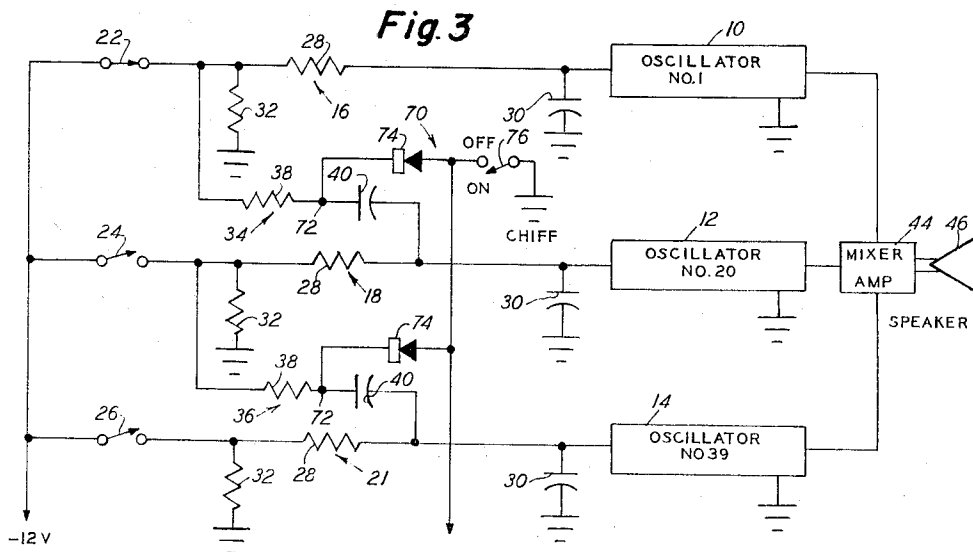
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TRANSIENT TONE SIGNAL CIRCUITS

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This invention relates to transient tone signal circuits and more particularly to circuits for electronic musical instruments by which a transient tone signal of a different frequency is delivered to an output circuit when the delivery of a main tone signal to the output signal is initiated.

The circuits of the present invention have utility in electronic organs in which tone signals of various frequencies corresponding to the musical scale are produced by tone generators. Such tone generators may be electronic oscillators or, for example, may include tone wheels such as wheels having magnetic elements carried past magnetic pickup devices or may include electrically vibrated reeds, etc. Thus the tone generators may generate and supply a tone signal to an output circuit only when keying electrical energy is supplied thereto through a keying circuit, or may be constantly running generators which deliver tone signals to an output circuit only when keying electrical energy is supplied through keying circuits.

The harmonic content of the tone signals delivered to the output circuit in different types of organs or with different organ stops in a given organ may be determined primarily by the nature of the signal generated by the generators, or may be determined by shaping the waveforms of the signals with filter or other wave shaping circuits after generation, or may be determined by synthesizing output tone signals by adding together controlled proportions of signals of different frequencies from several generators, or by any desired combination of such effects.

The rate at which a tone signal delivered to the output circuit builds up when a key is depressed is controlled to give a desired attack and also the rate of decrease of such output tone signal after the key is released may be controlled to give a desired decay. It is also possible to cause the output tone signal to decrease at a desired rate even if the key is retained in a depressed condition. By suitably varying such rates as well as the waveforms of the output signals, for example, by circuits switched in or out by organ stops, a large number of effects can be obtained.

Pipe organs produce an effect sometimes referred to as a "chiff" which cannot be obtained by the circuits discussed above. This effect is a transient output tone signal of considerably higher frequency than the main output tone signal associated with a given key. The "chiff" or transient output tone signal occurs immediately after the key is depressed and rapidly dies away, usually before the main output tone signal reaches its maximum amplitude.

In order to make an electronic organ more nearly simulate a pipe organ, various types of "chiff" circuits have been suggested. These include circuits for maintaining a separate capacitor for each key in charged condition as long as the key is not depressed and discharging such capacitor through key contacts separate from the main key contacts when a key is depressed to gate on a varistor gate and deliver a transient tone signal from one of a group of special constantly running "chiff" oscillators to the output circuit. Another prior approach is to deliver through a capacitor in series with a diode a pulse of keying electrical energy from the main contacts closed by depression of a first key to a normally inactive main oscillator for producing a tone signal of higher frequency

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than that of the main oscillator associated with the first key. The diode in series with the capacitor in the chiff circuit for each key and also a second diode in series in each keying circuit are required as isolation diodes for the capacitor to prevent reverse delivery of a transient of electrical keying energy through the capacitor when the key for the oscillator for producing the higher frequency tone signal is depressed. This reverse flow of keying energy would cause an undesirable transient output tone signal of lower frequency to be delivered to the output circuit from the oscillator associated with the first key.

The present invention provides a simplified circuit for causing a transient tone signal of a different frequency, such as a higher frequency chiff signal, to be delivered to an output circuit whenever a keying circuit is closed for the purpose of causing a first main output tone signal to be delivered to the output circuit. The simplified circuit transmits a pulse of keying electrical energy through a bilateral A.C. current conducting transient circuit, including a capacitor in series, from a first keying circuit associated with a generator for a first main frequency to a second keying circuit associated with a second generator for a second and different frequency to cause a transient tone signal of the second frequency to also be delivered to the output circuit when the key associated with the first generator is depressed.

If the key for the second generator referred to above is depressed to cause a main tone signal to be delivered to the output circuit from such second generator, insufficient energy is transmitted back through the transient circuit to the first keying circuit to cause a transient tone signal to be delivered to the output circuit from the first generator. This is accomplished by employing energy dissipating elements, such as bilateral current conducting resistors, in the keying circuits and connecting the transient circuit so that it by-passes the energy dissipating elements when the keying switch associated with the first generator is actuated to cause a main tone signal to be delivered from this generator to the output circuit and so that the transient circuit is connected in series with the energy dissipating elements in both the first and second keying circuits when the keying switch associated with the second generator is actuated to cause a main tone signal to be delivered to the output circuit from the second generator.

The circuits of the present invention require no isolating diodes or other active or nonlinear elements such as varistors or transistors in the transient circuits or in the keying circuits. The circuits of the present invention also do not require any separate oscillators or other tone generators for the transient output tone signal nor do they require any extra contacts on the keying switches in order to energize the transient circuits.

The transient tone signal circuits of the present invention are compatible with most other circuits desirably employed in electronic organs and may be turned on or off at will, for example, with a stop actuated switch. It is convenient to employ a diode in the turn off circuit for the transient tone signal circuit for each key in order that a single one or two contact switch may be used in the turn off circuit, but such diodes are not essential to the operation of the transient tone signal circuits and can be dispensed with by employing a switch having a separate contact for each such circuit.

It is therefore an object of the present invention to provide an improved circuit for delivering to an output circuit a transient tone signal of a different frequency from that of a main tone signal when the main tone signal is initiated.

Another object of the invention is to provide a transient tone signal circuit for an electronic musical instrument in which a pulse of electric keying energy is transmitted through a transient circuit to cause a transient tone signal

of higher frequency or chiff signal to be delivered to an output circuit in addition to a main tone signal when a key for the main tone signal is depressed, and in which no active or nonlinear elements such as diodes, varistors, transistors are required.

A further object of the invention is to provide an improved chiff circuit for an electronic organ which is compatible with other circuits usually employed in such organs and which can be turned on and off by the operator of the organ.

Other objects and advantages of the invention will appear in the following description of preferred embodiments thereof in which reference is made to the attached drawings of which:

FIG. 1 is a schematic diagram illustrating the basic transient tone signal circuits or chiff circuits of the present invention employed in conjunction with tone generators which operate only when keying electrical energy is supplied thereto;

FIG. 2 is a schematic diagram showing the basic transient tone signal circuits of FIG. 1 employed in conjunction with constantly running tone generators;

FIG. 3 is a schematic diagram illustrating a turn off circuit for the transient tone signal circuits of FIG. 1; and

FIG. 4 is a schematic diagram showing how the transient tone signal circuits and turn off circuits therefor can be employed in conjunction with a sustain circuit.

Referring to the drawings, the circuit of FIG. 1 includes a plurality of tone signal generators of which three, indicated at 10, 12 and 14, are shown. It will be understood that there will be a tone generator for each note of the chromatic scale. The tone generators shown in FIG. 1 may be electronic oscillators of any one of several suitable types, such as oscillators, suitable types, such as oscillators, employing transistors. They are normally inactive and operate or run only when supplied with keying electrical energy from a suitable source. A keying circuit 16, 18 or 21 is associated with each of the oscillators 10, 12 and 14, respectively, and each keying circuit contains a key actuated switch 22, 24 and 26, respectively, which is closed when a key (not shown) associated with each switch is depressed. Closure of a keying switch, such as switch 21, connects the associated or corresponding oscillator, such as oscillator 10, to a source of keying energy, indicated as -12 v. in FIG. 1, through a keying circuit, such as keying circuit 16, to cause operation of such oscillator.

Each keying circuit contains a series resistor 28 and has a shunt capacitor 30 connected between ground and a point in the circuit between the resistor 28 and the associated oscillator 10, 12 or 14. The primary purpose of the resistor 28 and capacitor 30 in a keying circuit is to cause the keying voltage applied to a given oscillator, for example to the oscillator 10 when the switch 22 is closed, to increase gradually as the capacitor 30 charges through the resistor 16 so that the output tone signal indicated at 32 builds up gradually over several cycles thus providing a desired attack. Each keying circuit also includes a shunt resistor 32 connected between ground and a point in the respective keying circuit between the resistor 28 and keying switch 22, 24 or 26 for the respective keying circuit. Upon opening of the switch 21, after it has been closed to charge the capacitor 30 of the keying circuit 16 and cause operation of the oscillator 10, the charged capacitor 30 discharges through the oscillator 10 and also through the resistors 28 and 32 of the keying circuit 16 to provide the desired decay of the output signal 33. It will be apparent that the other keying circuits 18 and 21 and associated oscillators 12 and 14 operate in a similar manner.

The resistors 28 and 32 also function as energy dissipating or voltage dropping elements in conjunction with transient circuits also shown in FIG. 1. That is to say, a transient circuit 34 is connected between the two key-

ing circuits 16 and 18 and a similar transient circuit 36 is connected between the keying circuits 18 and 21. Thus one terminal of the transient circuit 34 is connected to a point in the keying circuit 16 between the switch 22 and the resistor 28 in such keying circuit and the other terminal of the transient circuit 34 is connected to a point in the keying circuit 18 between the oscillator 12 and the resistor 28 in such keying circuit. The two terminals of the transient circuit 36 are connected to similar points in the keying circuits 18 and 21.

Each transient circuit contains a resistor 38 and a capacitor 40 in series. The circuit 34 is effective to transmit a pulse of keying energy from the keying circuit 16 to the oscillator 12 when the switch 22 is initially closed. Thus current flows through the capacitor 40 to charge such capacitor and produce a voltage across the oscillator but this current rapidly drops to a very small value as the voltage across the capacitor approaches the voltage of the source. A transient of output tone signal 42 at the frequency of oscillation of the oscillator 12 is produced by this oscillator. The two signals 32 and 42 are delivered to the output circuit, shown as a mixer and amplifier 44 with a speaker 46 connected thereto, to produce a chiff for the main output tone signal 33. When the switch 22 is again opened by releasing the associated key, the charge on the capacitor 40 in the transient circuit 34 adds to that of the charge on the capacitor 30 in this circuit to provide the decay of the main tone signal 33 but the charge on such capacitor 40 is rapidly dissipated through the resistor 32 of the keying circuit 16, the resistors 28 and 32 of the keying circuit 18 and the resistor 38 in the transient circuit 34. The transient circuit 36 operates in a similar manner to deliver a pulse of keying energy to the oscillator 14 to produce a chiff for the main tone signal from the oscillator 12 when the switch 24 is closed. As an example, the chiff for each main output tone signal may be the nineteenth semitone above the main tone signal.

When the switch 24 is closed, insufficient keying energy is transmitted back through the transient circuit 34 to the oscillator 10 to cause operation of the oscillator 10. The resistor 28 in the keying circuit 18 is an energy dissipating or voltage dropping element since the load current of the oscillator 20 flows therethrough. Also any reverse charging current for the capacitor 40 in the transient circuit 34 flows through such resistor 28. There is a further dissipation of energy or voltage drop in the resistor 38 in the transient circuit 34 due to flow of the capacitor charging current just referred to through this resistor. This charging current divides through the resistors 32 and 28 of the keying circuit 16 so that the amount of transient current reaching the oscillator 10 is insufficient to cause operation of this oscillator. That is to say, the transient voltage produced across the oscillator 10 does not reach the operating voltage of this oscillator even if the switch 24 is closed and opened in rapid succession. The transient circuit 36 operates in a similar manner and does not transmit sufficient transient energy to the oscillator 12 when the switch 26 is closed to cause operation of this oscillator. Thus, when a keying switch is closed, each transient circuit is connected to by-pass energy dissipating elements or voltage dropping resistors in keying circuits to deliver a pulse of keying energy to an oscillator producing a tone signal of higher frequency than that of the oscillator supplied directly with keying energy from the switch. On the other hand the energy dissipating elements are effective to prevent the transmission of keying energy to oscillators producing tone signals of lower frequencies. This is accomplished without the use of unidirectional conductive devices such as diodes.

FIG. 2 illustrates how the keying circuits and transient circuits of FIG. 1 may be employed in combination with constantly running tone generators such as the generators 48, 50 and 52 associated with the keying circuits 16, 18 and 21 of FIG. 2. Thus the keying circuits of FIG. 2 may be the same as the keying circuits of FIG. 1 and

these keying circuits as well as the circuit elements therein have been given the same reference numerals employed in FIG. 1. The tone generators have been indicated to be constantly running oscillators supplied with electrical energy from a suitable source through a separate resistor 54 for each oscillator, although it will be understood that the tone generators 48, 50 and 52 may be of any other type which provide suitable tone signals during the time the electrical instrument is operating. These tone generators each include a gating diode 56 connected in series with their signal output conductors 58 and also include a resistor 59 in the respective keying circuit between the tone generator and the capacitor 30.

When the keying switch 22 is open in the specific circuit shown, the anode of the gating diode 56 of the generator 48 is sufficiently more negative than the cathode connected to the keying circuit 16 so that such diode is cut off. When the switch 22 is closed the cathode of the diode becomes more negative than the anode and keying current flows through the diode and generator 48 to ground. A tone signal 60 from the generator 48 is present at the anode of the diode 56 at all times during operation of the musical instrument but is of insufficient amplitude to overcome the reverse or cut off bias normally applied to the diode. When the keying switch 22 is closed the cathode of the diode 56 is driven negative as the capacitor 30 in the keying circuit 16 charges to reduce the reverse bias on the diode 56 so that positive going waveforms of the signal 60 are transmitted through the diode to provide an output tone signal 62 which is delivered to the output circuit represented by the mixer and amplifier 44. The resistor 59 prevents the output tone signal from being short circuited by the capacitor 30. The tone signal 60 is preferably a square wave signal, such as shown, so that the wave forms of the output tone signal are all of the same shape. A sawtooth tone signal may also be employed in the same manner and the output tone signals may have their wave forms changed by filters or other wave shaping circuits in the mixer and amplifier 44 to give the desired effect.

Each tone generator may also include a resistor 64 connected between the cathode of the diode 56 and ground to provide a series voltage dividing circuit with the resistor 28 and set the maximum negative gating voltage applied to this cathode. This resistor 64 thus functions as a load for the voltage dropping or energy dissipating resistor 28. Each tone generator 48, 50 and 52 and keying circuit associated therewith operates in the same manner. The transient circuits 34 and 36 operate in the same manner as the equivalent circuits of FIG. 1. Thus the transient circuit 34 delivers a pulse of keying energy to the cathode of the diode 56 forming part of the generator 50 to render such diode conductive and cause a portion of the tone signal 66 of the generator 50 to be delivered as a transient output tone signal 68 to the output circuit. Closure of the keying switch 24 does not result in a pulse of keying energy reaching the generator 48 of sufficient intensity to render the diode 56 of this generator conductive.

The circuit of FIG. 3 contains all of the circuit elements of FIG. 1 in the same relationship and the same reference numerals employed in FIG. 1 are applied in FIG. 3. In addition a transient or chuff turn off circuit 70 is shown. The points 72 between the resistors 38 and capacitors 40 in the transient circuits 34 and 36 may be individually clamped to ground potential to short circuit the transients transmitted through these circuits and prevent a transient tone signal such as the signals 42 and 68 of FIGS. 1 and 2 from being transmitted to the output circuit in addition to a main tone signal such as the signals 33 and 62, respectively. This does not materially effect the operation of the keying circuits 16, 18 and 21. This clamping action could be accomplished by employing a switch having a separate contact for each transient circuit for connecting the points 72 of each transient circuit to

ground. There may, however, be a large number of the transient circuits in a musical instrument so that a switch having a large number of contacts is required. By employing a diode 74 in the turn off circuit for each transient circuit in conjunction with a single contact transient or chuff turn off switch 76, the closing of this switch will effectively connect all of the points 72 to ground while at the same time not connecting these points to each other when the switch 76 is open. While the turn off circuit of FIG. 3 clamps the points 72 to ground potential, it is also possible to clamp these points to a low impedance source of fixed potential other than ground as discussed with respect to FIG. 4.

The circuit of FIG. 4 also contains all of the circuit elements of FIG. 1 in the same relationship and in addition contains a sustain circuit 78 and a somewhat modified transient or chuff turn off circuit 80 which, however, employs most of the elements of the turn off circuit of FIG. 3. The same reference numerals applied in FIGS. 1 to 3 are applied to similar elements in FIG. 4.

The sustain circuit 78 of FIG. 4 includes a resistor 82 and a capacitor 84 in a series circuit for each keying circuit 16, 18 and 21. This series circuit for each keying circuit has one terminal connected to its associated keying circuit between the keying switch 22, 24 or 26, respectively, and the resistor 28 in the respective keying circuit. The other terminal of each of the series circuits containing the resistors 82 and capacitors 84 is connected to the anode of a separate diode 86 for each series circuit and also to the cathode of a separate diode 88 for each series circuit. A sustain switch 90 has contacts 92 which, when closed, connect the cathodes of all of the diodes 88 to ground and separate contacts 94 which, when closed, connect the anodes to all of the diodes 88 to ground.

When the switch 90 is in the open position the sustain circuit has no effect upon the keying circuits 16, 18 and 21, since the diodes 86 and 88 block any current flow through the series circuits containing the resistors 82 and capacitors 84. When the switch 90 is closed the terminals of the series circuits containing the resistors 82 and capacitors 84 which are connected to the diodes 86 and 88 are effectively connected to ground.

When the switch 90 is closed and the keying switch 22 is closed, the capacitor 84 in the series circuit connected to the keying circuit 16 charges from the source through the resistor 82 and diode 88 connected thereto. This charging of a capacitor 84 does not effect the operation of the keying circuit 16 associated therewith but upon again opening the keying switch 22, this capacitor 84 discharges through a diode 86, a resistor 82 and the keying circuit 16 and generator 10 to delay the decay of the output tone signal and produce a "sustain" effect. Similar "sustain" effects are produced when the keying switches 24 and 26 associated with the generators 12 and 14 are opened after being closed.

If the points 72 in the transient circuits 34 and 36 are connected to ground by a turn off switch such as the switch 76 of FIG. 3, it has been found that the rate of discharge of the capacitors 84 of the sustain circuit 78 is sufficiently different, when the switch 76 is opened, from the rate, when the switch is closed, to produce noticeable different sustain effect. With a switch such as the switch 76 of FIG. 3 closed to establish a connection directly to ground, the capacitors 84, when charged, can in part discharge to ground through the resistors 38 but cannot do so with the switch 76 open.

It has been found that the points 72 in the transient circuits 34 and 36, in the specific circuit shown, can be clamped to a voltage somewhat negative with respect to ground instead of ground when the transient circuits are turned off without deleteriously affecting the operation of the transient circuits or of the keying circuits 16, 18 and 21. The negative voltage in the circuit shown can be about 2 to 3 volts and this can be provided by a string of diodes 96 connected in series with a resistor 98

between a source of negative voltage and ground when the contacts of a transient or chuff turn off switch 100 are closed. The diodes 96 are forwardly biased when the contacts of the switch 100 are closed and maintain a constant low voltage across the string of diodes. This voltage is applied to the anodes of the diodes 74 in the transient turn off circuit 80, a separate resistor 101 having a high resistance value relative to the resistors 38 being connected between the source of negative voltage referred to above, and each of the points 72 of the transient circuits to maintain the diodes 74 also in forwardly biased condition when the turn off switch 100 is closed.

The result is that the points 72 of the transient turn off circuits 34 and 36 are clamped to a low negative voltage when the transient turn off switch is closed and, when the switch 100 is open, they each vary between ground potential when the associated keying switch 22, 24 and 26 is open and the potential of the source to which these switches connect the respective keying circuits. The capacitors 84 of the sustain circuits do not discharge to any appreciable extent through the transient circuits 34 and 36 when the transient turn off switch 100 is open because of the diodes 74 and the high values of the resistors 101, and also do not discharge at a rapid rate through such circuits when the switch 100 is closed because such discharge is resisted by the opposing voltage to which the points 72 therein are clamped. The further result is that no significant change in the sustain effect occurs when the transit or chuff turn off switch is opened or closed. A capacitor 102 is connected across the contacts of the switch 100 which connect the source of negative voltage to the transient turn off circuit to prevent noise pulses in the output circuits when the switch is opened or closed.

The constant value voltage applied to the points 72 of the turn off circuits through diodes 96 and 74 and resistors 98 and 101 when the switch 100 is closed is not sufficient to cause operation of the tone generators 10 or 12. Thus the resistors 38 and 32 provide voltage divider circuits for reducing the voltage applied to the generators 10 and 12 and in a specific circuit these resistors were equal in value and were each of 47K ohms, while the resistors 28 were each 28K ohms and the resistors 101 were each 150K ohms. These values are appropriate for relatively low impedance circuits employing tone generators of the transient oscillator type operated at low voltages but suitable values of resistors and capacitors can be employed with other types of tone generators such as vacuum tube oscillators requiring higher operating voltages, or in the type of circuit shown in FIG. 2 in which gating diodes 56 are employed in tone generators having constantly running oscillators or other constantly operating sources of tone signals.

I claim:

1. In an electric musical instrument having a plurality of tone generators each generating a tone signal of a different frequency and also having a source of keying electrical energy for the generators and an output circuit, the improvement comprising:

a keying circuit means associated with each generator, including a keying switch means and voltage dropping means comprising a resistor capable of bilateral current conduction connected between the switch means and the associated generator for supplying keying energy from the source to said associated generator to cause a tone signal of a first frequency to be delivered from said associated generator to the output circuit when the switch means is actuated, and a plurality of transient circuit means each capable of bilateral A.C. current conduction and connected to and extending from a point between the switch means and one side of the voltage dropping means in one of the keying circuit means to a point between the other side of the voltage dropping means and the generator in another keying circuit means for also supplying a transient of keying energy to the generator asso-

ciated with the other keying circuit means to cause a transient tone signal of a second frequency to be delivered to the output circuit when the switch means in the one keying circuit means is actuated.

2. An electrical musical instrument in accordance with claim 1 in which each transient circuit means contains series capacitance.

3. An electrical musical instrument in accordance with claim 1 in which each transient circuit means contains a resistor and capacitor in series, and in which the instrument also comprises manually actuatable means for clamping a point in each transient circuit between the resistor and the capacitor therein at a constant voltage to prevent the supplying of the transient of keying voltage to the generator associated with the other keying circuit means when the switch means in the one keying circuit means is actuated.

4. In an electronic musical instrument having a plurality of tone generators for generating tone signals of different frequencies and also having a source of keying electrical energy for the generators and an output circuit, the tone generators delivering tone signals to the output circuit when supplied with keying energy from the source, the improvement comprising:

a first keying circuit means including a first keying switch means for supplying keying energy from the source to a first generator when the first switch means is actuated and having a voltage dropping means comprising a first resistor capable of bilateral current conduction and connected between the first switch means and the first generator,

a second keying circuit means including a second keying switch means for supplying keying energy from the source to a second generator when the second switch means is actuated and having a voltage dropping means including a second resistor capable of bilateral current conduction and connected between the second switch means and the second generator,

and transient circuit means capable of bilateral A.C. current conduction extending between the first and second circuit means and being connected to by-pass the voltage dropping means in the first and second keying circuit means for delivering an effective transient keying energy to the second generator when the first switch means is actuated and being connected in series with the voltage dropping means in the first and second keying circuit means to prevent the delivery of an effective transient of keying energy to the first generator when the second switch means is actuated.

5. An electronic musical instrument in accordance with claim 4 in which said transient circuit means including a pair of impedance elements in series at least one of which is a capacitor, and the instrument also comprises manually actuatable means for clamping a point in the transient circuit means between the impedance elements at a constant voltage to disable the transient circuit means.

6. An electronic musical instrument in accordance with claim 4 in which the tone generators are oscillators which are caused to oscillate to generate tone signals when supplied with keying energy from said source through said keying and transient circuit means.

7. An electronic musical instrument in accordance with claim 4 in which the tone generators are constantly running oscillators which are connected to deliver tone signals to said output circuit when supplied with keying energy from said source through said keying and transient circuit means.

References Cited by the Examiner

UNITED STATES PATENTS

2,486,208	10/1949	Rienstra	84-1.13
3,037,413	6/1962	Markowitz	84-1.19

ARTHUR GAUSS, *Primary Examiner*.

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