

June 19, 1962

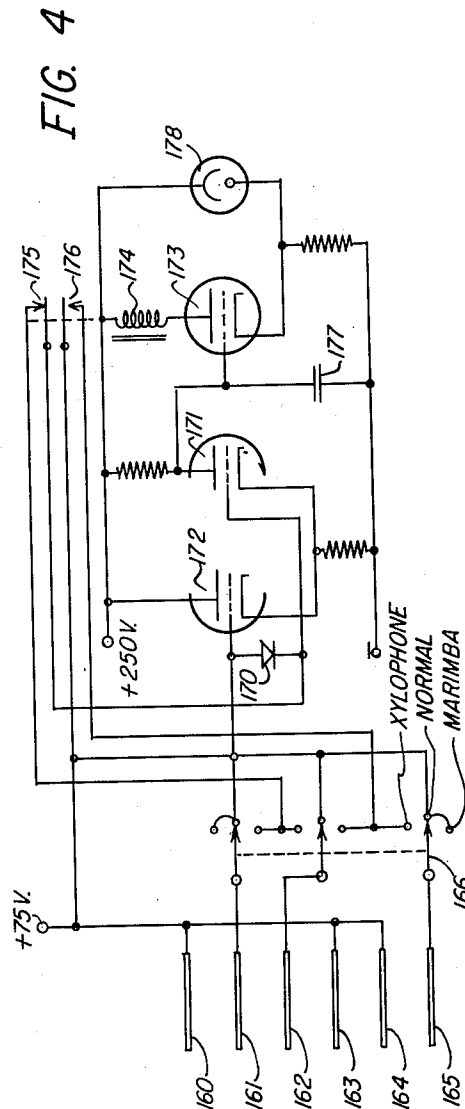
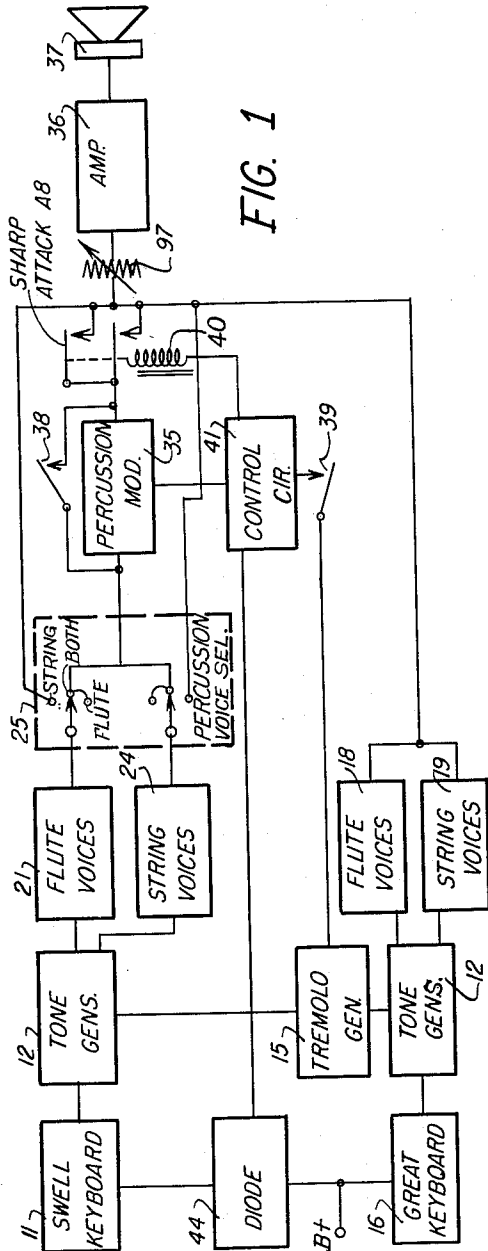
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PERCUSSIVE TYPE ELECTRIC MUSICAL INSTRUMENT

Filed Aug. 8, 1957

3 Sheets-Sheet 1



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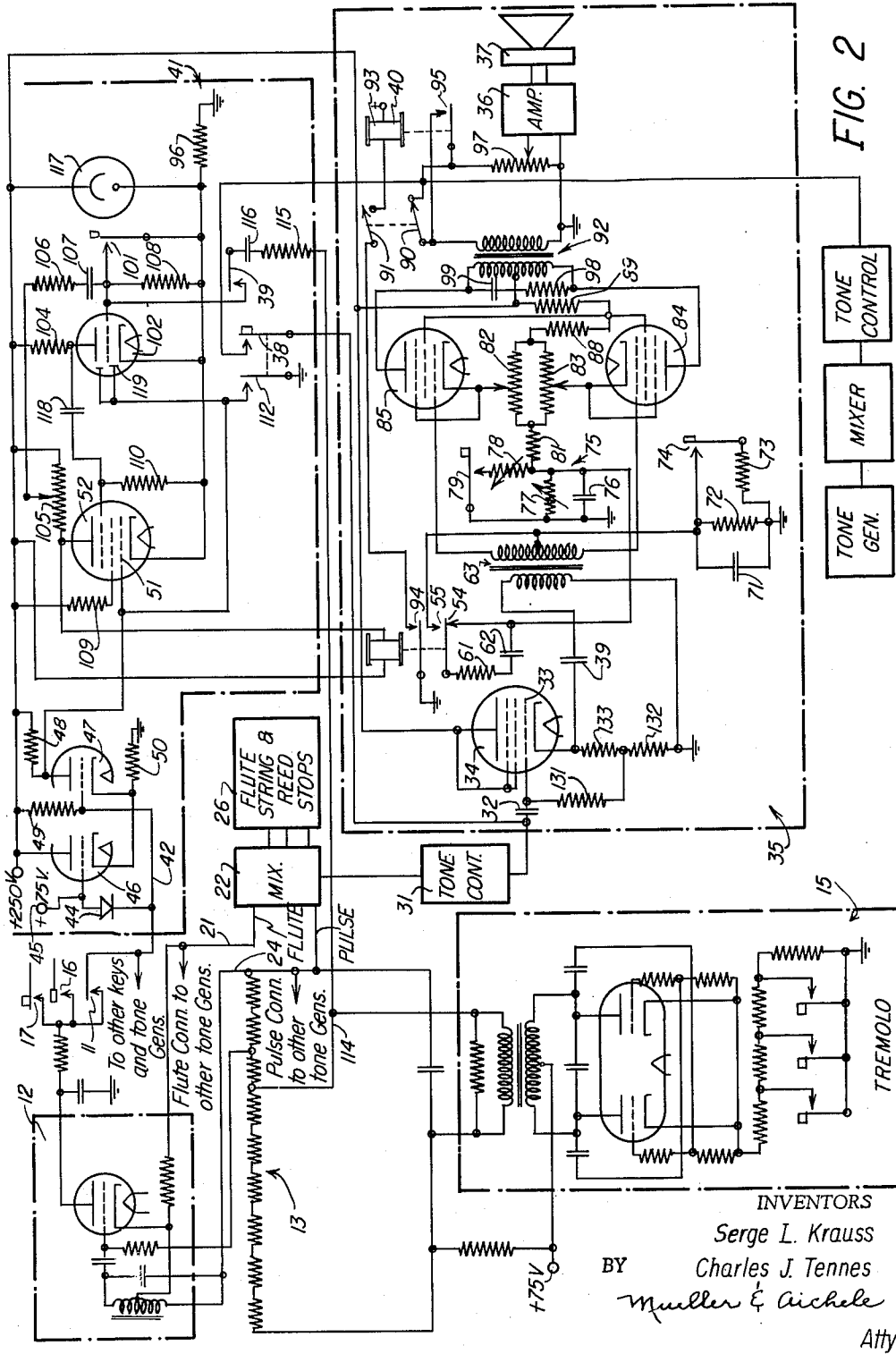
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PERCUSSIVE TYPE ELECTRIC MUSICAL INSTRUMENT

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This invention relates generally to electric musical instruments, and more particularly to percussion systems for modifying the characteristics of the tones produced by electric organs.

In electric organs and other electric musical instruments, it is desirable to simulate the characteristics of many instruments. One problem is to provide percussive bursts of sound to simulate plucked strings, bells, and other percussion instruments. Percussion systems known hitherto have either been very expensive or, when less expensive, have been very limited in performance. Also percussion systems known hitherto have required mechanical attachments on the keyboard which complicate and increase the cost of the instrument as well as require additional maintenance.

Accordingly, it is an object of the invention to provide a simple, inexpensive, effective, and versatile percussion system for an electric musical instrument.

Another object of the invention is to provide a percussion system for an electric musical instrument which is set in operation by cooperation with the circuit of the instrument and requires no mechanical connection to the keys thereof.

A further object of the invention is to provide a percussion system for an electric organ serving to cause repetitive bursts of tone of the organ to duplicate the sounds of struck bar and plucked string instruments.

Still another object of the invention is to provide a percussion system for an electric musical instrument for providing repetitive bursts of sound with a predetermined audible level between the bursts.

A still further object is to provide repetitive bursts of sound which are interspersed with sound of a different tone to simulate the xylophone, marimba, and vibraharp.

Yet another object of the invention is to provide a percussion system for an electric organ in which repetitive bursts of sound are created with decay time for the bursts varying from a very short time to several seconds to produce sounds of plucked string and struck bar instruments as well as the sounds of other percussion instruments.

A feature of the invention is the provision of an electric musical instrument having a percussion system which is selectively connected in and out of the signal transmission path of tone generators of the instrument and operates to produce bursts of signal when actuated by an electric control circuit connected to the keying circuit of the instrument without mechanical modification of the keys or sacrifice of any of their functions. A diode in the keying circuit provides a voltage drop which is amplified to actuate the percussion system.

Another feature of the invention is the provision in an electric musical instrument of a modulator operable by keys of the instrument for producing bursts of sound from any of several tone generators of the instrument, with controls provided for changing the duration of the bursts. There also may be provided means for varying the sound level between bursts to provide no sound or a chosen level of sound. The tone of the generators may also be varied during the burst to simulate a particular instrument.

A further feature of the invention is the provision of a relay operated system which interrupts the selected tone to produce bursts, and supplies a different related tone between the bursts.

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A still further feature of the invention is the provision of an electric organ including a plurality of key-actuated tone generators and a control circuit actuated by one of the keys to cause a modulator circuit to gate the output of the generators supplying a sound reproducer to produce a percussive burst of tone from the reproducer. The control circuit may provide cyclic operation (multi-vibrator) for repetitively actuating the burst-producing network of the modulator circuit when one of the keys is actuated.

The repeating action may be synchronized with the tremolo generator of the organ. A selectively operable control may also be provided for producing a single burst or repeated bursts when one of the keys is touched momentarily, and the decay time of the bursts may be adjusted to produce different effects. For example, the decay time may be made short to cause the bursts of sound to duplicate the sound of a plucked string or a struck bar, or it may be set to have a longer time to simulate a bell or other percussion instruments.

In the drawings:

FIG. 1 is a block diagram of an electric organ system in accordance with the invention;

FIG. 2 shows a circuit diagram of an electric organ including a percussion system forming one embodiment of the invention;

FIG. 3 shows a part of a circuit diagram of an electric organ forming an alternate embodiment of the invention; and

FIG. 4 shows a part of an organ circuit which illustrates a further embodiment of the invention.

The invention is illustrated in an electric organ and provides a percussion system which may be actuated to provide single or repetitive bursts of selected tones with either no sound between the bursts or a predetermined audible sound level between the bursts which may be of the same or a different tone. A decay time of several seconds may be provided for each burst, or a short decay time to simulate a plucked string, or a struck bar, or the like may be used. The percussion system is incorporated into an electric organ having a plurality of tone generators which actuate one or more mixer sections normally transmitting the tone signals to an amplifier driving a reproducer such as a loudspeaker. The percussion system includes a control circuit connected in the circuit of the keys of one of the keyboards of the organ, and whenever one of these keys is operated current flows through a diode in the control circuit and provides a voltage drop which actuates relay means in the control circuit. The actuation of the relay means applies a gating pulse to trigger a gating or modulator section in the signal transmission path.

The control circuit may include cyclic interrupting means such as a multi-vibrator or a relay circuit to cause the relay means to repeatedly actuate the modulator to form repetitive bursts of the sound, thus producing effects such as the sounds from a xylophone, marimba, mandolin, guitar, and the like. The multi-vibrator may be selectively cut in or cut out of the circuit so that either repetitive bursts or only a single burst of sound is produced. Also, control means for the multi-vibrator is provided which may be adjusted to provide different repetition rates of operations of the relay, and the modulator section may be adjusted to provide different decay times for the different bursts of sound so that various percussive instruments may be simulated. The modulator circuit may be adjusted so that, between the tone burst, the tone level may be either zero or at a chosen audible level. The system may also provide a different related tone between the bursts of the selected tone to better simulate certain instruments. A steel guitar or novelty effect may also be provided in the organ by use of the percussion system. This is accomplished by altering the

bias on the tone generator to detune the same at the start of the burst, with the generator being allowed to resume its normal pitch while the tone burst is decayed.

FIG. 1 shows the basic system of the organ in block diagram, and illustrates an organ having two keyboards, the swell keyboard 11 and the great keyboard 16. Tone generators 12 are actuated by both keyboards and a tremolo generator 15 provides low frequency signals to all the tone generators. The tone generators provide tones of different characteristics with sine wave or flute voices being provided at 21 and pulse or string voices being provided at 24. The tones at 21 and 24 are the voices associated with the swell keyboard 11 and the tones at 18 and 19 are the flute and string voices controlled by the great keyboard 16.

The percussion control 25 is arranged so that either the flute or string voices may be applied to the percussion system or both the flute and string voices may be so applied. The percussion modulator 35 acts on the voices applied therethrough, and may be by-passed by the switch 38. A relay 40 is provided for imparting a sharp attack characteristic and this may be by-passed by switch 48. The circuit 41 which control the percussion modulator is actuated by the diode 44 connected to the swell keyboard 11. The control circuit may provide a repeating or cyclic action which may be synchronized with the tremolo generator 15 through action of the switch 39. The output of the percussion modulator may be combined with the output from the generators associated with the great keyboard and with signals from the swell keyboard which are by-passed about the percussion modulator. The combined signals are applied to the expression pedal 97, which controls the level of signals applied to the amplifier 36. The amplifier 36 raises the level of the signals to that required to drive the loudspeaker 37.

FIG. 2 shows the electric organ circuit more particularly, with keys 11, 16, and 17 of various keyboards of the organ being connected to a tone generator 12 which may be of a known type. A plurality of such tone generators will be provided to furnish the different tones to be produced. The tone generators each include a bias network 13 to which is connected a tremolo section 15 of known construction and operation. A flute output from each of the tone generators 12 is applied through conductor 21 to a mixer section 22, and, similarly, a pulse or string output is coupled by a lead 24 from the tone generators 12 to the mixer section 22. The mixer section 22 produces various combinations of flute and string tones and is controlled by various organ stops shown schematically at 26.

The output of the mixer is transmitted to a tone control section 31 of a known type, and the output thereof is coupled by a capacitor 32 to a control grid 33 of tube 34 forming a part of a gating or modulator circuit 35. The tube 34 is connected in a cathode follower circuit and applies the tone signals to transformer 63. The transformer 63 provides a balanced input to push-pull tubes 84 and 85 which are gated to selectively pass the signals as will be described in more detail. The output of the tubes 84 and 85 is applied through transformer 92 to amplifier 36. The modulator circuit 35 may be by-passed by operation of switch contacts 38 so that it is selectively connected in and out of the signal transmission path from the tone control 31 to the amplifier 36 which drives a loudspeaker reproducer 37 of the organ.

The modulator circuit 35 is controlled by a control circuit 41 having a lead 42 connected to the key 11 of one keyboard of the electric organ. When the key 11 is depressed to actuate the tone generator 12, B+ voltage is supplied to the tone generator from a terminal 45 through the impedance device formed by diode 44, the terminal 45 being connected to a positive direct current potential source which may provide 75 volts. The flow of current through the diode 44 causes a drop of voltage to occur across the diode, and this voltage drop reduces

the conductivity of a control tube 47. Tube 46 is associated with the control tube 47 to compensate for power supply voltage variations.

The tube 46 establishes the bias for the tube 47 with reference to the 75 volt positive supply. This prevents the normal variations in the supply potential from being impressed on the stage including tube 47 as a control signal. With no key operated, the tube 47 is held at zero bias by the bleeder resistor 49 from the 250 volt source. When a note is keyed, the oscillator current flowing through the diode 44 in series between the 75 volt supply and the keying bus causes a drop of approximately .3 volt in the diode. The voltage difference across the diode resulting from actuation of a key is the normal bias of the tube 46 plus the .3 volt drop, or approximately 2.0 volts total, which is impressed on the grid of the tube 47. When the conductivity of tube 47 is so reduced, its plate voltage rises to increase the voltage on a signal grid 51 of a vacuum tube 52 to allow the tube 52 to conduct. When the tube 52 is made conductive, a relay 53 in the plate circuit of the tube is operated to open contacts 54 and close contacts 55 in the modulator circuit 35.

The tubes 84 and 85 in the modulator circuit are normally cut off by the positive bias applied to the cathodes thereof through the voltage divider including resistors 77, 81, 82, 83, 88, and 89. Resistor 77 is variable so that the cut-off bias may be adjusted. The opening of contacts 54 of the modulator circuit 35 connects series resistor 61 and capacitor 62 to a center tap on the secondary of transformer 63 in the control grid circuits of tubes 84 and 85. This transmits a positive pulse to the control grids of tubes 84 and 85 from the voltage-divider mentioned above, which overcomes the cut-off bias on the tubes 84 and 85. This pulse lasts until the capacitor 62 charges up through resistors 61 and 72, and causes a burst of tone signal to be transmitted through transformer 92 and potentiometer 97 to the output amplifier 36. The potentiometer 97 may be controlled by the expression pedal of the organ to thereby control the audio volume of the output. The duration of the resulting burst of sound is controlled by the resistance-capacitance network, which may be adjusted between short bursts and longer bursts by operation of switch 74. Switch or tablet 74 connects resistor 73 in parallel with resistor 72 to decrease the resistance of the charging path of capacitor so that a short burst is provided when the switch is closed, and a longer burst is provided when the switch 74 is open.

The push-pull circuit of the modulator 35 is balanced by the cathode of tube 84 being connected to the midpoint of resistor 83, and the cathode of tube 85 being connected to the slider of the potentiometer 82. The resistor 78 may be connected by a tablet switch 79 in the bias circuits of the tubes 84 and 85 in shunt with resistor 77 to reduce the bias to a point at which the tubes are not completely cut off and a predetermined audible tone level is produced between the bursts of sound. Resistor 78 is adjustable to set this level as desired. When tablet 79 is open, the bias is increased so that there is no sound producing signal from the modulator 35 during intervals between the percussive bursts.

The tube 52 of the control circuit 41 and a tube 102 form a free running multi-vibrator circuit which includes a potentiometer 105 paralleling the relay 53. A slider on the potentiometer is connected through resistor 106 and capacitor 107 to the control grid of tube 102. The grid is biased by resistor 108 and the cathode is grounded through resistor 96. The potentiometer 105 controls the feedback to tube 102 and thereby controls the repetition rate of the multi-vibrator. The feedback path to tube 52 is through capacitor 118 to the suppressor grid which is biased by resistor 110. The dwell of the relay 53 is determined by the value of the resistor 104, and in one instance, the dwell time was slightly less than half the time of one cycle of the multi-vibrator circuit. Also, the

internal plate resistance of the tube 102 affects the dwell time. The control of dwell time and repetition rate are substantially independent of each other. For each cycle of the multi-vibrator circuit, the relay 53 is energized and deenergized, and a burst of sound is produced.

A repeat tablet or stop 101 is provided in shunt with the resistor 108, and when the tablet 101 is open, the multi-vibrator is free running to alternately cause the relay 53 to pull up and drop out. The multi-vibrator will continue to run as long as one of the keys 11 is depressed. When the tablet 101 is closed, the grid resistor 108 is shunted and the tube 102 is kept inoperative so that the tube 52 is kept conductive as long as one of the keys 11 is closed and only a single burst of tone is produced.

Switch 112 is mechanically connected to switch contacts 38 and may be actuated by a single control or tablet. To cut out the percussion effect from the organ, the tablet 112 and contacts 38 are closed. The switch 112 connects grid 51 and clamping anodes 119 of tube 102 to ground to cut off the tube 52 and prevent operation of the relay 53. The anodes 119 of tube 102 connected to the signal grid 51 of tube 52 act as a clamp during operation of the multi-vibrator when stop 112 is open. A regulator glow-lamp 117 absorbs the equivalent of the relay current when tube 52 is cut off to prevent load fluctuation from being impressed on the power supply. As previously stated the contacts 38 apply signals from the tone control section 31 past the modulator circuit 35 to the amplifier 36.

The signal may be applied from the transformer 92 to the expression pedal potentiometer 97 through a switch 90. This switch is coupled to a switch 91 so that when switch 90 is opened, switch 91 is closed. Switch 91 is in the energizing circuit for relay 93, being connected in series with contacts 94 on relay 53. Accordingly, when switch 90 is opened and switch 91 is closed, operation of the relay 53 will close contacts 94 to cause operation of the relay 93. This will close contacts 95 which connects the transformer 92 to the potentiometer 97 of the expression pedal. The relay 95 is a slow to operate relay so that the signal will not be applied to the expression pedal potentiometer 97 for an interval provided by this relay. Accordingly, operation of this relay will provide what may be considered a sharp attack since the signal will be built up in the system before it is applied to the output amplifier and speaker.

As previously stated, the repeat action of the percussion system may be synchronized with the tremolo of the organ. The circuit for accomplishing this is shown in FIG. 2, with the conductor 114 applying oscillations from the tremolo section 15 through resistor 115, condenser 116, and switch 39 to the grid of tube 102. This synchronizes the multi-vibrator formed by tubes 52 and 102, with the oscillations from the tremolo section 15.

In the circuit of FIG. 2, the line 42 to the control circuit is connected only to the keys 11 on one manual. These may be the keys on the swell manual, with the keys 16 being on the great manual and the keys 17 on the pedal board. It is quite easy to provide more elaborate or unique features such as percussing families of voices or even individual voices and exclude the remainder from this effect. Keying any of the swell manual keys gates the modulator for a tone burst. A swell to great inter-manual coupler provides a means of keying the swell manual generators from the great manual keys without gating the modulator. Then when any key is pressed in the swell manual the tones from the generators being keyed by the great manual keys (via the intermanual coupler) will be percussed simultaneously. In this manner a group of keys can be pressed on the great manual for a chime or chord effect and a simultaneous tone burst can be triggered by the same or another note keyed on the swell manual. A sharper tone burst is provided in this manner because the generators are already up to amplitude before the modulator is gated. Both hands may be used on the great manual with only one finger raised to press a swell manual key for gating the tones. The chord

organ effect so produced is very striking, for one finger playing on the swell manual will produce percussed chords played on the great manual.

In FIG. 3, there is shown a second embodiment of the invention in which the repeating or cyclic action is provided by a relay. The modulator 35 is connected between the tone control 31 and amplifier 36 as in FIG. 1. The control circuit 141 includes tubes 46 and 47 as in FIG. 1 and actuates the modulator 35 to cause bursts of sound whenever one of keys 11 is depressed to actuate a tone generator 12. A switch 145, in its actuated position (dotted), connects tubes 46 and 47 operatively to keys 11 and connects tone control section 31 to modulator 35, breaking the direct connection of the tone control section 31 and the amplifier 36. Then when key 11 of a tone generator is closed, the tube 142 is made conductive to provide current flow through closed contacts 154 to the relay winding of the relay 147. This energizes the relay to break contacts 54 and 153 and make contacts 55. This connects resistor 61 and capacitor 62 to the modulator 35 as described in connection with FIG. 1 to actuate the modulator to cause a burst of tone.

To provide a repeating effect, switch 154 may be moved to its dotted position to connect capacitor 146 across relay 147. Now when a key 11 is closed, the relay is energized through contacts 149 and 151 of switch 152 and through contacts 153. When the relay operates, opening of contacts 153 cuts off the relay 147, but it remains energized while capacitor 146 discharges and the burst of tone occurs before the relay 147 drops out. As the relay 147 drops out, it recloses contacts 153 to reenergize itself and cause another burst of tone, assuming the key 11 is still depressed. Thus, a repetition of the sound bursts may be effected. When the switch 145 is moved to its "Off" position (solid line), the tubes 46 and 47 are cut out of the key circuit, and the tone control section 31 is connected directly to the amplifier 36, and normal playing of the organ may be effected.

The switch 152 may be operated to provide a "steel guitar" effect in the organ. Contacts 149 and 151 in the dotted position shunt out a portion of the bias resistor 13 through closed contacts 153 to detune flat the tone generator oscillator 12. The contacts 154 are in the "Off" position as no repetitive effect is provided in this condition. When the relay 147 operates, contacts 153 open so that the shunt is removed from the bias resistor and the generator resumes its normal tone. This is the tone effect provided by a steel guitar. This bias shunting arrangement may also be provided with the circuit of FIG. 2 to produce a steel guitar effect with this circuit. A good novelty effect may be provided by detuning the tone generator oscillator sharp. Otherwise, the circuit and operation may be exactly the same as for the steel guitar effect.

The following constants which have been used in the circuit of FIG. 2 are listed below merely by way of illustration and are not intended to limit the scope of the invention in any way.

Capacitor 32	-----microfarads--	.047
Tube 34	-----	6AU6
Capacitor 39	-----microfarads--	10
Tubes 46 and 47	-----	12AX7
Resistor 48	-----megohms--	.56
Resistor 49	-----do--	2.2
Resistor 50	-----kilohms--	82
Tube 52	-----	6AU6
Capacitor 62	-----microfarads--	.47
Capacitor 71	-----do--	0.47
Resistor 72	-----megohms--	3.3
Resistor 73	-----do--	1.0
Capacitor 76	-----microfarads--	50
Resistor 77	-----kilohm--	1
Resistor 78	-----do--	1
Resistor 81	-----ohms--	68

Potentiometer 82	ohms	50
Resistor 83	ohms (each)	27
Tubes 84 and 85		6AU6
Resistor 88	kilohms	10
Resistor 89	do	12.5
Resistor 96	do	7.5
Potentiometer 97	do	100
Resistor 98	megohm	.1
Capacitor 99	microfarads	.039
Tube 102		6AV6
Resistor 104	megohms	.27
Resistor 106	do	.47
Capacitor 107	microfarads	.1
Resistor 108	megohms	.47
Resistor 109	kilohms	3.9
Resistor 110	megohm	1
Capacitor 118	microfarads	.15
Resistor 131	megohms	1.0
Resistor 132	kilohms	56
Resistor 133	ohms	1500

FIG. 4 shows a somewhat simplified percussion arrangement which includes the same control circuit as in the prior embodiments. When a key from the keyboard 11 is depressed, engagement will be made with one or more of the couplers 160, 161, 162, 163, 164, or 165, depending upon the operation of the tablets which control the couplers. A particular generator will be actuated depending upon the key operated and the operation of the tablets. It will be noted that couplers 160, 163, and 164 are directly connected to the 75-volt keying source so that connection to these couplers upon actuation of the keys will cause operation of the tone generators without any action in the percussion system. Couplers 161, 162, and 165 are also connected to the 75 volt keying source through the percussion control switch 166, when this switch is in its center or normal position. However, when the switch 166 is turned counterclockwise to the xylophone position, while coupler 161 still remains connected to the 75-volt keying source, couplers 162 and 165 are disconnected therefrom. In the clockwise or marimba position, coupler 165 remains connected to the keying source and couplers 161 and 162 are disconnected therefrom.

When the switch 166 is in the xylophone position, coupler 162 controls the system. When a connection is made to coupler 162, the tone generator so connected is energized through the diode 170. This diode controls the potential to triode tube 171 in exactly the same manner as in the circuit of FIG. 2. Triode 172 serves to establish the bias on tube 171 as previously described. The voltage drop across the diode is amplified in triode 172 and causes tube 173 to conduct to actuate the relay 174 connected in the plate circuit thereof. This opens contact 175 to break the connection to the coupler 162 and thereby denegize the tone generator connected thereto. Operation of relay 174 closes contact 176 which provides a keying voltage for the coupler 165. Accordingly, as long as a key associated with the couplers is still operated, the tone changes from the tone produced by action of coupler 162 to the tone produced by action of coupler 165. Since the circuit through the diode 170 and coupler 162 is broken, the tube 173 ceases to conduct and the relay 174 drops out. This causes contacts 175 to make the connection to the coupler 162. Therefore, a repeating intermittent change between the tones produced by coupler 162 and 165 is provided. The capacitor 177 connected to the grid of tube 173 controls the repetition interval to thereby provide the desired speed of the cyclic or intermittent operation. The regulator lamp 178 absorbs the relay current as previously described to prevent fluctuations in the load on the power supply.

When the control switch 166 is placed in the marimba position, it is the coupler 161 which is normally connected to contacts 175 and the diode 170 by operation of a key. When the coupler 161 is rendered active, the tone associated with coupler 161 is produced, and the voltage across

the diode 170 drops to actuate the relay 174 in the manner previously described. This opens contacts 175 so that the tone operating potential is removed from the coupler 161. However, at the same time, contact 176 is made to apply operating potential to the coupler 162. The connection through contacts 176 to coupler 162, however, does not pass through the diode 170 so that the voltage drop across the diode disappears and the relay 174 will fall out. Then contacts 175 will be made again so that alternation between the tones produced by couplers 161 and 162 is provided.

The system of FIG. 4, as previously stated, is somewhat simpler and less expensive than that of FIGS. 2 and 3. The effect produced, however, very closely approaches that of certain percussion instruments. When the couplers 160 to 165 are used to provide 16', 8', 4', 2½', 2, and 1½' tones respectively, the combination of tones from couplers 162 and 165 provides a good xylophone effect, and the combination of tones from couplers 161 and 162 provides a good marimba or vibraharp effect.

In FIG. 4 only the energizing circuit for the tone generators is illustrated and the system for applying the tones from the generators to the mixers, expression pedal, the output amplifier and the loudspeaker may be as shown in FIG. 1. In such a system the percussion modulator may be eliminated as the percussion effect is obtained by interruption of the energization of the oscillators. The system of FIG. 4 shows the connections to the couplers of a single key and it will be understood that the system may also be connected to couplers of other keys.

The above described electric organs are highly flexible in providing percussion tones. The tones may be very short or may be very long as selected by the organist. No multiple contact keys are required therefor, nor are any mechanical actuating devices required to incorporate the percussion producing components into the electric organ. The organs may be adjusted merely by use of the tablets to provide repetitive bursts of either long duration or short duration to simulate the electric guitar with no tone in between bursts or with a desired tone maintained between bursts. The organs so fabricated cost very little more than organs without the percussion systems incorporated therein, only the modulator circuit and the control circuit being required in addition to the normal components of the organ.

We claim:

1. In an electric organ including a tone generator, a sound reproducer, a mixer operable by the tone generator for applying signals from the tone generator to the reproducer and a plurality of keys connected in parallel in an energizing circuit for the tone generator, the combination therewith of a modulator circuit normally blocking signals from the mixer to the reproducer and operable when actuated to apply a burst of signals from the mixer to the reproducer, and timing means coupled to the energizing circuit and operable in response to current flow therein resulting from actuation of one of said keys said timing means being coupled to said modulator circuit and initiating operation of the same so that said modulator circuit operates to pass signals to the reproducer for a predetermined period of time to cause a burst of sound from the reproducer, said timing means including adjustable means for selectively controlling the duration of each burst of sound.

2. In an electric organ including a loudspeaker, an amplifier for driving the loudspeaker, an electronic tone generator, a key for applying energizing potential to the tone generator, and a mixer circuit for transmitting signals from the tone generator to the amplifier, the combination therewith of gating means for selectively providing a burst of signal to the amplifier, and control means operable upon actuation of the tone generator for actuating said gating means, said control means including impedance means connected to the key for applying current to the

generator, and electron valve means responsive to the voltage drop across said impedance means coupled to said gating means for actuating the same.

3. In an electric musical instrument including a loudspeaker, an amplifier for driving the loudspeaker, an electric tone generator, a key for applying energizing potential to the tone generator, and a mixer circuit for transmitting signals from the tone generator to the amplifier, the combination therewith of gating means for selectively providing a burst of signal to the amplifier, and control means coupled to said gating means and operable upon actuation of the key for actuating said gating means, said control means including diode means connected between the key and the generator and conducting the energizing current thereto, a control tube coupled to said diode means and rendered conductive in response to the voltage drop across said diode means, and relay means coupled to said control tube and controlled thereby, said relay means being connected to said gating means for actuating the same.

4. In an electric musical instrument including a loudspeaker, an amplifier for driving the loudspeaker, an electric tone generator, supply means for providing energizing potential, a key for applying potential from the supply means to the tone generator, and a mixer circuit for transmitting signals from the tone generator to the amplifier, the combination therewith of gating means for selectively providing a burst of signal to the amplifier, and control means operable upon actuation of the key for actuating said gating means, said control means including diode means connected to the key for applying current to the generator, a first electron valve connected to said diode means and responsive to the voltage drop across said diode means, means coupling said first electron valve to said gating means for actuating the same, and a second electron valve coupled to said first valve for reducing the effect on said first valve of variations in the potential of the supply means.

5. In an electric organ including a tone generator, a sound reproducer, and a key for actuating the tone generator, the combination therewith of a gating stage coupled between the generator and the sound reproducer, a resistance capacitance timing network for applying an actuating pulse relay means coupled to said network and to said gating stage, said relay means having a first position for coupling said network to said gating stage for actuating the same and a second position for removing said network from said stage, cyclic means coupled to said relay means for actuating said relay means alternately between said first position and said second position, and means operable by the key for actuating said cyclic means.

6. In an electric musical instrument including a plurality of tone generators with keys for selectively operating the same, a mixer for combining signals from the tone generators and a loudspeaker for reproducing the signals produced by the tone generator, the combination therewith of modulator means for coupling the mixer to the loudspeaker and including an electron discharge device, means for applying signals from the mixer to said electron device, adjustable biasing means coupled to said device for holding the same at a low level of conductivity, means coupled to said keys and responsive to operation thereof for providing a voltage pulse, said last named means being coupled to said electron device and applying said pulse thereto for increasing the conductivity thereof, said last named means including an adjustable timing circuit for controlling the duration of the applied pulses.

7. In an electric organ including a tone generator for producing tone signals, a loudspeaker, and a key for actuating the tone generator, the combination therewith of gating means coupled to the tone generator for transmitting signals therefrom, supply means for providing positive potential, a circuit including rectifier means connecting said positive potential supply means to the key

for supplying energizing current to the tone generator, first relay means for selectively actuating said gating means, means connecting said rectifier means to said first relay means and responsive to the flow of current through said rectifier means for actuating said first relay means, and second relay means connecting said gating means to the loudspeaker, said second relay means being coupled to said first relay means and including delay means causing operation of said second relay means in response to operation of said first relay means after a time interval, so that signals are transmitted by said gating means and applied through said second relay means to the loudspeaker in response to operation of said first relay means.

8. In an electric musical instrument including a plurality of tone generators with keys for selectively operating the same, a mixer for combining signals from the tone generators and a loudspeaker for reproducing the signals produced by the tone generator, modulator means for coupling the mixer to the loudspeaker including first and second electron discharge devices connected in push-pull, means for applying signals from the mixer to said electron devices, biasing means coupled to said devices including switch means having a first position for holding said devices cut off and a second position for holding said devices at a low level of conductivity, means coupled to said keys and responsive to operation thereof for applying a voltage pulse to said electron devices for increasing the conductivity thereof, said last named means including a timing circuit for controlling the duration of the pulses applied thereto, said timing circuit including second switch means having a first position providing pulses of a first duration and a second position providing pulses of a different duration.

9. An electric musical instrument including in combination, a loudspeaker, a tone generator, a key for establishing an energizing circuit to the tone generator, gating means coupled to said tone generator for selectively translating signals from said generator, control means coupled to the tone generator and responsive to operation of said tone generator, said control means being coupled to said gating means for actuating the same, and adjustable bias means for said tone generator, said control means adjusting said bias means for changing the tone pitch of the tone generator simultaneously with the transmission of signals from said generator.

10. An electric musical instrument including in combination a plurality of tone generators for providing tone signals, a plurality of keys operable to selectively apply current to said tone generators to actuate the same, a sound reproducer for reproducing the tone signals, gating means for selectively controlling the application of tone signals to said sound reproducer, and a control circuit coupled to said gating means and operating the same in response to actuation of a tone generator resulting from operation of one of said keys, said control circuit including impedance means connected to said keys for applying current through an actuated key to said generators coupled thereto, and electron valve means coupled to said impedance means and responsive to the voltage drop thereacross, said electron valve means being coupled to said gating means for actuating the same, said gating means including first contact means for interrupting signals from one tone generator associated with an operated key and second contact means for providing signals from a different tone generator operated by the same key.

11. An electric organ including in combination, a plurality of tone generators for producing different tone signals and including tone generators provided as first and second groups, a plurality of keys including a group of keys each of which is associated with a tone generator of the first group and with a tone generator of the second group, each of said keys including switch means, a sound reproducer coupled to said tone generators for reproducing tone signals therefrom, gating means including relay

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means having first normally closed contact means and second normally open contact means, rectifier means, an energizing circuit for said tone generators of said first group including said rectifier means and said first contact means with the circuits to the individual tone generators being completed through said switch means of the associated keys, an energizing circuit for said generators of said second group including said second contact means with the circuits to the individual generators being completed through said switch means of the associated keys, said first contact means and said rectifier means operating to apply current to a generator of the first group in response to operation of the key associated with said generator, and control means coupled to said gating means and operable upon actuation of a tone generator for actuating said gating means, said control means including an electron valve coupled to said rectifier means and responsive to the voltage drop across said rectifier means, said electron valve operating said relay means of said gating means to open said first contact means and cut off the generator of the first group and to close said second contact means and actuate the generator of said second group associated with the operated key.

12. An electric organ including in combination, a plurality of tone generators for producing different tone signals and including tone generators provided as first and second groups, a plurality of keys including a group of keys each of which is associated with a tone generator of the first group and with a tone generator of the second group, each of said keys including switch means, a sound reproducer coupled to said tone generators for reproducing tone signals therefrom, gating means including relay means having first normally closed contact means and second normally open contact means, rectifier means, an energizing circuit for said tone generators of said first group including said rectifier means and said first contact means with the circuits to the individual tone generators being completed through said switch means of the associated keys, an energizing circuit for said generators of said second group including said second contact means with the circuits to the individual generators being completed through said switch means of the associated keys, said first contact means and said rectifier means operating to apply current to a generator of the first group in response to operation of the key associated with said generator, and control means coupled to said gating means and operable upon actuation of a tone generator for actuating said gating means, said control means including electron valve means coupled to said rectifier means and responsive to the voltage drop across said rectifier means, said electron valve means operating said relay means of said gating means to open said first contact means and cut off the generator of the first group and to close said second contact means and actuate the generator of said second group associated with the operated key, whereby tone signals from said generators of said first and second groups are alternately reproduced, said control means including means controlling the rate of alternate reproduction of the tone signals.

13. In an electric musical instrument including a tone generator, a tremolo generator selectively coupled to the tone generator, a loudspeaker, and a key for actuating the tone generator, the combination therewith of gating means coupled between the tone generator and the loudspeaker for controlling the application of signals from the tone generator to the loudspeaker, a control circuit coupled to the key and to said gating means for applying actuating pulses to said gating means in response to actuation of the key, and cycling means coupled to the tremolo generator and cooperating with said control circuit for repeatedly applying actuating pulses to said gating means for actuating the same in synchronism with the tremolo generator to provide repeating bursts of signals to the loudspeaker.

14. In an electric musical instrument including a loud-

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speaker, an amplifier for driving the loudspeaker, an electric tone generator, supply means for providing energizing potential, and a key for applying potential from the supply means to the tone generator, the combination therewith of gating means for selectively providing a burst of signals from the generator to the amplifier, and control means operable upon actuation of the key for actuating said gating means, said control means including impedance means connected to the key for applying energizing current to the generator, an electron valve connected to said impedance means and responsive to the voltage drop thereacross, means coupling said electron valve to said gating means for actuating the same, and stabilizing means coupled to said electron valve for reducing the effect thereon of variations in the potential of the supply means.

15. In an electric musical instrument including a plurality of tone generators with keys for selectively operating the same, a mixer for combining signals from the tone generators, and a loudspeaker for reproducing the signals produced by the tone generators, the combination therewith of modulator means for coupling the mixer to the loudspeaker including an electron device, means for applying signals from the mixer to said electron device, biasing means coupled to said electron device for holding the same at a low level of conductivity, means coupled to said keys and responsive to operation thereof for providing a voltage pulse, said last named means being coupled to said electron device and applying said pulse thereto for increasing the conductivity thereof, said last named means including a timing circuit for controlling the duration of the applied pulses, whereby signals from the tone generators are applied to the loudspeaker for reproduction thereby at a first level for a period of time after a key is actuated and are then applied to the loudspeaker at a reduced level resulting from the low level of conductivity of said electron device.

16. In an electric organ including a tone generator for producing tone signals, a key for actuating the tone generator, supply means for providing positive potential, and a loudspeaker, the combination therewith of gating means coupled to the tone generator for transmitting signals therefrom to the loudspeaker, a circuit including rectifier means connecting the positive potential supply means to the key for supplying energizing current to the tone generator, relay means for selectively actuating said gating means, control means including an electron device connected to said rectifier means and responsive to the voltage thereacross, means connecting said electron device to said relay means for actuating the same so that signals are transmitted by said gating means, said control means including feedback means coupled to said electron device for causing recurring operation thereof, and switch means for selectively activating said feedback means, with said control means producing a single burst of signals in response to operation of the key when said feedback means is deactivated and a plurality of bursts of signals when said feedback means is activated.

17. The combination of claim 2 including means selectively connecting said gating means between the mixer circuit and the amplifier, and wherein said control means includes relay means for applying pulses to said gating means for rendering the same operative in response to actuation of the key, and means for changing the tone produced by the electric tone generator coupled to said relay means and operated thereby simultaneously with the transmission of signals from the tone generator by said gating means.

18. The combination of claim 2 wherein said control means includes means for applying pulses to said gating means for rendering the same operative in response to actuation of the key, and bias means coupled to the tone generator for changing the pitch thereof, said bias means being actuated by said control means to change the pitch

of the tone generator simultaneously with the transmission
of signals from the tone generator by said gating means.

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