

[54] **DEVICE FOR AUTOMATICALLY PRODUCING TONE PATTERNS BASED ON A TONIC NOTE**

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[51] Int. Cl. **G10f 1/00**

[58] Field of Search **84/1.01, 1.03, 1.10, 1.11, 84/1.24, 1.28 G, 1.17, 1.22, 1.26, 443, 425, 337; 367/259**

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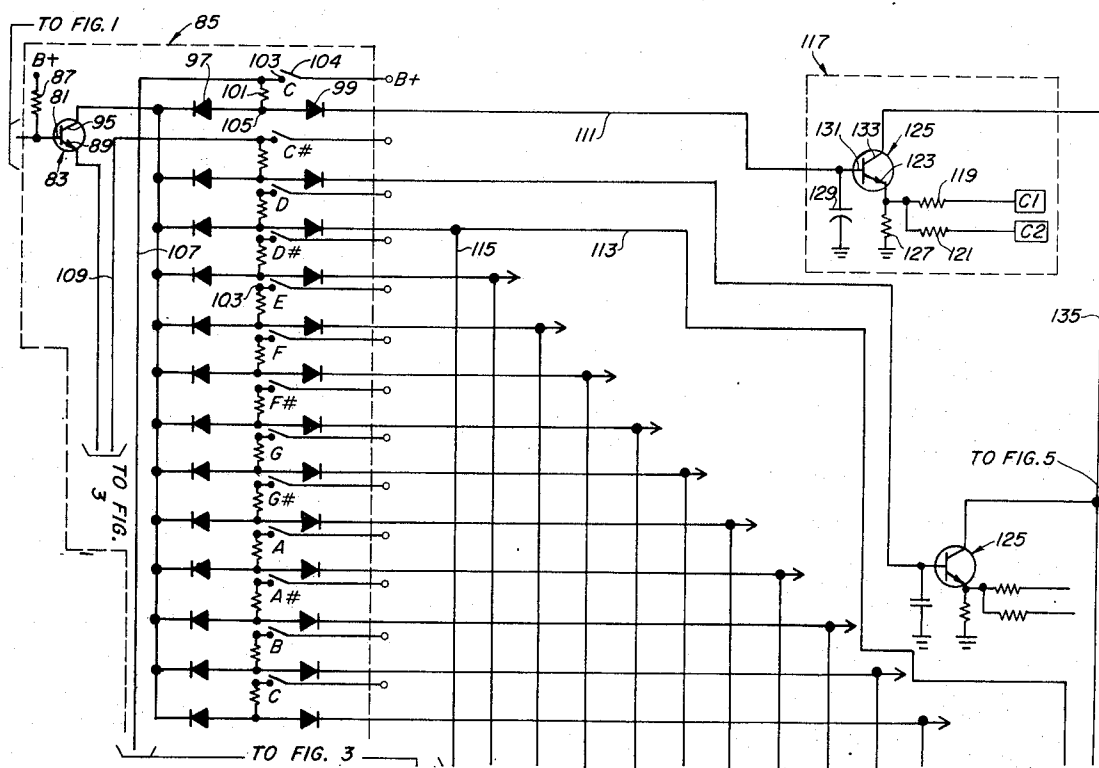
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[57] **ABSTRACT**

Electronically produced pulses are conveyed in predetermined patterns to a plurality of pedal gate circuits. Each of the pedal gate circuits includes a plurality of individual pedal gates equal to the number of semitones in a musical octave. Pedals operated by an instrumentalist are connected to one pedal gate in each of the pedal gate circuits. Audio gates are actuated by pulses from the pedal gates to pass tone generator signals to an output audio circuit. The pedal gates associated with a given pedal are each connected to different audio gates, the audio gates passing tone generator signals that produce tones related to one another in that they have as a tonic note that note represented by the pedal operated by the instrumentalist.

17 Claims, 8 Drawing Figures

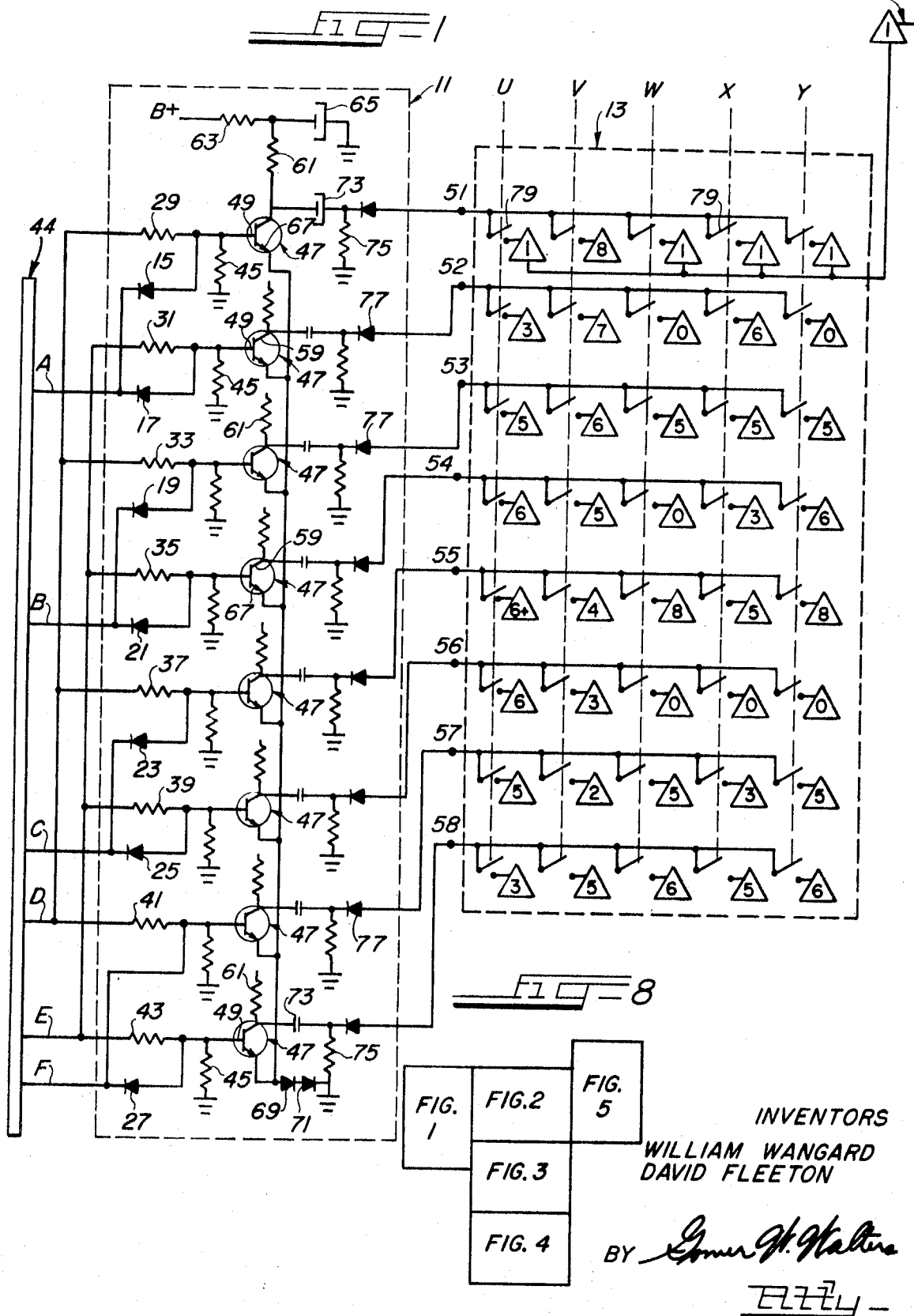


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TO FIG. 2

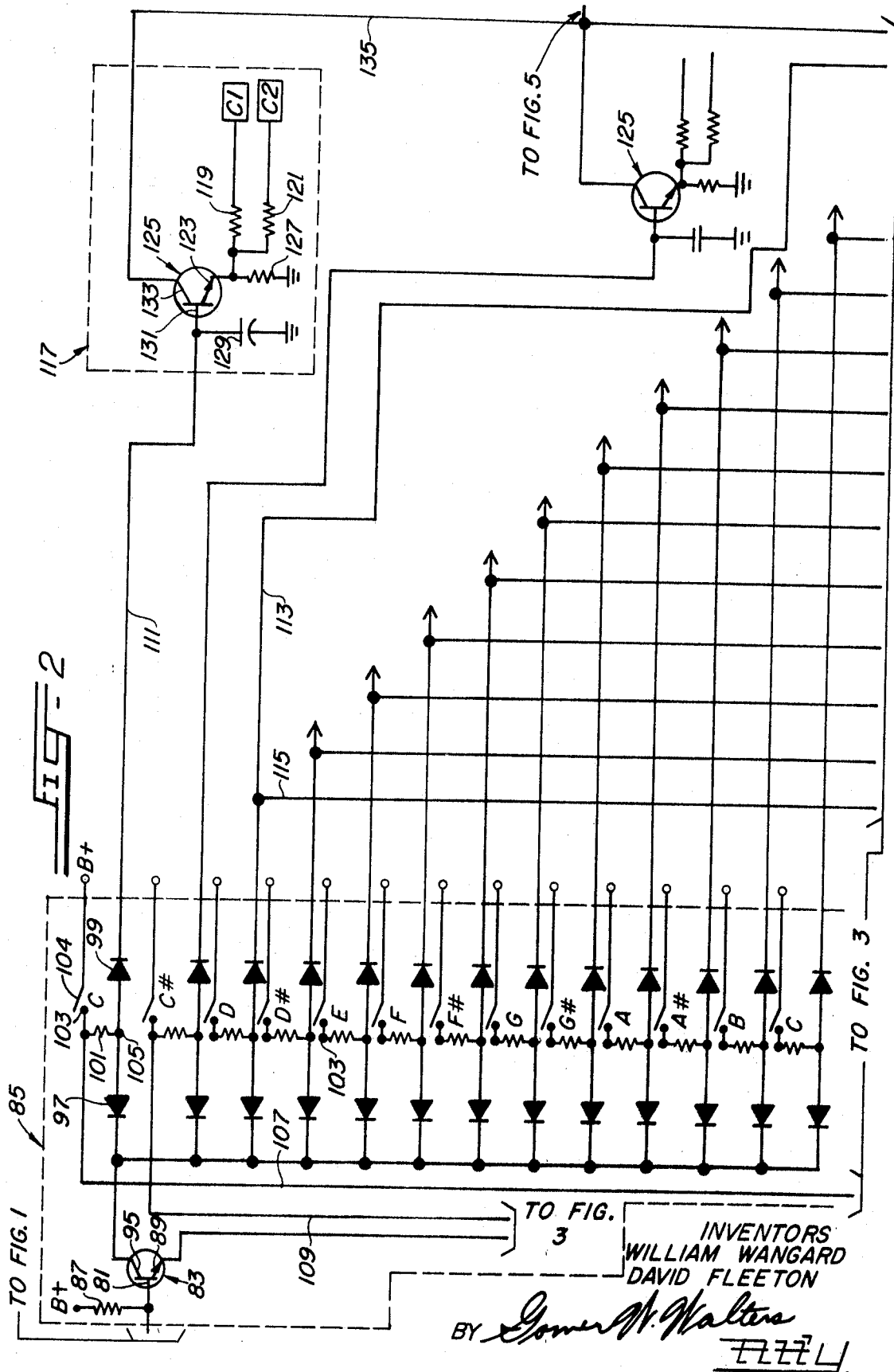


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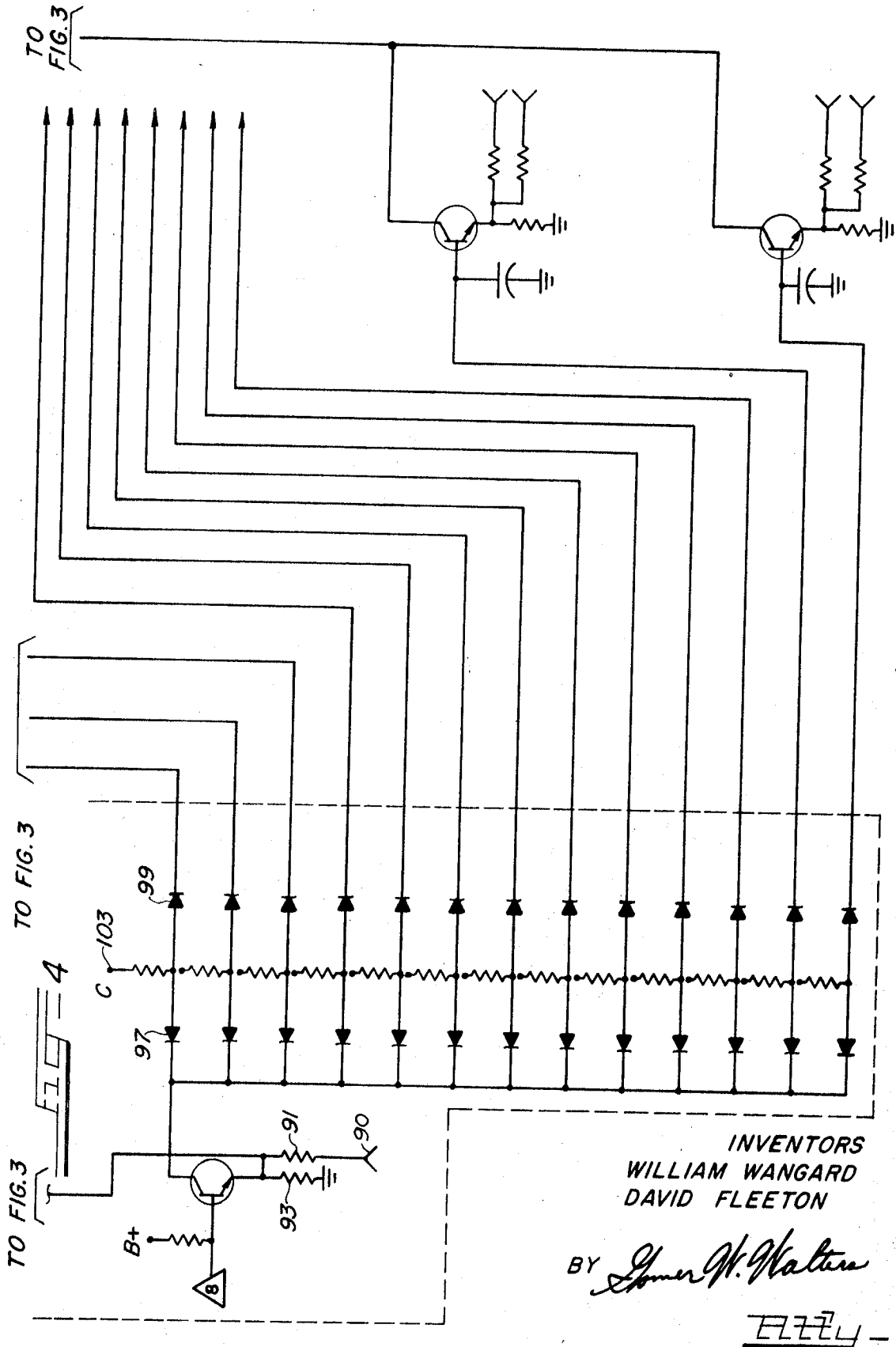
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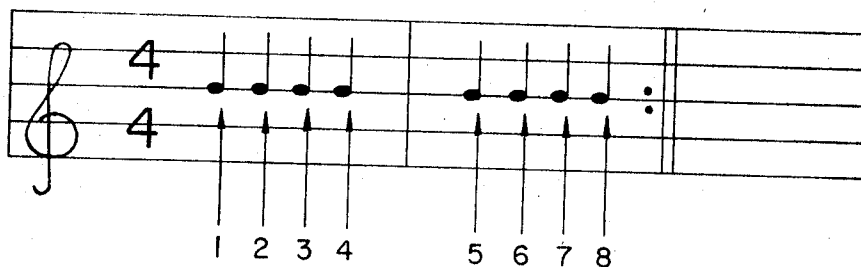


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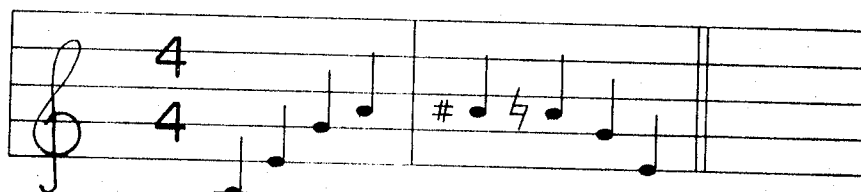
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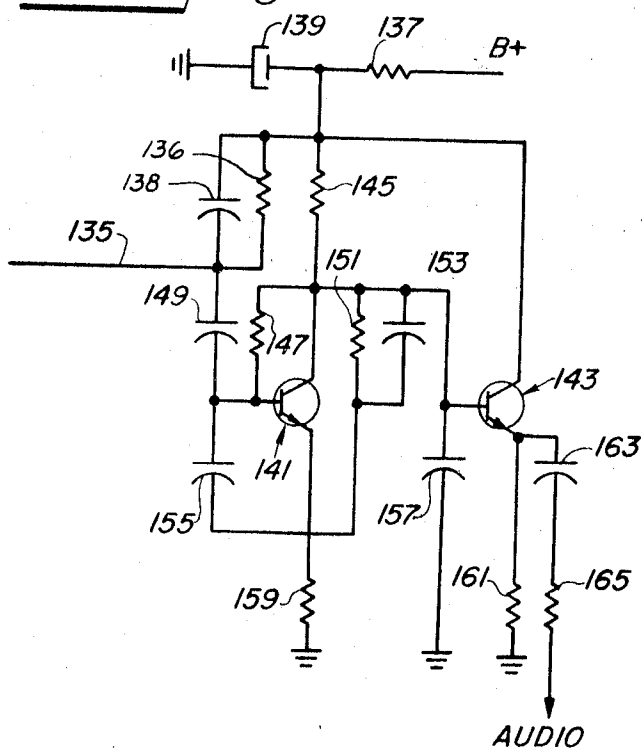


F1 = 7

PATTERN U
(TONIC=C)



F1 = 5



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ATTN -

DEVICE FOR AUTOMATICALLY PRODUCING TONE PATTERNS BASED ON A TONIC NOTE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to the electronic production of musical tones and, more specifically, this invention relates to a device that electronically produces patterns of bass tones having a tonic note selected by an instrumentalist.

2. Description of the Prior Art

Although the concept of automatically controlled musical instruments extends back to the old player pianos, it is only fairly recently that much headway has been made in providing devices that will automatically yield musical patterns that may be selected at will by an operator or instrumentalist.

One area in which efforts have been expended is the development of rhythm accompaniment devices. These devices are adapted to produce various rhythms (e.g., fox trot, samba, etc.) by utilization of various percussion instrument sounds (e.g., drums, cymbals, etc.). The particular rhythm to be played may be selected by the operator or instrumentalist. Some rhythm accompaniment devices are provided with an arrangement by which the beat of the device will be altered to conform to the beat of an instrumentalist playing on an associated primary instrument, such as an electronic organ.

Rhythm accompaniment devices have been quite successful in the market place and have provided an added dimension to the playing of music. By utilization of a rhythm accompaniment device in connection with the play of a basic instrument, an instrumentalist can play the melody and the device will provide a rhythm accompaniment, so that the end effect is that of a full band.

While rhythm accompaniment devices play an important part in the modern musical world, their use has been restricted to the production of rhythms by actuation of circuits that simulate percussion instrument sounds. Thus, the device plays on its own, essentially independent of what the instrumentalist is doing. Normally, the instrumentalist will condition his beat to coincide with that of the rhythm accompaniment device, but in some cases the beat of the rhythm accompaniment device can be modified to follow the beat of the instrumentalist. However, even when the device is adapted to follow the beat of the instrumentalist, the only change in the musical output of the device is the beat or speed of the music — there is no change in the basic sound of the music.

In the area of providing accompaniment utilizing notes or tones, there are other problems that prevent an easy solution. The primary problem, of course, is that when a musical note or tone is produced there is a much greater interaction with the music being played by the instrumentalist than when a rhythm accompaniment is being produced. In the latter case, it is only necessary to match the beat of the instrumentalist and the rhythm accompaniment, whereas in the former it is necessary that the notes or tones played produce the proper musical effect when combined with the notes being played by the instrumentalist. As a result, it is necessary that the instrumentalist have control over the tonal nature of the accompaniment being produced.

Some prior art attempts have been made to provide tonal accompaniment patterns. One such prior art arrangement utilizes an approach in which an instrumentalist can produce basic accompaniment patterns by successively actuating a pedal for each of the notes of the pattern. Such an arrangement is, of course, difficult for the instrumentalist to play and has a limitation on the number of notes that can be played without the instrumentalist wearing himself out.

Other attempts have provided tonal accompaniment characteristics by utilizing arrangements such as a series of keys to be depressed in rapid succession by an instrumentalist to provide a run of notes based on a note being played by the instrumentalist. Again, though, such arrangement is difficult for an instrumentalist and detracts from his play of the basic instrument.

SUMMARY OF THE INVENTION

The present invention obviates the difficulties encountered in prior art attempts at providing tonal accompaniment arrangements by providing a wholly automatic pattern of notes played in response to choice of the basic or tonic note by the instrumentalist. Briefly, in the preferred embodiment disclosed herein, the present invention relates to an arrangement utilizing selected patterns of pulses to produce tonal patterns based upon a tonic note selected by the instrumentalist.

A driving portion of the system includes a pulse generating circuit and a pattern switching arrangement. Various types of pulse generating circuits could be utilized, of course, but in this case spatially separated driving pulses are obtained by making use of signals obtained from the logic circuitry of a rhythm accompaniment device utilized in association with the present invention. Examples of rhythm accompaniment devices of the type referred to are illustrated in U.S. Pats. Nos. Re.26,521; 3,358,068; and 3,383,452. The signals from the rhythm accompaniment device are passed through a logic circuit to inverting amplifiers. Since the rhythm accompaniment device utilized in connection with the present invention relies on positive logic, negative going pulses are passed to the pattern switch.

In the present embodiment, five separate patterns may be chosen by use of the pattern switch. Of course, the number of patterns supplied could be increased if desired. Actuation of a particular pattern switch connects the terminals to which the driving pulses are applied to corresponding control points. Each of the control points is associated with a tone production controlling means that comprises a set of pedal actuated gates. The pedal actuated gates are normally closed to prevent passage of pulses, but operation of a pedal or selection means by the instrumentalist causes one gate in each of the sets of pedal gates to be opened for passage of pulses. Each pedal opens the same pedal gate in each set of pedal gates, but each of the pedal gates is interrelated by means of electrical connections so that a different but related tone (e.g., a tone in the same diatonic scale) is produced by each pedal gate when a pulse is applied thereto. It should be noted that the tonic note may not be actually included in the musical pattern, although it does determine the notes that are played.

The pulses passed through the pedal gates are then conveyed to audio gates in an audio system. The audio gates pass tone generator signals when actuated by the pulses. The audio gates combine tone generator signals to give even harmonic content to the signals and shape the decay characteristics to approximate those of string bass tones. The combined tone generator signals are then conveyed to a pre-amplifier which also has a high frequency rolloff to change the formant of the signal to more nearly approximate the sound of a string bass. Operation of the device results in pulses being conveyed to different audio gates in different predetermined patterns to provide the desired pattern of tones.

This arrangement could be utilized with any type of tonal accompaniment, but in this embodiment it is primarily related to a string bass accompaniment.

Accordingly, it is a primary object of this invention to provide a device that will automatically produce a desired pattern of musical tones based upon a tonic note selected by an instrumentalist.

Another object of this invention is to provide an accompaniment for an instrumentalist that will enhance the quality of this play and yet be simple to utilize.

Yet another object of this invention is to provide a tonal accompaniment device that may be operated in synchronism with a rhythm accompaniment device.

These and other objects, advantages, and features of the present invention will hereinafter appear and, for purposes of illustration, but not of limitation, an exemplary embodiment of the subject invention is illustrated in the attached drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1-5 are a schematic circuit diagram of a preferred embodiment of the present invention.

FIG. 6 is a schematic diagram of two measures of a musical staff illustrating the spacing of the driving pulses utilized in the preferred embodiment.

FIG. 7 is a schematic diagram of two measures of a musical staff illustrating an exemplary pattern of the type produced by the preferred embodiment of the present invention.

FIG. 8 is a schematic diagram illustrating the relationship of FIGS. 1-5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 1-5, it may be seen that the preferred embodiment incorporates a driving means including a generating means 11 and a pattern switching means 13. Generating means 11 actually has three functions: a logic analysis function, an inverting and amplifying function, and a differentiating function.

The logic function is performed by diodes 15, 17, 19, 21, 23, 25, and 27 and resistors 29, 31, 33, 35, 37, 39, 41, and 43. As previously indicated, the signals applied to the logic could be obtained from anywhere, but in this particular embodiment they are derived from a rhythm accompaniment device, schematically illustrated at 44, utilized in connection with the subject invention. Since the rhythm accompaniment device with which this system is utilized is based on positive logic, the signals appearing on the inputs of generating means 11 are positive going. The incoming signals have been identified as A-F and are referenced to the lines on which they enter the system. Thus, if there is an incoming signal D, a positive signal would be applied to resistors 29, 33, 37, and 41. The signal appearing across these resistors, in series with the associated base resistors 45, causes a positive voltage to be applied to the base 49 of an associated one of transistors 47. However, this situation only occurs if the signal applied to the cathode of the associated diodes 15, 19, 23, and 27 is also positive going. If this signal be negative going, the diodes would be biased for forward conduction and shunt out the associated resistors 45. Thus, a transistor 47 will only be biased for conduction if the two signals connected to it are both positive going.

The logic relations that result in the biasing of a transistor 47 for conduction can best be understood by reference to FIG. 6. As seen there, the eight quarter notes produced in this preferred embodiment are identified by the numbers 1-8. These numbers correspond to terminals 51-58 in FIG. 1, since biasing of a transistor 47 to conduction will result in a corresponding pulse being applied to these terminals. The logic required to produce these pulses may be identified in the following manner:

Note	Logic
1 1	AD
2	AE
3	BD
4	BE
5	CD
6	CE
7	FD
8	FE

Comparison of this logic table with the circuit diagram of FIG. 1 illustrates the correspondence of the logic outputs to the transistors 47.

Each of the transistors 47 has its collector 59 connected to a source of B+ power through an associated resistor 61 and a common resistor 63. A capacitor 65 smooths the power signal and bleeds off high frequency variations. The emitters 67 of transistors 47 are all connected to ground through series connected diodes 69 and 71. When a transistor 47 is biased for conduction by an appropriate logic combination, current flow is initiated and the collector of that transistor goes to nearly ground potential, as virtually all of the voltage drop occurs across resistors 61 and 63. Since the collector was at B+ potential during nonconduction of the transistor, a negative pulse is produced.

The output of each of the transistors 47 is differentiated by an RC differentiator circuit including a capacitor 73 and a resistor 75. Since transistors 47 inverted the positive going logic

signals during amplification, negative going pulses differentiated by capacitor 73 and resistor 75 are conveyed to the diodes 77. Diodes 77 pass negative pulses to the terminals 51-58 and serve to prevent undesired feedback from pattern switching arrangement 13 resulting from combining switching functions.

The pulses appearing on terminals 51-58 are then passed through the pattern switching means 13. Pattern switching means 13 has five separate patterns, each of which includes eight normally opened switches 79. Eight switches are utilized in each of the pattern switching arrangements in this embodiment to correspond to the eight pulse outputs of the driving circuit, which correspond to the eight quarter notes of the 4/4 time utilized in this preferred embodiment, although the invention is not, of course, limited to the use of this particular meter. The five patterns that may be selected have been designated as U, V, W, X, and Y.

Selection of a particular pattern causes the associated switches 79 to connect terminals 51-58 to a series of control points designated by the numerals 0-8. A control point designated by 0 is merely an open circuit connection. FIG. 7 illustrates the musical pattern corresponding to selection of pattern U by an instrumentalist. (It should be noted that in the present embodiment the tones are actually played two octaves lower than shown in the drawing.)

Each of the control points is connected to the base 81 of a transistor 83 in an associated tone production controlling circuit 85. Biasing for base 81 of each of the transistors 83 is achieved through resistors 87. The emitters 89 of transistors 83 are connected to a relatively small negative supply at terminal 90 through a common resistor 91 (FIG. 4). The emitters 89 are held at a point somewhat below ground potential by means of the voltage divider action of resistor 91 in connection with another resistor 93. This relatively small negative potential compensates for the small voltage drop across transistors 83 to insure that the collectors of these transistors are at true ground potential when the transistors are conducting.

Collectors 95 of transistors 83 are each connected to a set of thirteen pedal gates. The thirteen pedal gates are representative of the thirteen semitones in a musical octave (counting both ends of the octave. Each pedal gate comprises back-to-back diodes 97 and 99, with a resistor 101 extending from the common terminal 105 at the junction thereof.

Each of the pedal gates in FIG. 2 has been identified with a note in the scale to which it corresponds. Each resistor 101 is connected from common terminal 105 to an input terminal 103. Terminal 103 is normally open circuited, but when an instrumentalist pushes a pedal, schematically illustrated at 104, the terminal 103 associated with the note represented by the pedal depressed by the instrumentalist is supplied with a positive voltage.

Base 81 of transistors 83 is biased by a source of B+ potential through resistor 87 to such a condition that transistors 83 are normally saturated. Thus, common terminal 105 of back-to-back diodes 97 and 99 is normally grounded through diode 97 and transistor 83 for positive signals, while any negative signals at terminal 105 would be blocked by the diodes. In such a case, depression of a pedal to apply a positive voltage at terminal 103 produces no change in the audio circuit since the entire voltage drop is across resistor 101. However, if a pedal should be depressed to apply a positive potential to its terminal 103 and a negative going pulse from pattern switching arrangement 13 is connected to base 81, thereby cutting off the transistor 83, conduction through diode 97 is prevented and a positive pulse will be conveyed through the corresponding diode 99 to the audio circuits.

It should be noted that the signal appearing on a terminal 103 of a given pedal is simultaneously connected to similar terminals 103 in each of the sets of pedal gates. For example, the C pedal in FIG. 2 is connected through line 107 to the C pedal in FIG. 3. Similarly, the C# pedal in FIG. 2 is connected to the C# pedal in FIG. 3 through line 109. In this

fashion, the C pedal is connected to the top terminal 103 in each of the nine sets of pedal gates utilized in this embodiment. Nine sets of pedal gates are utilized in this embodiment since the only semitone not in the diatonic scale utilized in the patterns is 6+ (in pattern U), which corresponds to A # if the tonic note is C. Of course, the number of sets of pedal gates used could be increased or decreased, as desired.

In order that different notes may be played upon depression of a single pedal, it is necessary that the corresponding pedal gate in each set of pedal gates be arranged to provide a different tone. It should be noted that although the tone will be different, the tones still will be related and based upon the tonic note represented by the pedal depressed. To achieve this interrelationship between sets of pedal gates in the production of tones, the circuit includes connections that make the same pedal gate in each set of gates produce a different tone. Thus, the C pedal gate associated with control point 1 is connected to line 111, while the C pedal gate associated with control point 2 is connected to line 113 through a line 115. Similarly, each C pedal gate in each of the other sets of pedal gates is connected to a different but related line. The same is true for each of the other pedals.

When a pulse from the pattern switch 13 is passed through a pedal gate, it is conveyed by a line such as 111 to an audio gate 117. In audio gate 117 signals from tone generators C1 and C2, which may be any conventional type of tone producing arrangement, are connected through resistors 119 and 121, respectively, to the emitter 123 of transistor 125. A biasing resistor 127 is also connected to emitter 123.

The two tone generator signals are combined in the audio gate to add even harmonic content to the tones, which is characteristic of a string bass tone, which this embodiment is intended to duplicate. To achieve this even harmonic content the higher frequency tone generator signal (which is a second harmonic of the first, i.e., one octave removed) is added to the lower frequency signal at half the amplitude. The relative amplitudes are determined by judicious selection of resistors 119 and 121.

A capacitor 129 is connected to base 131 of transistor 125. Capacitor 129 controls the attack of the tone signal and provides a slight amount of sustain to yield a decay characteristic similar to that of a string bass tone.

Collector 133 of transistor 125 is connected to a line 135 in common with the collectors of all of the other audio gate transistors 125. The tone generator signals passing through audio gates 117 and appearing on line 135 are conveyed to the pre-amplifier illustrated in FIG. 5. The collector load resistor 136 is illustrated in the pre-amplifier circuit of FIG. 5. Since normally only one pedal will be depressed at a time, it is possible to use the single load resistor 136 for all the audio gate transistor 125.

The pre-amplifier illustrated in FIG. 5 is essentially a conventional pre-amplifier with the exception that provision has been made to secure a high frequency rolloff effect which alters the formant of the amplified signal to more closely simulate the sound of a string bass. A first circuit arrangement to remove high frequency components from the signal is the capacitor 138 connected in parallel with load resistor 136.

Bias for the pre-amplifier is obtained from the junction of resistor 137 and capacitor 139 and conveyed to the collectors of transistors 141 and 143. The collector of transistor 141 is biased through a resistor 145, while the base thereof is biased through a resistor 147 connected between the base and collector.

The input signal appearing on line 135 is connected to the base of transistor 141 through a capacitor 149, and the output on the collector of transistor 141 is fed back to the base thereof through a parallel RC network comprising a resistor 151 and a capacitor 153 and then through a series capacitor 155. This feedback arrangement provides a negative feedback of high frequency components to yield a second high frequency rolloff effect.

The signal on the collector of transistor 141 is fed to the base of transistor 143, which is connected to ground through a capacitor 157. A third high frequency rolloff effect is provided by capacitor 157 which shorts the high frequency components to ground.

The emitter of transistor 141, which is connected in a common emitter configuration, and the emitter of transistor 143, which is connected in an emitter follower configuration, 143 are connected to ground through resistors 159 and 161, respectively. The output obtained from the emitter of transistor 143 is conveyed to the audio circuitry through a capacitor 163 and a resistor 165.

From the foregoing discussion it is apparent that the instrumentalist may select one of a number of predetermined patterns by utilization of pattern switch 13. The pulses transmitted to pattern switch 13 from pulse generator 11 are then conveyed to the pedal gates, through which the pulses are passed when pedal gates have been opened by actuation of a pedal by the instrumentalist. The different signals passed by the various gates are interrelated to the tonic note represented by the pedal actuated by the instrumentalist. The signals from the pedal gates are then conveyed to appropriate audio gates to open these gates and permit tone generator signals to be conveyed to the audio circuitry. In this fashion, various tone patterns are produced based upon the tonic note selected by the instrumentalist.

It should be understood that the embodiment described is merely exemplary of the preferred practice of the present invention and that various changes, modifications, and variations may be made in the details of construction, arrangement, and operation of the elements disclosed herein, without departing from the spirit and scope of the present invention.

We claim:

1. A device for automatically producing musical tone patterns having a tonic note selected by an instrumentalist comprising:

a plurality of tone production controlling means, each of said tone production controlling means adapted to selectively provide a plurality of tone controlling signals;

instrumentalist operated selection means connected to simultaneously condition each of said tone production controlling means to provide, upon actuation thereof, a tone controlling signal;

driving means for actuating preselected individual ones of said tone production controlling means at predetermined times to provide a predetermined pattern of the tone controlling signals which said tone production controlling means are conditioned to provide;

audio means responsive to said tone controlling signals to produce musical tones; and

interrelating means connected between the said tone controlling means and the said audio means to cause each of said tone controlling means to provide a tone controlling signal to the said audio means to control production of a tone different from but related to each of the other tones, production of which is controlled by each of the other tone controlling signals, one of said tones being the tonic note which is determined by operation of said selection means but which may not be included in a particular musical tone pattern produced by the device.

2. A device as claimed in claim 1 wherein said driving means comprises a pulse generator developing pulses on a plurality of spatially separated terminals.

3. A device as claimed in claim 2 wherein: each of said tone production controlling means comprises a plurality of pedal gates, each pedal gate normally blocking passage of pulses from said pulse generator; and said selection means comprises a plurality of pedals, operation of a pedal by an instrumentalist opening one of said pedal gates in each of said tone production controlling means.

4. A device as claimed in claim 3 wherein: each of said pedal gates comprises a pair of back-to-back diodes connected to a common terminal; and

each of said pedals is adapted, when operated, to apply a forward biasing signal to said common terminal of said diodes.

5. A device as claimed in claim 4 wherein each of said tone production controlling means further comprises a normally saturated transistor connected to all of the pedal gates in its associated tone production controlling means, application of a pulse from said pulse generator to one of said transistors terminating conduction of that transistor to cause said pulse to be conveyed to said audio means.

6. A device as claimed in claim 2 wherein said driving means further comprises a pattern switching arrangement to provide a plurality of predetermined patterns which may be selectively chosen by the instrumentalist.

7. A device as claimed in claim 6 wherein said pulse generator comprises:

a logic circuit to provide signals on lines corresponding to said terminals at predetermined time increments; amplifying and inverting means for amplifying and inverting the signals from said logic circuit; and differentiating means to appropriately shape the pulses appearing on said terminals.

8. A device as claimed in claim 6 wherein said pattern switching arrangement is adapted to connect each of said terminals to a particular one of said tone production controlling means dependent upon which pattern is chosen.

9. A device as claimed in claim 3 wherein:

said audio means comprises a plurality of audio gates normally blocking passage of tone generator signals; and each of said pedal gates is connected to a particular one of said audio gates.

10. A device as claimed in claim 9 wherein said interrelating means comprises electrical leads connecting each of a group of said pedal gates associated with a given one of said pedals to a different audio gate, each of said audio gates connected to one of said group of pedal gates adapted to pass a tone generator signal that produces a tone related to the tones corresponding to the audio gates connected to the other pedal gates in said group of pedal gates.

11. A device as claimed in claim 9 wherein:

said audio means further comprises a pre-amplifier circuit; and

said audio gates and said pre-amplifier circuit modify said tone generator signals to produce string bass characteristics of the tones produced therefrom.

12. A device for automatically producing tone patterns having a tonic note selected by an instrumentalist comprising:

a plurality of spaced terminals; pulse generating means for producing driving pulses on said spaced terminals at predetermined time intervals;

a plurality of control points;

pattern switching means for selectively connecting each of said terminals to one of said plurality of control points, the particular one of said control points to which a given one of said terminals is connected being determined by the pattern chosen;

a plurality of sets of pedal gates, each of said sets containing a number of pedal gates corresponding to the semitones of an octave, each of said control points being connected to an associated one of said sets of pedal gates;

pedal means operatively associated with said pedal gates and adapted upon actuation to open one of said pedal gates in each of said sets of pedal gates; and

a plurality of tone producing circuits connected to said pedal gates, each tone producing circuit developing a different semitone in a two octave range,

whereby driving pulses are applied to certain ones of said tone producing circuits as determined by said pedal means and in a pattern determined by said pattern switching means.

13. A device as claimed in claim 12 wherein each of said

pedal gates actuated by a given pedal means is connected to a different tone producing circuit to develop differing but related semitones.

14. A device as claimed in claim 13 wherein each of said tone producing circuits comprises an audio gate adapted to pass two combined, harmonically related tone generator signals, combining of said harmonically related tone generator signals producing even harmonics characteristic of string bass tones.

15. A device as claimed in claim 14 wherein:

each of said audio gates comprises a transistor, said harmonically related tone generator signals being combined at the emitter of said transistor; and

a capacitor connected to ground from the base of said transistor to produce a decay characteristic of the type exhibited by string bass tones.

16. A device as claimed in claim 12 wherein:

each of said pedal gates comprises a pair of back-to-back diodes connected to a common terminal;

each of said pedal means is adapted, when operated, to apply a forward biasing signal to said common terminal of said diodes; and

a normally saturated transistor is connected to each set of pedal gates, application of a driving pulse to said transistor terminating conduction of that transistor to cause said driving pulse to be conveyed to an associated tone producing circuit.

17. A device for automatically producing bass tone patterns having a tonic note selected by an instrumentalist comprising:

logic circuitry pulse generating means, connected to said generating means to produce spatially separated pulses at predetermined time intervals;

pulse forming means connected to said logic circuitry to give a desired shape and polarity to said pulses;

a plurality of control points;

pattern switching means connected to apply said pulses from said pulse forming means to designated ones of said control points in one of a plurality of predetermined patterns, the predetermined pattern being selected by actuation of said pattern switching means;

a plurality of sets of pedal gates, each set of pedal gates having thirteen pedal gates corresponding to the semitones of an octave and each of said pedal gates normally blocking passage of said pulses;

control elements connected to said sets of pedal gates, each of said control points being connected to a corresponding control element;

a plurality of pedals, each pedal representing a musical note and connected to a pedal gate in each of said sets of pedal gates, operation of a pedal conditioning the associated pedal gates to pass said pulses, application of one of said pulses to one of said control elements causing said pulse to be passed through the corresponding pedal gate;

a source of harmonically related tone generator signals;

a plurality of audio gates, each of said audio gates normally blocking passage of the harmonically related tone generator signals which are combined at said audio gates, each of said audio gates adapted to pass the combined tone generator signals when actuated by one of said pulses and adapted to provide a decay characteristic representative of a string bass note to the combined tone generator signals passed therethrough;

interrelating means connecting each of the pedal gates actuated by a pedal to an audio gate that passes tone generator signals corresponding to notes having as a tonic note the note represented by said pedal; and

a pre-amplifier connected to said audio gates to amplify said tone generator signals passed by said audio gates and to alter said tone generator signals to more nearly approximate string bass tone signals prior to conversion to audio tones.

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