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[45] Patented Dec. 15, 1970

3,098,888 7/1963 Tomcik 84/1.17
3,305,620 2/1967 Young 84/1.17
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Primary Examiner—W. E. Ray

[54] **PLURAL MODE AUTOMATIC BASS NOTE SYSTEM FOR MUSICAL CHORDS WITH AUTOMATIC RHYTHM DEVICE**
17 Claims, 5 Drawing Figs.

[52] U.S. Cl. 84/1.03,
84/1.17, 84/1.24

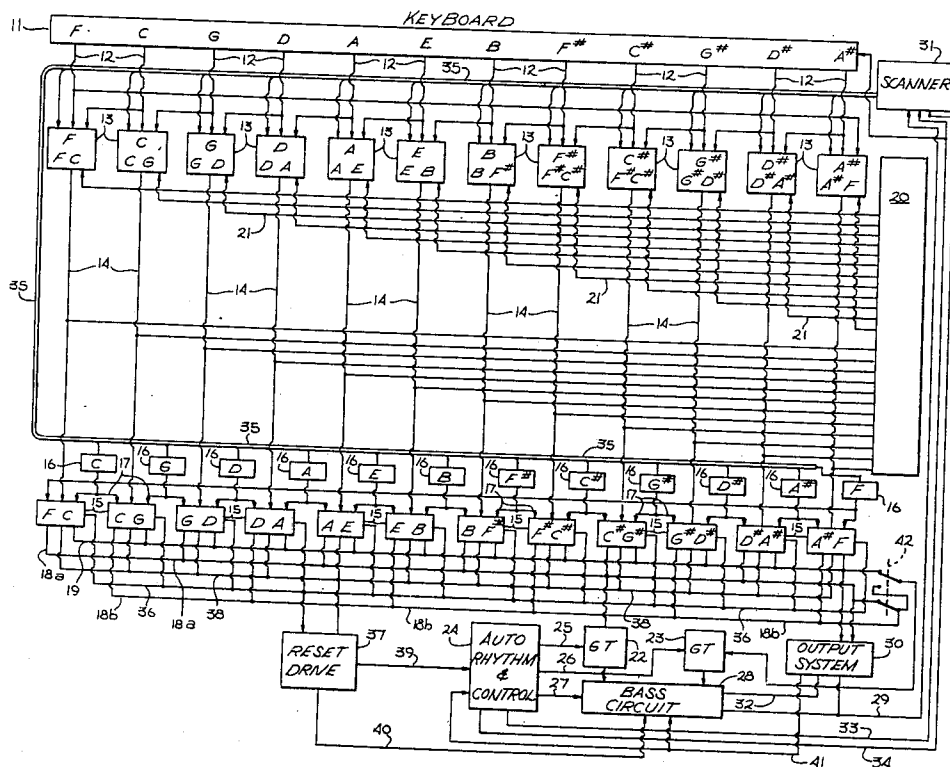
[51] Int. Cl. G10h 1/00,
G10h 5/02

[50] Field of Search 84/1.01,
1.03, 1.17, 1.19, 1.22, 1.24, (B,E,FD,G,M,N,O)

[56] **References Cited**
UNITED STATES PATENTS

2,645,968 7/1953 Hanert 84/1.22
3,001,432 9/1961 Greif 84/1.01

ABSTRACT: Apparatus for automatically playing bass parts to accompany manually played chords which has 12 drivers responsive to operation of manual playing keys for notes in musical fifths relation, inhibiting links between drivers restricting operation to one at a time, tone signal keyers responsive to driver operation to individually key corresponding notes in perfect fifth relation, a bass divider and bass keyer, and means gating the keyed tone signals one at a time to the bass divider and driving the bass keyer whereby the root and fifth parts of the chord being played are normally sounded alternately in the bass. The apparatus further includes sensing and switching means for changing the responsiveness of the drivers and operation of the gating means for different modes of operation.



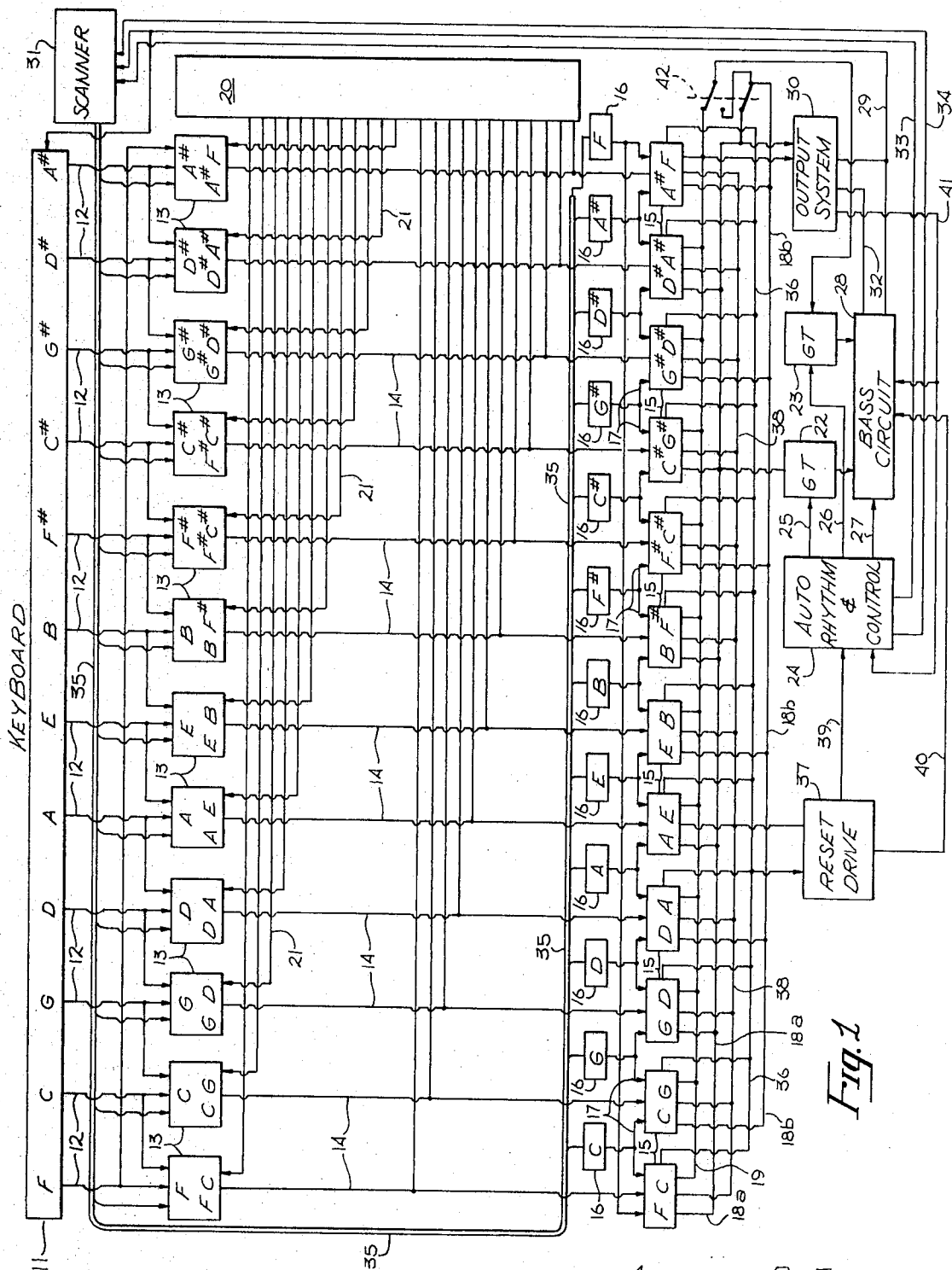


Fig. 1

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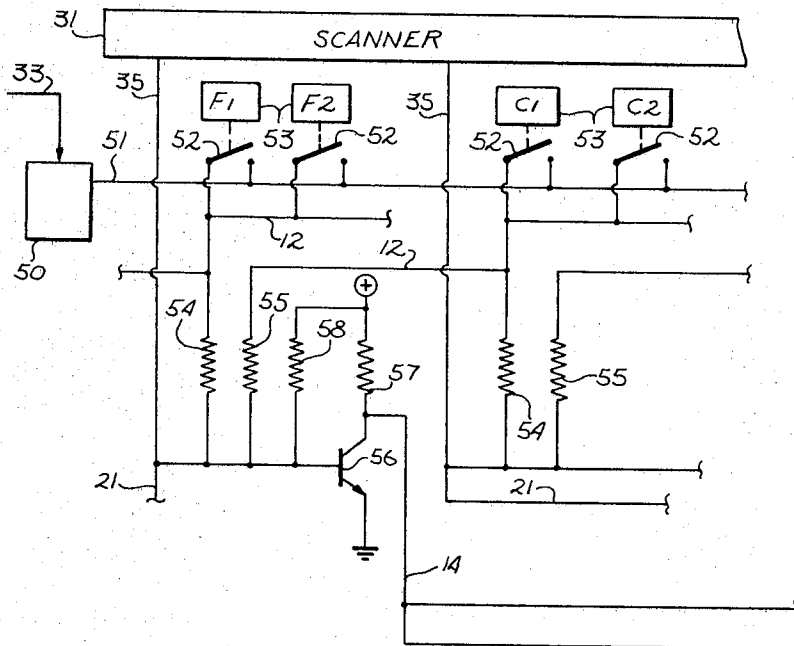


Fig. 2

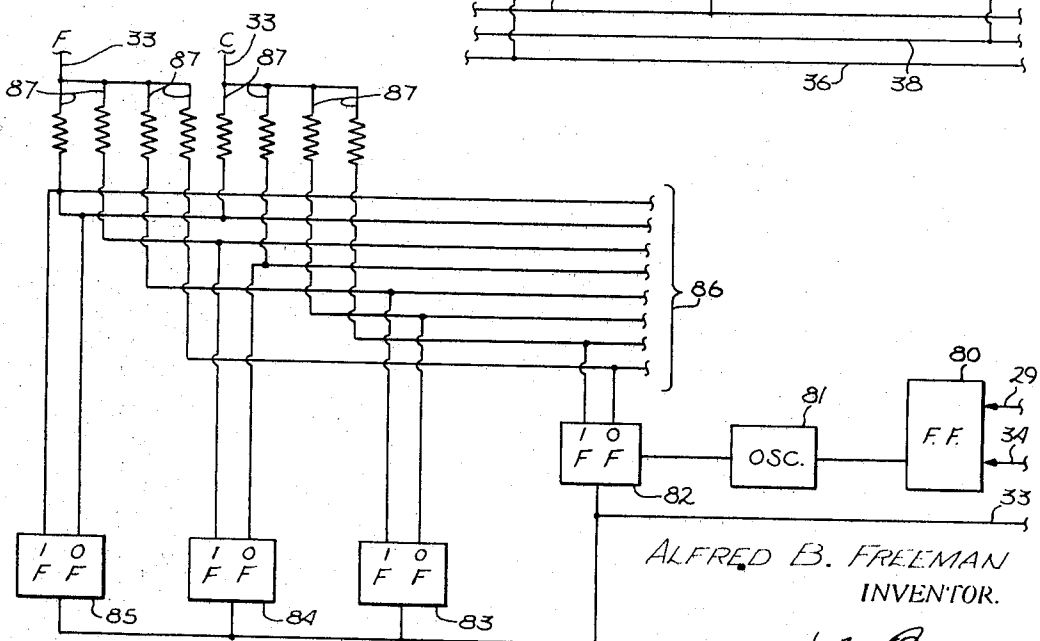
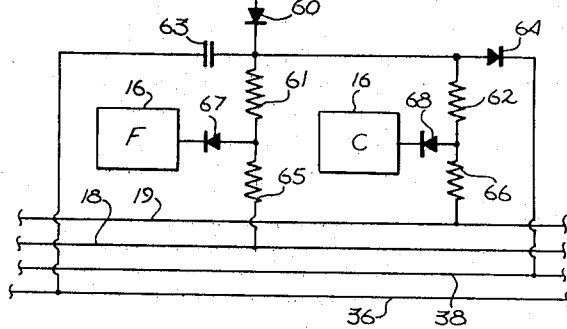
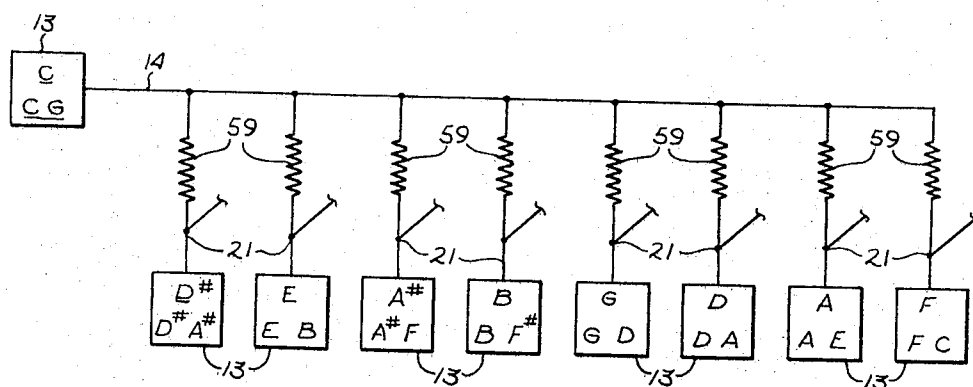
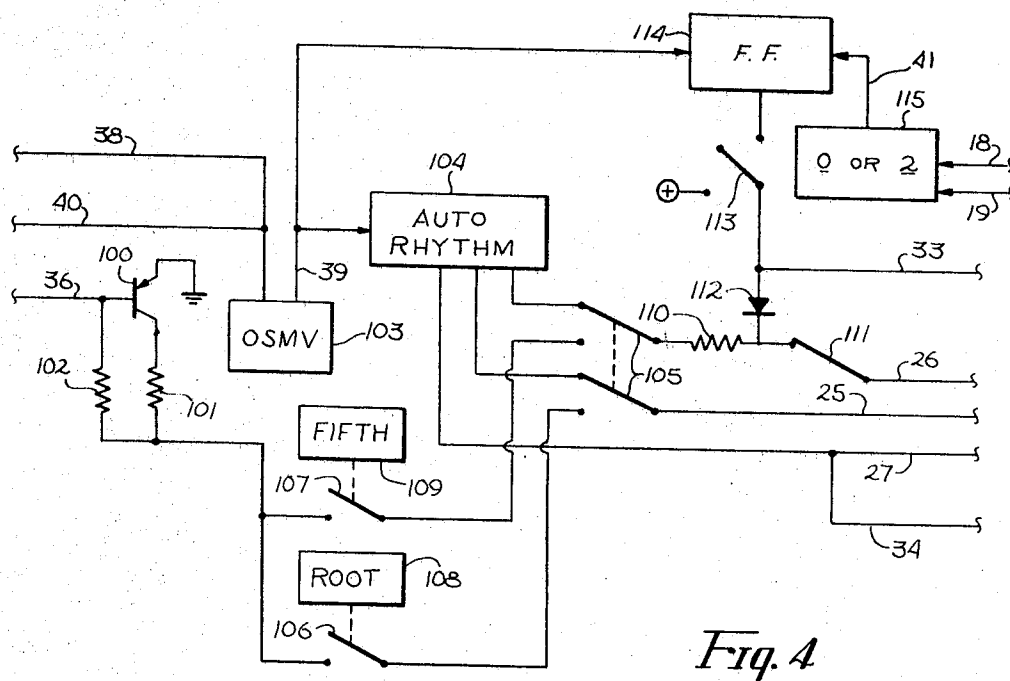


Fig. 3

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PLURAL MODE AUTOMATIC BASS NOTE SYSTEM FOR MUSICAL CHORDS WITH AUTOMATIC RHYTHM DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is directed to apparatus for playing bass parts automatically in response to harmony playing on manual keyboards or to root playing on the pedals with the sounding of the parts implemented by an automatic rhythm means or by special controls.

2. Description of the Prior Art

In U.S. Pat. No. 2,645,968, Hanert discloses means to play the root and fifth parts of chords selected by operation of one of a set of buttons individually by two pedals. Hanert's apparatus is not responsive to chords played on a standard keyboard.

In U.S. Pat. No. 3,001,432, Greif discloses means for playing tones in the bass in response to playing on the manual which limits bass playing to the root part for certain note combinations on the manual. Greif does not include means for playing the also important fifth part in the bass and the playing of sometimes desirable combinations of notes on the manual could result in more than one bass tone sounding at a time for an undesirable musical effect.

SUMMARY OF THE INVENTION

The apparatus of the present invention provides several possible modes of operation beyond the capabilities of the prior art. In one mode, all notes being played on one or both manuals can be played in a walkaround bass pattern by a scanning means that precludes more than one being sounded in the bass at a time, and that produces successive soundings in rhythmic patterns. In another mode, only the root and fifth parts of chord being played on the manuals are sounded in the bass and playing could further be restricted to either. The root and fifth response is obtained either by having enabling means respond only to playing keys for notes in perfect fifth relation and having operated enabling means inhibit the operation of other enabling means or by having enabling means responsive to all playing keys and having operated enabling means inhibit the operation of other enabling means.

The two ways of obtaining root and fifth response just mentioned have relative advantages and disadvantages. The fifth interval playing key response system requires fewer inhibiting links and identifies root and fifth parts for special treatment while the other system provides for playing diminished fifths in the bass and insures only one bass note at a time. Both systems inhibit operation of enabling means by other operated enabling means to get root fifth response for a variety of chords with a minimum of restrictions on the permissible note combinations. The two parts can be sounded in various rhythmic patterns by an automatic rhythm device or individually by two controls to be operated by the player.

Still another mode of operation enables root and fifth parts for sounding in the bass in response to operation of a single pedal or other control corresponding to the root. The pedal need only be operated by the player for each chord change while an automatic rhythm device sounds the root and fifth parts in various sequences and rhythmic patterns. Yet another mode uses automatic means to switch from the mode for root and fifth response to the mode playing all parts when two notes would otherwise sound simultaneously in the bass or when no part would otherwise sound in the bass even though a manual playing key is operated. Other variations in operation and response are possible under the invention but those already set forth should sufficiently indicate its main features to one skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of apparatus forming an embodiment of the invention.

FIG. 2 is a partial schematic and partial block diagram of one form of the driving and keying means for one note in the apparatus of FIG. 1.

FIG. 3 is a partial schematic and partial block diagram of one form of the scanner apparatus of FIG. 1.

FIG. 4 is a partial schematic and partial block diagram of the reset, controls, and gating apparatus of FIG. 1.

FIG. 5 is a partial schematic and partial block diagram of possible useful inhibiting interconnections and networks for the apparatus of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Keyboard 11 of FIG. 1 produces an output for each note of the musical scale whenever any of its playing keys for the respective note are operated in any octave location. Keyboard 11 may range from a pedal keyboard with 12 pedals operating switches to produce an output on any one of the 12 lines 12 to a manual section or even plural manuals having switches for the same notes in different octave locations tied together to produce outputs on any combination of the 12 lines 12. The outputs for the respective notes on lines 12 go to drivers 13 which are arranged in the well known circle of fifths, as are the outputs from keyboard 11.

Each line 12 goes to two adjacent drivers 13 so that each driver receives inputs for two notes adjacent around the circle of fifths. Drivers 13 have their respective note indicated in the upper section of the box and their respective pair of note inputs indicated in the lower section. The respective pair consists of the respective note and its musical fifth and drivers 13 are more sensitive to the input for their respective note than to the input for its fifth. Keyboard 11 includes means for controlling the level of outputs provided on lines 12 and so the responses of drivers 13. At a first level, drivers 13 will only operate if they are receiving both inputs. At a second level, drivers 13 will operate if they receive an input for their respective note. At a third level, drivers 13 will operate if they receive either input. The use to which these responses can be put will be discussed later.

The outputs of drivers 13 are applied via lines 14 to their respective keyers 15 which are shown as receiving inputs from two-tone generators 16 via lines 17. The two-tone generators 16 produce signals for notes which are adjacent around the circle of fifths and these signals are passed to lines 18 and 19 when the respective keyer 15 is operated by an output from its driver 13. Line 18 consists of two sections 18a and 18b which are connected together through switch 42 in the position shown and split apart in the other position for a purpose to be discussed later. The respective note, which may be considered the root part, is always passed to line 18 and its fifth, or the fifth part, to line 19. The outputs of drivers 13 on lines 14 also go to inhibiting networks 20 which produce outputs to inhibiting inputs of drivers 13 via lines 21. The output input links through networks 20 allows an operated driver 13 to inhibit the operation of one or more other drivers 13 in certain relationships to it. The effects of the links and various relationships possible will be discussed later.

Gates 22 and 23 receive signal inputs from lines 18 and 19 respectively and control inputs from automatic rhythm and control unit 24 via lines 25 and 26. Unit 24 also provides an output on line 27 to bass circuit 28. The control inputs on lines 25 and 26 occur at different times so gates 22 and 23 will pass their respective signal inputs from lines 18 and 19 to bass circuit 28 one at a time. The control inputs may be steady to pass one signal continuously or may occur in rhythmic patterns and various sequences. The control on line 27 may also be continuous or rhythmic and is necessary to the passage of signals by bass circuit 28. Circuit 28 may consist of one or more dividers to produce octave-lower outputs of the same notes as it receives for inputs and of percussion keying circuits to produce a variety of output characteristics.

Bass circuit 28 provides one output on line 29 to output system 30 and scanner 31 and another output on line 32 to

output system 30. The two outputs may be of different footages or other character which output system 30 can apply to its tone-forming circuits and selection switches for application to its sound transducer. Output system 30 also receives the signals on lines 18 and 19 directly and can similarly apply them to its tone-forming circuits and sound transducer through its selection switches. It will be recognized that the divider outputs of bass circuit 28 will only be useful if only single note signals are applied from gates 22 and 23. Gates 22 and 23 must only operate one at a time, so only one signal at a time must appear on each of lines 18 and 19. Accomplishment of the latter will be discussed later.

With signals corresponding to the root and fifth parts appearing singly on lines 18 and 19 respectively, the root and fifth parts can be sounding in various rhythmic patterns with operation of gates 22 and 23 and bass circuit 28 in response to signals from automatic rhythm and control unit 24 on lines 25, 26, and 27. The control signals can be produced by automatic rhythm means or by player operation of two pedals or other controls forming part of unit 24. The signals on lines 18 and 19 are the root and fifth parts in an intermediate pitch range and these can also be sounded by operation of the appropriate controls in output system 30.

Unit 24 also provides outputs on lines 33 and 34 to scanner 31 for another mode of playing. The output on line 33, which also goes to keyboard 11, turns scanner 31 on and sets the outputs of keyboard 11 at the second level where drivers 13 operate if they receive their respective note inputs. Turning on scanner 31 provides inhibiting voltages via cable 35 to all but one of drivers 13. Cable 35 also goes to generators 16 for use in another mode of operation to be discussed later. When scanner 31 runs, it removes the inhibiting voltage to each of drivers 13 in turn and any receiving the necessary input from their respective note out of keyboard 11 will operate in its turn. A pulse on line 34 starts scanner running and a signal on line 29 from bass circuit stops it until another pulse is received on line 34.

Scanner 31 is thus started at rhythmic intervals by pulses on line 34 and provides inhibiting inputs to all but one of drivers 13 in turn until one is reached which is receiving an input for its respective note from keyboard 11. The signal output then produced on line 29 then stops scanner 31 at that position and the respective note can sound until the next pulse on line 34 restarts scanner 31 and again moves it along to the driver 13 next producing a signal. The time required for scanner 31 to move from one to another of drivers 13 is very short so there is no perceptible delay between occurrence of a pulse on line 34 and the production of an audible output if any of drivers 13 are receiving inputs from keyboard 11. Gate 22 will be held on during this mode of operation so signals can pass immediately to line 29. Rhythmic pulses can, however, be applied to line 27 to produce percussive outputs on line 32.

Transient outputs which occur when keyers 15 are first turned on are applied to line 36 to drive reset circuit 37 which then produces a drive pulse on line 38 to discharge storage means in any previously turned on keyer 15. At the end of the pulse, the keyer 15 newly turned on can complete the charging of its storage device and produce a signal. This action is only necessary if sustaining of signals after release of playing keys on keyboard 11 is desired and is relatively standard in electronic organ bass systems. Reset drive 37 also produces pulse outputs on lines 39 and 40 to unit 24 and bass circuit 40. The pulse on line 39 can be used to reset the automatic rhythm means to restart its cycle which may include opening gate 22 to sound the root part first or producing a pulse on line 34 to immediately start scanner 31. The pulse on line 40 will reset bass circuit 28 or squelch its operation momentarily to avoid a transient in the output during the resetting operation.

Output system 30 also includes means for detecting when either line 18 or line 19 have two signals and when neither has a signal. This means produces an output on line 41 whenever these conditions obtain to bass circuit 28 and unit 24. This output squelches bass circuit 28 and switches control unit 24

to the mode of operation in which scanner 31 operates and so prevents the production of more than one signal in the bass at a time. This also varies bass playing automatically from sounding only the root fifth parts to sounding all parts of chords being played.

The apparatus of FIG. 1 provides for various modes of operation in playing bass. If keyboard 11 consisted of a pedal keyboard with interlocking means so only one output would be produced at a time and the output level was set for drivers 13 to respond only to their respective notes, the player could hold pedals operated for the roots of chords and have the root and fifth parts sounded in various rhythmic patterns by operation of gates 22 and 23 in response to drives from automatic rhythm and control unit 24 as was previously discussed. Intricate and active bass playing would thus be obtained simply by holding a pedal for the root of each chord in turn.

The output level from keyboard 11 for the pedal mode of operation could also be raised to that for which two adjacent drivers 13 would operate in response to each pedal. The sections 18a and 18b of line 18 would then be split apart by placing switch 42 in its other position. This also connects section 18b in place of line 19 and requires the use of only one section for each of keyers 15. Keyers 15 for the notes F, G, A, B, C0, and D0 connect to section 18a and keyers 15 for the remaining notes to section 18b. The root part would sometimes appear on section 18a and sometimes on section 18b with the fifth part always on the other section. Any distinguishing treatment of root and fifth parts would thus get reversed upon occasion unless additional means were added but there would be a possible economy in the simplifying of keyers 15 if only this mode of playing were desired.

In another mode of operation, keyboard 11 may consist of a manual, a section of manual, or even a combination of two or more manuals, providing a plurality of outputs when chords are played. With the output level set for response to respective notes only, scanner 31 can be operated to sound each of the notes in turn by permitting their associated drivers 13 to operate as was previously discussed. It is more generally useful, however, to have only the root and fifth parts sounded in the bass rather than all of the notes of the chord. This mode may be used when a walk around type of bass playing is desired or as a fill in or replacement when root fifth playing does not provide bass or would provide the wrong bass.

If the output of keyboard 11 is set so both outputs are necessary as inputs to operate a driver 13, then only those notes which are adjacent around the circle of fifths will cause a driver to operate and key the two notes to lines 18 and 19 respectively. The root and fifth in major and minor chords pass this requirement and so would be keyed to lines 18 and 19 respectively where they could be played in various ways as previously discussed. If four-part chords are to be played on the manuals, however, other combinations of parts will also form perfect fifth intervals and more than one driver 13 would be operated. This is prevented by the inhibiting feedback links through network 20 as will later be discussed.

If the output level of keyboard 11 is set so drivers 13 respond to their respective notes only, restriction to root and fifth parts can still be accomplished by the inhibiting action of network 20. More feedback links are required but there are some advantages and other disadvantages. The root part can be played in the bass without the fifth part being played in the chord and diminished fifth parts can be played as well as perfect fifths. Keyers 15 can be simplified to one channel each by splitting line 18 into sections 18a and 18b by operation of switch 42 as previously discussed but additional means would be necessary to determine which section 18a or 18b had the root part at any time. The diminished fifth part would be produced on the same section 18a or 18b as the root and inhibiting means must be used to prevent it or the playing must be done by scanner 31 operating on generators 16 to energize them one at a time via cable 35. As in the previously described operation, scanner 31 is started by pulses on line 34 and stopped by signal on line 29 which in this case would occur

when a generator 16 was turned on having a keyer 15 to line 18 receiving drive from an operated driver 13. Only one bass note can thus be produced at a time on line 18.

The apparatus of FIG. 5 shows the possibly useful feedback link which could be provided by network 20 of FIG. 1. A smaller number of links would be sufficient for most designs. The links from a driver 13 for the respective note C is shown as going through resistors 59 to the inhibiting inputs of eight other drivers 13. It will be understood that each driver 13 would have its output connected to similar links to other drivers 13 in the same relation to its respective note as those shown for C. The links shown will suffice for either or both types of operation for the two output levels from keyboard 11 which will hereafter be referred to as the perfect fifth mode and the respective note mode. Drivers 13 respond only to two adjacent notes around the circle of fifths for the first and to their respective notes only for the second.

In the perfect fifth mode, it is only necessary to be concerned with inhibiting other perfect fifth intervals which may be played along with the root and fifth of major and minor chords. For four-part chords, triads are not of concern, the perfect fifth intervals occur between the minor third and seventh parts in the very frequently used minor seventh chords and between the third and major seventh parts in major seventh chords. It will also be recognized that the same notes making up a minor seventh chord also constitute a major sixth chord on a different root. In this mode of operation, the apparatus of the invention assumes the combination of notes will represent the more frequently used minor seventh chord. A similar condition exists for the minor sixth chord and the so called flat fifth chord. The combination is then taken in this mode as the minor sixth chord with the perfect fifth interval being between the root and fifth parts. It will be recognized that the alternative choice could also be made.

The inhibiting link from the driver 13 for the note C to the driver 13 for its minor third, D $\flat$, prevents response to the other perfect fifth interval in the minor seventh chord having C as its root. This one inhibiting link would permit the playing of all triads and all four-part diatonic chords as well as many others. The link from C to its third, E, likewise prevents response to the other perfect fifth interval in the major seventh chord. The link from C to its fifth, G, does not inhibit G from being sounded as its fifth as G is keyed to line 19 by the other channel of the keyer 15 but it does prevent the driver 13 from being operated by the combination of G and D which is the second or ninth with respect to C. This link then permits the playing of ninth chords without upsetting the automatic playing of bass.

The links from C to its sixth, A, and its fourth or eleventh, F, would provide interactions as there would then be links from A to its minor third, C, and from F to its fifth, C. These can be useful, however, as the order of operation determines the action. If the notes C and G are played, driver 13 for C would be operated and later playing of A or F and their fifths would not operate their respective drivers because of the inhibiting drive from C. If A and E were operated first, C would be inhibited and the combination of notes C, E, G, and A could either be played as a C6 chord or an Am7 chord depending upon whether C and G or A and E were operated first on keyboard 11. The links to A0 and B would repress other perfect fifth pairs A0 and F and B and F0 in combination with C and G which could occur in C11 and C+11 chords. The link to D would add rejection of a sixth and ninth combination but would also mean a link from A0 to C and further dependence on the order of operation.

In the respective note mode of operation, links from C to D0 and A0 are necessary in the case of minor seventh chords if it is desired to have the root sound when the fifth is not played but the minor third and seventh are. Links to E and B permit the same response for the major seventh chord. The fifth or diminished fifth can be played in either case and the augmented fifth as well. The link to G would not be used as it would prevent the fifth from being played in this mode. Links

to D, A, and F would suppress the sounding of those notes in C chords, but, as in the previously described mode, would add links to C which would make the action dependent on the order of operation.

Referring now to FIG. 2, voltage control source 50 supplies line 51 with the level of output desired on lines 12 from keyboard 11 for the particular mode of operation. The level can be set in response to manual operation and in response to receipt of a voltage on line 33 when scanner 31 is operating.

The level is then set so the drivers 13 will respond to their respective notes. Switches 52 connect the voltage on line 51 to their respective lines 12 when operated by their respective playing keys 53. It will be recognized that more switches 52 could be added for each note and that other arrangements such as interlocking chain of double-throw switches to provide one output at a time from either the highest or lowest playing key could be used. Line 12 for the F output goes through a resistor 54 to the base of transistor 56 serving as a major component for the driver 13 for F, and through a resistor 55 to the base of transistor 56 for G (not shown). Line 12 for the C output goes through a resistor 55 to the base of transistor 56 for F and through a resistor 54 to the base of the transistor 56 for C (not shown).

The collector of each transistor 56 connects to a line 14 and to a positive supply through a resistor 57. The base of each transistor 56 connects to a line 21 from network 20, a line 35 from scanner 31, and to the positive supply through a resistor 58. The drive through resistor 58 holds transistor 56 well in saturation until a negative drive through resistor 54 or resistor 55 or both produced by operation of a switch 52 pulls it to cut off. Resistors 54 are smaller than resistors 55 so less negative voltage on bus 51 is necessary to pull transistors 56 for the respective notes than for also pulling the one for the fifth. Less voltage still is necessary to permit drive through both resistors 54 and 55 to pull a transistor 56 out of saturation. Scanner 31 provides positive drive to hold all except one stage at a time in saturation against all pull off drives via lines 35.

Line 14 goes to network 20 and through diode 60 to the junction of resistors 61 and 62 with capacitor 63 and diode 64. The other ends of resistors 61 and 62 connect through resistors 65 and 66 to lines 18 and 19 respectively and through diodes 67 and 68 to generators 16 for F and C respectively. Turn off of transistor 56 provides a positive going voltage on line 14 which forward biases all diodes and keys the signals of generators 16 for F and C to lines 18 and 19 respectively. It also provides a positive going signal through capacitor 63 to line 36 to reset drive 37 which then momentarily lowers the voltage on line 38 to discharge all capacitors 63 for any previously operated stages. This delays the keying of the generator 16 signals until the discharge pulse ends. The charge on capacitor 63 after the key 53 is released sustains the keying for a short period. If the sustain action is not desired, capacitor 63 and diodes 60 and 64 could be eliminated.

FIG. 3 shows one possible form for scanner 31 in which flip-flop 80 is set by a pulse on line 34 and reset by a signal on line 29. Oscillator 81 runs when flip-flop 80 is set and stops when it is reset. Flip-flops 82 through 85 function as a binary counter driven by oscillator 81 when they receive a supply voltage on line 33. The outputs of flip-flops 82 through 85 on lines 86 are connected together in 12 combinations by resistors 87 to provide the scanner outputs on lines 35. The two combinations for the notes F and C are shown by way of example. Each combination includes one of the outputs from each flip-flop 82 through 85 and so one or more resistors 87 will be providing a positive drive from one or more outputs except when a particular count is registered by the counter for the combination. The four outputs in the combination will then have zero output and no positive drive will be provided.

The drive voltage and the size of resistors 87 must be such that transistors 56 or other means used for drivers 13 will be held in the nonoperated condition despite pulloff drives. Generators 16 could include a clamping stage like transistor 56 so one at a time would operate in response to the same

drive. When scanner 31 is not operating, the saturating drive must be removed so the other modes can operate. Removal of the voltage on line 33 also removes the drive to resistors 87 by removing the supply voltage and so the source. Four of the counter positions are not used but the scanning speed is sufficiently fast to avoid perceptible delays in signal sounding as scanner 31 moves between operated stages.

Referring now to FIG. 4, line 36 to which capacitors 63 of FIG. 2 are connected is applied to the base of transistor 100. Transistor 100 is a PNP type and has its emitter grounded and its collector and base connected to a negative supply through resistors 101 and 102 respectively. Resistor 102 is sized to hold transistor 100 well in saturation except when providing peak charging current for a capacitor 63. The negative pulse on the collector of transistor 100 when this occurs is applied to trigger one shot multivibrator 103 which then provides a short negative pulse on line 38 to discharge all capacitors 63 and on line 40 to squelch bass circuit 28. Multivibrator 103 further provides a positive pulse at the same time on line 39 to reset automatic rhythm device 104 and flip-flop 114. After the end of the one shot cycle, the capacitor 63 can resume charging and the negative pulse on the collector of transistor 100 will not retrigger multivibrator 103 due to its temporarily reduced sensitivity to trigger.

One output of automatic rhythm generator 104 goes directly to lines 27 and 34 and has a pulse each time either of the other two outputs have a pulse. The other two outputs never have pulses at the same time and are applied to lines 25 and 26 through switch 105 in the position shown. When switch 105 is in the other position, lines 25 and 26 receive drives instead from switches 106 and 107 respectively when they are operated by root and fifth pedals 108 and 109 respectively. Lines 25 and 26 can thus be activated by device 104 or by the player through pedals 108 and 109. As previously discussed, lines 25 and 26 control gates 22 and 23 for root fifth part playing. Automatic rhythm device 104 may consist of a multivibrator with a reset circuit responsive to pulses on line 39 and a means for producing a pulse with each change of state to lines 27 and 34. The two other outputs could be taken from the two sides of the multivibrator.

The connections to line 26 have resistor 110 and switch 111 interposed so its drive can be removed when gate 23 is not to be operated. Diode 112 to the arm of switch 113 clamps line 26 positive and line 33 is held positive when switch 113 connects to the positive supply. A negative drive is considered necessary to turn on gates 22 and 23. The positive voltage on line 33 starts scanner 31 or rather enables its operation and the positive clamp prevents gate 23 from operating. When switch 113 is connected to flip-flop 114, it may receive a positive or negative voltage depending on the state of flip-flop 114. With no voltage or a negative voltage, scanner 31 does not operate and gate 23 can respond to negative pulses on line 26.

Flip-flop 114 does not produce a voltage on line 33 to operate scanner 31 when it is reset by a positive pulse on line 39. The apparatus can then be in condition for root fifth playing with gate 23 also responsive to drives on line 26. The 0 or 2 circuit 115 receives signal inputs from lines 18 and 19 and produces a positive output to set flip-flop 114 if no signal is being received or if two signals are being received on either of lines 18 or 19. If a signal is appearing on each line 18 and 19, no output will be produced and flip-flop 114 will remain in the reset condition. When flip-flop 114 is set, it clamps line 26 and supplies a voltage to operate scanner 31 via line 33. All notes are then played in the bass until the next operation of a playing key 53 again triggers multivibrator 103 and resets flip-flop 114. Root and fifth parts are then played until no signal or two signals on one of lines 18 or 19 again sets flip-flop 114. Circuit 115 can also be set to only produce an output when two signals are present on one of lines 18 or 19 and thus switch from root and fifth playing only when the bass signal would be scrambled by two signals at the same time.

I claim:

1. In an electronic musical instrument having a sound transducer, a set of controls, and means for sounding musical notes responsive to operation of said controls, the combination of:

means for enabling bass notes individually responsive to operation of lack of a plurality of said controls; and means for producing signals for said enabled bass notes one at a time in turn to drive said sound transducer.

2. The combination according to claim 1 including means responsive to operated enabling means for inhibiting operation of other enabling means.

3. The combination according to claim 1 wherein said producing means includes means for generating a series of rhythmic signals and means for keying said enabled bass notes one at a time responsive to said generating means.

4. The combination according to claim 1 wherein said producing means includes means for scanning said enabling means to permit operation of each in turn.

5. The combination according to claim 4 wherein said producing means further includes a source of rhythmic signals, means for detecting operation of any of said enabling means, and means for controlling said scanning means to start in response to a signal from said source and to stop in response to said detecting means.

6. In an electronic musical instrument having a sound transducer, a set of playing controls for the notes of a musical scale, and means for sounding musical notes responsive to operation of said controls, the combination of:

means for enabling bass notes individually responsive to operation of a pair of said controls for notes in perfect fifth relation to each other; and

means for producing signals for said enabled bass notes one at a time to drive said sound transducer.

7. The combination according to claim 6 including means responsive to operated enabling means for inhibiting operation of other enabling means.

8. The combination according to claim 6 wherein said enabling means enables bass notes in pairs adjacent to each other around the circle of fifths and including means for inhibiting the sounding of bass notes a minor third above or minor sixth below each of said enabled bass notes.

9. The combination according to claim 6 including means for switching responsiveness of said enabling means from pairs to individual controls when no bass notes are enabled.

10. The combination according to claim 9 wherein said enabling means responds only to one of said operated controls at a time and enables a pair of bass notes adjacent to each other around the circle of fifths.

11. The combination according to claim 6 wherein said enabled bass notes are always a pair adjacent to each other around the circle of fifths.

12. The combination according to claim 11 including a pair of special controls for individually sounding said enabled bass notes through operation of said producing means.

13. The combination according to claim 11 including means for obtaining signals in an intermediate pitch range for said enabled bass notes to drive said sound transducer.

14. The combination according to claim 11 wherein said producing means is resettable and starts with the enabled bass note corresponding to the root part after resetting and including means for resetting said producing means responsive to each change of said enabling means.

15. The combination according to claim 11 wherein said producing means includes means for generating a series of rhythmic signals and means for keying said enabled bass notes alternately responsive to said generating means.

16. The combination according to claim 6 including means for limiting the operation of said enabling means to one at a time.

17. The combination according to claim 6 wherein the bass notes produced are the roots of the pairs of notes for said controls operating said enabling means.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3548066 Dated December 15, 1970

Inventor(s) ALFRED B. FREEMAN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 1, line 6, "lack" should be -each-.

Signed and sealed this 28th day of September 1971.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Pa