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Hebeisen et al.

[11] **3,823,246**

[45] **July 9, 1974**

[54] **CHORD PLAYING ORGAN INCLUDING A CIRCUIT ARRANGEMENT FOR ADDING FILL-IN NOTES TO THE SOLO PART**

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[51] **Int. Cl.** **G10h 1/00**

[58] **Field of Search** ..... 84/1.01, 1.03, 1.17, 1.24, 84/DIG. 22, DIG. 23, DIG. 25

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Attorney, Agent, or Firm—Melvin A. Crosby

[57] **ABSTRACT**

An electronic organ which is selectively adjustable between conventional playing and chord playing modes and in which chord playing mode at least certain ones of the keys of the accompaniment manual key groups of notes which make up chords. When the organ is adjusted into chord playing mode, the depressing of a single chord playing key and a single solo key will actuate circuitry that causes added notes to be sounded inthe solo and which are musically related to the solo note being played and to the chord being played and which are preferably within about an octave range of the solo note being played.

21 Claims, 3 Drawing Figures

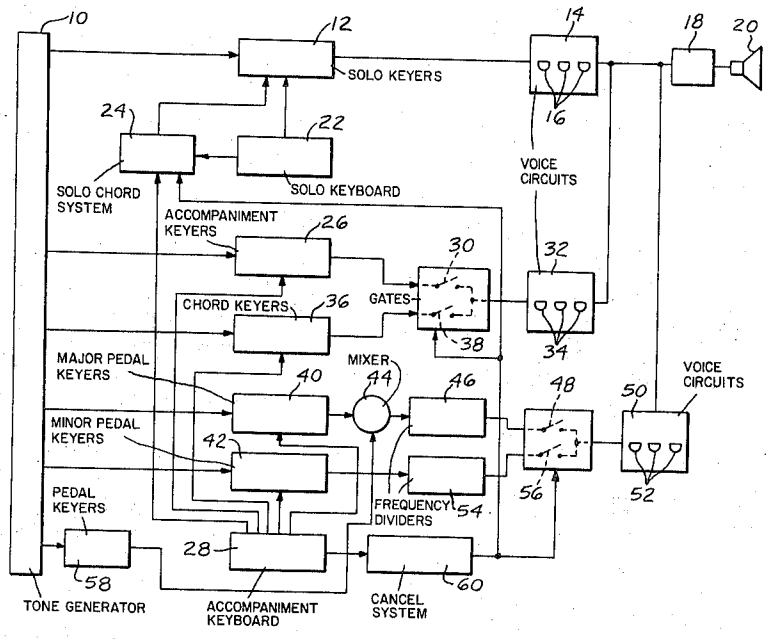


FIG-1

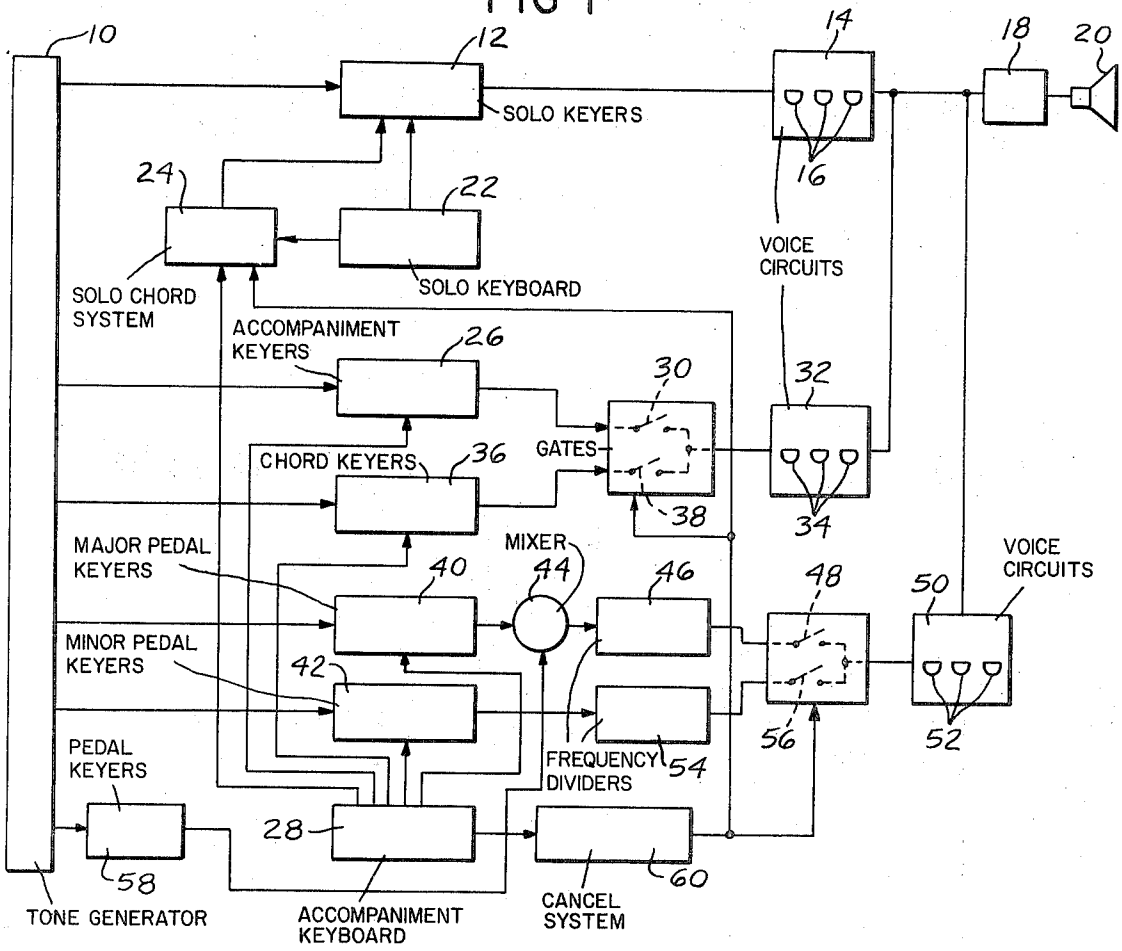

10
12
14
18
20
SOLO KEYERS
16
24
22
VOICE CIRCUITS
SOLO CHORD SYSTEM
SOLO KEYBOARD
ACCOMPANIMENT KEYERS
26
30
32
GATES
CHORD KEYERS
36
38
34
MIXER
MAJOR PEDAL KEYERS
40
44
46
48
50
VOICE CIRCUITS
MINOR PEDAL KEYERS
42
56
52
FREQUENCY DIVIDERS
54
PEDAL KEYERS
28
58
60
TONE GENERATOR
ACCOMPANIMENT KEYBOARD
CANCEL SYSTEM

FIG-3

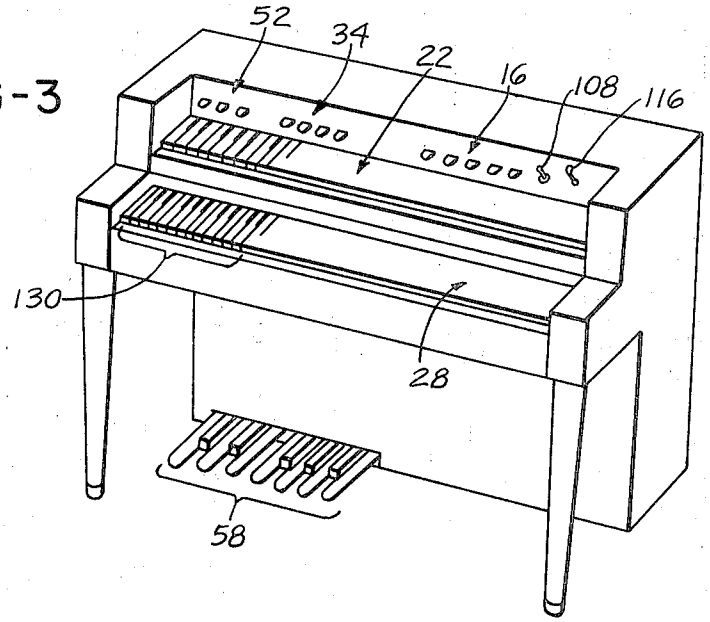
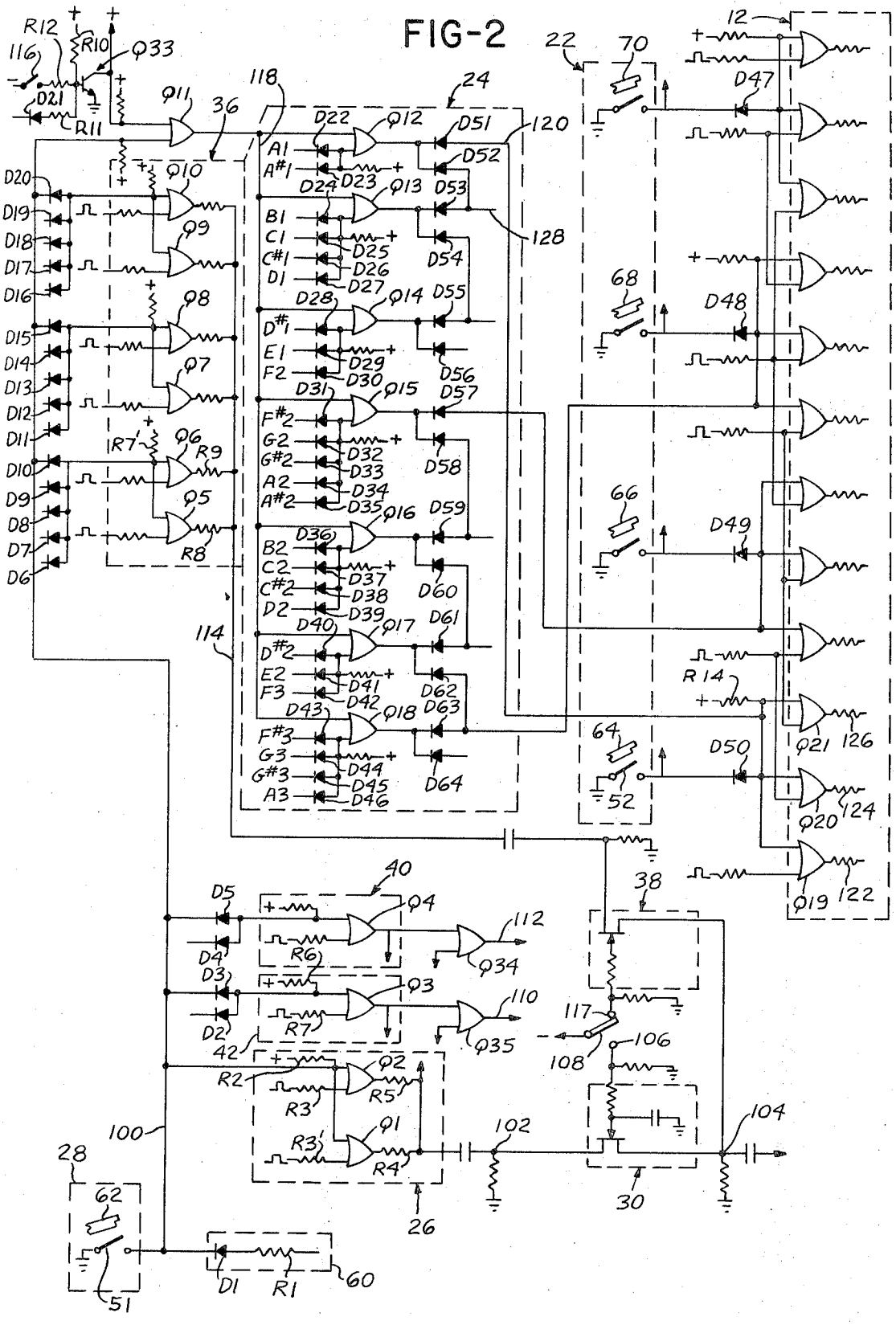

52
34
22
16
108
116
130
28
58

FIG-2


R12
R10
Q33
116
D21
R11
Q11
36
118
24
D22
Q12
D51
120
A1
A#1
D24
D23
Q13
D52
D53
B1
C1
C#1
D1
D25
D26
D27
D54
128
D28
Q14
D55
D#1
E1
F2
D29
D30
D56
D31
Q15
D57
F#2
G2
G#2
A2
A#2
D32
D33
D34
D35
D58
Q16
D59
D36
B2
C2
C#2
D2
D37
D38
D39
D60
D40
Q17
D61
D#2
E2
F3
D41
D42
D62
D43
Q18
D63
F#3
G3
G#3
A3
D44
D45
D46
D64
114
D20
D19
D18
D17
D16
D15
D14
D13
D12
D11
D10
D9
D8
D7
D6
Q10
Q9
Q8
Q7
Q6
Q5
R7'
R9
R8
22
70
D47
68
D48
66
D49
64
D50
52
R14
Q21
126
Q20
124
Q19
122
12
40
D5
D4
D3
D2
Q4
Q3
R6
R7
112
110
Q34
Q35
42
R2
R3
R3'
R4
R5
Q2
Q1
100
102
104
38
117
108
106
30
28
62
51
D1
R1
60
26

CHORD PLAYING ORGAN INCLUDING A CIRCUIT ARRANGEMENT FOR ADDING FILL-IN NOTES TO THE SOLO PART

The present invention relates to electronic organs and is particularly concerned with a circuit arrangement for an electronic organ which automatically adds, or fills in, selected notes, especially for the solo, during the playing of the organ.

Electronic organs are, of course, well known and consist, generally, of solo and accompaniment keyboards and a pedal keyboard with each key of the keyboards controlling a respective note.

In conventional playing, only those notes will sound which pertain to the keys of the keyboards that are depressed. Thus, if a chord is to be played in the accompaniment, all of the keys pertaining to the notes of the chord must be depressed. Similarly, if more than one note is to be sounded in the solo manual, a corresponding number of key of the solo manual must be depressed.

Accomplished organ players can augment the solo part of a composition being played by adding notes thereto during playing, especially notes corresponding to notes in the chord which is being played in the accompaniment. The added notes in the solo part, often referred to as "fill-ins" are not usually scored in the written music, but are provided by the player during playing by depressing the proper keys when playing the solo part of the composition.

It will be apparent that the proper supply of such fill-in notes during playing requires considerable skill and practice and can be done in a proper manner only by an accomplished player.

For the reason that much skill is required to supply such fill-in notes during playing, a novice, or a less than accomplished player, can loose a great deal during the playing of a composition and can, if attempting to supply the fill-in notes, easily depress the wrong key and obtain undesired dissonant effects.

With the foregoing in mind, a primary objective of the present invention is the provision of a circuit arrangement for an electronic organ in which fill-in notes can automatically be supplied in the solo manual during the playing of a composition.

Still another object of the present invention is the provision of an organ circuit in which the accompaniment manual is integrated with the solo manual in such a manner as to cause fill-in notes to be sounded in the solo manual when a key therein is depressed while a chord is being played in the accompaniment manual.

A still further object is the provision of a circuit arrangement of the nature referred to in which dissonant effects are automatically eliminated.

Another object of the present invention is the provision of an organ circuit arrangement in which the playing of a single note in the accompaniment manual results in the sounding of a chord while automatically preparing circuits for notes in the solo manual which will sound when a key of the solo manual in the next octave thereabove is depressed.

These and other objects and advantages of the present invention will become more apparent upon reference to the following detailed specification taken in connection with the accompanying drawings in which:

FIG. 1 is a highly schematic view of an entire organ circuit according to the present invention shown in block diagram form.

FIG. 2 is a schematic representation of basic circuitry pertaining to the organ.

FIG. 3 is a schematic representation of an organ embodying the circuitry of the present invention.

BRIEF SUMMARY OF THE INVENTION

According to the present invention, the routing of signals in the organ circuit is accomplished by integrated circuit gates which are referred to herein as keyers when the routed signals are tone signals. When a control signal is routed, the component is referred to as a gate. Each gate, or keyer, has two inputs and is under the control of two sources of signals, both of which are control signals in the case of a gate, while in the case of a keyer, one of the signals is a control signal and the other is a tone signal.

By using keyers and gates of the nature referred to, the pressing of a single key in the accompaniment manual can be caused to supply signals to one input of a plurality of gates for the solo manual which, in turn, supply control signals to pertaining solo keyers.

The other input of the last mentioned gates is supplied by solo manual keys. Each gate has an output connected to one input of a respective group of solo keyers while each solo key of the solo keyboard also supplies an input to a respective group of solo keyers.

Thus, a key in the accompaniment manual prepares gates which are enabled by solo keys for actuating solo keyers related to the respective solo keys. Each accompaniment key of a selected group can also control chords and pedal tones.

The organ can be adjusted to play in any of several modes, including conventional mode.

The tone signals are in the form of square waves and, when supplied to one input terminal of keyer, will influence the output of the keyer only when the other input terminal of the keyer is at a logic 0. A keyer is, accordingly, disabled when one input terminal is held at a logic 1. The OR gates preceding a keyer, thus, enable keyers when supplying a logic 0 thereto and disable the keyers when supplying a logic 1 thereto. The keyers themselves are, also, as mentioned, in the form of OR gates.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings somewhat more in detail, and in particular to the schematic block diagram of FIG. 1, 10 indicates a tone generator which produces square waves at a plurality of output terminals at respective frequencies, and all of which terminals are not shown.

One group of output terminals from tone generator 10 is connected to the solo keyers indicated by block 12 and the outputs from these keyers are supplied to the solo voicing circuits, indicated at 14, which are under the control of the respective tab switches 16. From the tab switches, the outputs go to amplifier means 18 and finally to speaker means 20.

The solo keyers are under the control of the solo keyboard indicated at 22 and made up, in the customary manner, of a plurality of keys which supply enabling signals to the individual keyers of the group of solo keyers.

The solo manual also supplies signals to a solo chord system schematically indicated at **24** and which, in turn, when enabled, supplies enabling signals to the solo keyers **12.**

Generator **10** also supplies signals to the accompaniment keyers **26** which are under the control of the accompaniment keyboard indicated at **28.** The output from keyers **26** is routed through a switch, or gate, **30** and the accompaniment voicing circuits **32** with the respective tab switches **34** to the input of amplifier means **18.**

The accompaniment notes are also under the control of a further group of keyers **36** referred to as accompaniment chord keyers with these keyers also under the control of a certain group of chord playing keys of the accompaniment manual **28** and with the output of keyers **36** being routed through a switch, or gate, **38** to the accompaniment voicing circuits **32.**

The generator **10** also supplies signals to major pedal keyers **40** and minor pedal keyers **42** with the output of major keyers **40** passing through a mixer **44** and a set of frequency dividers **46** and a control switch, or gate, **48** to the pedal voicing circuits **50** having control tab switches **52.** The pedal tones are then supplied to the input of amplifier means **18.**

Similarly, the output from the minor pedal keyers is supplied to a respective set of frequency dividers **54** and then through a respective switch, or gate, **56** to the pedal voicing circuit **50.**

The pedal keyboard also comprises direct keying, by the keyers at **58,** the output from which is supplied to the aforementioned mixer **44.**

The major and minor pedal keyers **40** and **42** are also under the control of the chord playing keys of the accompaniment manual **28** as is also the aforementioned solo chord system **24.**

Accompaniment manual **28** is also connected to a cancel system **60** which detects the depressing of more than one of the chord playing keys at one time when the organ is adjusted to play in chord mode, and thereby disables switches, or gates, **38, 48** and **56** and solo chord system **24** in order to prevent dissonance in the event that more than one chord playing accompaniment key is depressed.

Such a cancel circuit is illustrated in the Hebeisen et al. U.S. Pat. No. 3,708,604 and consists, fundamentally, of an AND gate which detects a condition of two keys depressed at one time and generates a disabling signal for use in cancelling certain functions of the organ.

The accompaniment keyboard, according to the present invention, is arranged for the keying of a single note upon the depressing of each key while a certain portion of the keys of the accompaniment manual, for example, a group thereof near the left end of the accompaniment manual keyboard, and referred to herein as chord playing keys, are arranged for selectively playing chords. When the organ is adjusted so the chord playing keys will sound chords, the keys of the accompaniment keyboard are disabled in respect of playing the individual notes normally pertaining thereto. Thus, when the accompaniment keys are enabled for playing single notes, the chord playing system is disabled, and vice versa.

Thus, it will be seen that in one mode of operation, namely, conventional mode, each accompaniment key keys a single note and in another mode of operation, namely, chord mode, at least selected ones of the accompaniment manual keys will key chords while the other accompaniment manual keys are preferably disabled. It might be mentioned that the chords keyed in this manner do not necessarily contain the note normally associated with the chord playing key which causes the chord to sound but may consist of any chord which it is convenient to have associated with the respective key.

In the foregoing, where reference is made to the keying of single notes by a single key, it will be understood that all ranks of the respective note pertaining to the keyboard are normally keyed when a single key is depressed, and of the notes thus keyed, those will sound which pertain to voicing circuits of the accompaniment manual having closed tab switches.

Turning now to FIG. **2,** a greatly simplified system is illustrated with components of FIG. **1** identified by the same numerals applied to the dashed outline blocks. In FIG. **2,** a single key of the accompaniment manual **28** is indicated at **62** while a series of keys of the solo manual **22** are indicated at **64, 66, 68** and **70** respectively. No pedal keys are shown in FIG. **2.**

The circuit of FIG. **2** contains a plurality of keyers and gates, all of which are in the form of two input OR gates. When one input of a respective gate is a tone signal, the gate is referred to as a "keyer." When the gate supplies an output for the control of another gate, or a keyer, it is referred to as a "gate." In addition, a pair of FET swtiches are shown which operate as gates and which are referred to as "gates."

Key **62** controls a switch **51** which closes when the key is depressed to connect line **100** to ground. This line is connected through a diode **D1** and a resistor **R1** to the cancel system **60** so that if two keys are depressed, simultaneously, the cancel system will disable certain parts of the system. Wire **100** is also connected with one input of each of two keyers **Q1** and **Q2** which form the keyers that are normally under the control of key **62.** The input connected to wire **100** is connected with a plus source of voltage through a resistor **R2.**

The other input of each of the keyers **Q1** and **Q2** is connected through a respective resistors **R3** and **R3'** with a respective source of tone signals which might comprise, for example, the fundamental of the tone pertaining to key **62** and the second harmonic thereof.

The outputs of keyers **Q1** and **Q2** are supplied through respective resistors **R4** for **Q1** and **R5** for **Q2** to a line **102** leading to the input terminal of gate **30,** the output terminal of which is connected by wire **104** to the input sides of the accompaniment voicing circuits. The gate **30** shown in FIGS. **1** and **2** precedes the accompaniment voicing circuits.

Gate **30** may be an FET transistor and the control terminal thereof is connected to a switch terminal **106** adapted for engagement by blade **108** of a switch and which blade is connected to a source of negative potential.

In normal playing of the organ, key **62** controls keyers **Q1** and **Q2** while the other gates and keyers connected thereto are disabled.

Wire **100** is also connected through a diode **D3** with one terminal of a keyer **Q3** and which terminal is also connected through a resistor **R6** to a plus source. The other terminal of keyer **Q3** is connected by resistor **R7** with a source of minor pedal tone signals while the out-

put of the keyer is connected to one input terminal of a control gate Q35, the other terminal of which is connected to a control switch selectively operable for disabling the gate.

The output of gate Q35 is connected by wire 110 with the previously referred to pedal divider board 54. In normal playing, the gate Q35 is disabled and is only enabled when the organ is adjusted for playing pedal tones automatically when an accompaniment manual key is depressed.

Wire 100 is, furthermore, connected through a diode D5 with one input of a keyer Q4, the other input of which is connected to receive major pedal tones signals. The output of keyer Q4 is connected to one input of a gate Q34, the other input of which is connected to a control switch, which is selectively operable for disabling the gate, while output of the gate is connected by wire 112 with the major pedal divider board 46 referred to in respect of FIG. 1.

As in connection with gate Q35, gate Q34 is disabled during conventional organ playing.

Keyer Q3 is also adapted for being controlled from another accompaniment key switch via diode D2 and, in respect of keyer Q4, another control can be had via a diode D4.

With regard to the chording functions of key 62, this is accomplished by the chord keyers generally indicated in the dashed outline box at 36. Commencing from the bottom of the box and working upwardly there is a first keyer Q5 associated with second keyer Q6. Each of these keyers, and which are in the form of "OR" gates, receive at one terminal signals pertaining to the respective rank of a tone while the other input terminal is connected to a positive source by way of a resistor R7' and is also connected by way of a diode D10 with wire 100.

The outputs of keyers Q5 and Q6 are supplied through respective resistors R8 and R9 to a wire, or buss, 114 which leads to the input side of gate 38 referred to in respect of FIG. 1, the output side of which is connected to wire 104. Gate 38 comprises an FET transistor and the control terminal thereof is connected to a terminal 117 pertaining to switch 108. It will be seen that when switch blade 108 is in one position, signals on wire 102 will pass through gate 30, and when it is in the other position, signals on wire 114 will pass through gate 38 to wire 104.

The inputs of gates Q5 and Q6 supplied by diode D10 are also adapted for being supplied via diodes D6, D7, D8 and D9, each of which leads to a respective key operated switch of the accompaniment manual corresponding to switch S1 pertaining to key 62. The note supplied to buss 114 via keyers Q5 and Q6 may be, for example, the note, E.

Similar keyers are provided at Q7 and Q8 for the note G, and still other keyers are provided at Q9 and Q10 for the note C. The keyers Q7 and Q8 are adapted for having one input thereof controlled via diode D15 leading to wire 110 and via diodes D11, D12, D13 and D14 leading to other key controlled switches.

Similarly, keyers Q9 and Q10 have the one input terminal connected through a diode D20 with wire 100 and through diodes D16, D17, D18 and D19 with switches pertaining to other keys of the accompaniment manual.

The outputs of all of the keyers contained in the group of chord keyers 36 are supplied via respective resistors to buss or wire 114.

Wire 100 is, furthermore, connected to one input of a gate Q11 of which one input terminal is connected through a resistor to a positive source while the other terminal of gate Q11 is also connected through a resistor to a positive source and is, furthermore, connected to the collector of an NPN transistor Q33 having the emitter grounded. The base of transistor Q33 is connected through a resistor R10 to a source of plus voltage and through a resistor R11 to a diode D21 forming a part of the aforementioned cancel circuit 60.

Still further, the base terminal of transistor Q33 is connected through a resistor R12 with a terminal on which a switch blade 116 is adapted to close, the said switch blade being connected to a source of minus potential. It will be apparent that transistor Q33 is normally conductive when blade 116 is open thereby holding the terminal of gate Q11 which is connected to the collector of the transistor at zero. Closing of blade 116, however, will drive transistor Q33 to nonconduction and the aforesaid terminal of gate Q11 will go to a 1 value.

Similarly, actuation of the cancel circuit will cause transistor Q33 to go to nonconduction. Gate Q11 is an OR gate and will have a 1 output whenever either input terminal is at 1.

Turning now to the solo chord system, or the system which supplies fill-in notes to be played when a key is depressed in the solo manual, reference may be had to the dashed outline marked 24 in FIG. 2. This shows a part of the control gates pertaining to the fill-in system associated with accompaniment manual key 62.

The output of gate Q11 is connected to a wire 118 which leads to one terminal of each of the gates Q12 through Q18. The gates Q12 to Q18 are effectively disabled whenever wire 118 is at a 1 value. The other control terminal of each gate is connected through a respective resistor to a plus source and is, furthermore, connected through diodes with key operated switches pertaining to the solo manual.

For example, the other terminal of gate Q18 is connected through diode D46 with a switch pertaining to a key of the solo manual that can be designated A3 and also through a diode D45 with a switch pertaining to a key of the solo manual that can be identified as G # 3 and also through a diode D44 with a switch pertaining to the key G3 of the solo manual and, still further, through a diode D43 with the switch pertaining to the note F # 3 of the solo manual.

The other input terminal of gate Q17 is similarly connected with respective key switches, notes D # 2, E2 and F2 of the solo manual through diodes D40, D41 and D42.

Q16 has the other input terminal, similarly connected through diodes D36, D37, D38 and D39 with respective solo manual key switches for notes B2, C2, C # 2 and D2. Gate Q15 has the other input terminal connected via diodes D31, D32, D33, D34 and D35 to the solo manual key switches for notes F # 2, G2, G # 2, A2 and A # 2.

Gate Q14 has the other input terminal connected via diodes D28, D29 and D30 with the solo manual key switches for notes D # 1, E1 and F1, gate Q13 has diodes D24, D25, D26 and D27 connecting the other input terminal to solo key switches for notes B1, C1,

C # 1, and D1, and gate Q12 has diodes D22 and D22 connecting the other input terminal to solo keyer for notes A1 and A # 1.

In the note designations given above, the numerals 1, 2 and 3 indicate respective octaves. Thus, note A1 is in one octave, note A2 is in the next adjacent octave, and note A3 is in the next octave. Usually, the higher numeral indicates a higher note so that A1 is the lowest note shown and A3 is two octaves higher.

It will, at this point, be perceived that each of the gates Q12 to Q18 is subject to the joint control of the output of gate Q11 and the output of from two to five solo key switches. Each of gates Q12 and Q18 will supply an enabling signal only when both inputs are at zero and if either input is at 1, no enabling signal is supplied at the output.

Each of the gates Q12 to Q18 has two outputs, and the outputs pertaining to only one of the gates will be described. The output of gate Q12, for example, is connected through diode D51 with a wire 120 which leads to one terminal of each of three keyers Q19, Q20 and Q21, with the said terminals normally being held positive by way of a resistor R14.

The other terminal of keyer Q19 is connected to a source of tone signals, specifically, one rank of the note C, for example, the 16 foot rank. The second terminal of keyer Q20 is connected to a source of tone signals and which may be another rank of the note C, for example, the 8 foot rank. The other input terminal of keyer Q21 is connected to still another source of tone signals and which may be still another rank of the note C, for example, the 4 foot rank.

The output of keyer Q19 is supplied to a wire 122 leading to the solo voicing circuits, and this wire may constitute a 16 foot buss. Similarly, the output of keyer Q20 is connected to a wire 124 also leading to the solo voicing circuits and this wire may constitute an 8 foot buss. Still further, the output of keyer Q21 is connected to a wire 126 which may comprise a 4 foot buss and which leads to the solo voicing circuits.

Each of the three keyers is also connected to a respective switch 52 operated by solo key 64 and which controls keyers Q19, Q20 and Q21 via an isolating diode D50.

The aforementioned output side of gate Q12 is also connected through a diode D52 with a wire 128 which leads to a solo keyer system which might be, for example, the system pertaining to an E note. Wire 128 is connected to keyers pertaining to the key of E in the same manner as wire 120 is connected to keyers pertaining to the note of C.

The other outputs of gates Q12 to Q18 are connected through the diodes identified from D53 to D64 to various keyers pertaining to the solo manual in conformity with the legends shown on the drawings.

At this point, let is be assumed switch blade 108 is so adjusted that gate 38 is enabled and gate 30 is disabled and that switch blade 116 is open.

Disabling of gate 30 effectively disables at least the chord playing keys of the accompaniment manual in respect of the notes conventionally played thereby. Enabling of gate 38, at the same time, enables the selected group of keys of the accompaniment manual which form the chord playing keys, only one of which is shown in FIG. 2 at 62.

If, now, key 62 of the accompaniment manual is depressed to close its switch 51, wire 100 will go to ground. When wire 100 goes to ground, keyers Q1 and Q2 will be enabled, but signals therefrom cannot pass through disabled gate 30 so that the keyers are, in effect, disabled.

The keyers Q3 and Q4 pertaining to the pedal notes C and G, forming the fundamental and the fifth of the C chord, are, however, enabled and signals therefrom can pass to gates Q34 and Q35 and through the gates if these gates are enabled.

Grounding of wire 100 by closing of switch S1 also causes the control terminal of each of keyers Q5 to Q10 to go to zero so that the output sides thereof are under the control of the square wave tone signal supplied to the other inputs thereof and wire 114 will be supplied with a composite signal from the several keyers Q5 to Q10 making up the chord played.

In the particular portion of the chord keyers 36 illustrated, keyers Q9 and Q10 key C notes, keyers Q7 and Q8 key G notes and keyers Q5 and Q6 key E notes. The chord supplied to buss, or wire, 114 when accompaniment key 62 is depressed is, thus, a C chord. This chord, in turn, passes through the now enabled gate 38 to wire 104 and thence to the accompaniment voicing circuits.

Others of the selected group of chord playing accompaniment keys key respective chords in a like manner.

Simultaneously with the foregoing, grounding the wire 100 causes one input terminal of Q11 to go to zero and, since transistor Q33 is conductive, due to switch blade 116 being adjusted to open position, the other input terminal of gate Q11 is also at zero, and the output of Q11 will go to zero and make the one input terminal of each of the solo chord gates Q12 to Q18 go to zero. The other input terminals of these gates are normally at 1 so that the outputs of gates Q12 to Q18 will all remain at 1 until a solo key is depressed.

If, now, a key of the solo manual is closed, say, the key A1 or A # 1, then the other input terminal of gate Q12 will go to zero and the output terminal thereof will also go to zero and wires 120 and 128 will go to zero. When wire 120 goes to zero, keyers Q19 and Q20 and Q21 are all enabled and the tone signals pertaining thereto, namely, three ranks of the note C, will be supplied to the respective output lines 122, 124 and 126 and pass on to the solo voicing circuits.

At the same time, when wire 128 goes to zero, keyers pertaining to the note of E will be enabled so that not only is the note C supplied to the solo voicing circuits but also the note E. These notes will sound together with the note pertaining to the actuated solo key, in this case, an A, or an A # .

When a chord is produced by depressing one of the selected group of accompaniment keys which play chords, certain fill-in notes are caused to sound, in the manner described above, upon the depressing of a solo key. The fill-in notes are preferably added in the octave immediately below the depressed solo key.

The following chart shows a typical series of accompaniment chords in the left hand column with the chords identified by name while in parentheses, immediately below the chord name, are the specific accompaniment notes that are played to develop the chord sound.

In the center column of the chart, the notes of an octave of solo keys are indicated, divided into three rows and in the third column across from each row in the

middle column, are the fill-in solo notes which are added with a solo key of the pertaining row in the center column is depressed at the same time that the indicated accompaniment chord is activated by the respective chord playing key of the accompaniment manual.

ACCOMPANIMENT CHORD ACTIVATED	IF THIS SOLO KEY IS DEPRESSED	THESE SOLO NOTES ARE ADDED IN THE OCTAVE BELOW THE DEPRESSED SOLO KEY
Am	D♯ or E or F or F♯ or G	A and C
(A C E)	G♯ or A or A♯	C and E
	B or C or C♯ or D	E and A
D_7	G♯ or A or A♯ or B or C	D and F♯
(D F♯ C)	C♯ or D or D♯ or E	F♯ and A
	F or F♯ or G	A and D
G	C♯ or D or D♯ or E or F	G and B
(G B D)	F♯ or G or G♯ or A	B and D
G_7	A♯ or B or C	D and G
(F B D)		
C	F♯ or G or G♯ or A or A♯	C and E
(C E G)	B or C or C♯ or D	E and G
C_7	D♯ or E or F	G and C
(G A♯ E)		
F	B or C or C♯ or D or D♯	F and A
(F A C)	E or F or F♯ or G	A and C
	G♯ or A or A♯	C and F
B♭	E or F or F♯ or G or G♯	B♭ and D
(B♭ D F)	A or A♯ or B or C	D and F
	C♯ or D or D♯	F and B♭
A_7	D♯ or E or F or F♯ or G	A and C♯
(G C♯ E)	G♯ or A or A♯ or B	C♯ and E
	C or C♯ or D	E and A
Dm	G♯ or A or A♯ or B or C	D and F
(D F A)	C♯ or D or D♯	F and A
	E or F or F♯ or G	A and D
Gm	C♯ or D or D♯ or E or F	G and B♭
(G B♭ D)	F♯ or G or G♯	B♭ and D
	A or A♯ or B or C	D and G
E	A♯ or B or C or C♯ or D	D and G♯
(E G♯ B)	D♯ or E or F or F♯	G♯ and B
	G or G♯ or A	B and E
Fm	B or D or C♯ or D or D♯	F and A♭
(F A♭ C)	E or F or F♯	A♭ and C
	G or G♯ or A or A♯	C and F

From the foregoing, it will be appreciated that the organ circuitry of the present invention provides for normal playing as well as for special modes of playing. In normal playing, each key controls the keyers pertaining to a single tone in the conventional manner.

The keyer system also provides that, when the accompaniment chord keys are effective, a bass note of appropriate pitch will be keyed whenever a respective chord key is depressed. Still further, by the use of controlled gates, the bass notes can be played in the form, for example, of a fundamental and a fifth which alternate while a chord playing key is depressed.

When the organ is adjusted for playing in chord mode, which is to say, when the chord playing accompaniment manual keys are disabled with respect to the normal functions thereof are, instead, enabled for playing chords, at least the accompaniment and pedal sounds are eliminated automatically when more than one chord playing key is depressed at one time.

The features that have been stressed herein relate to the playing of chords in the solo manual or the supplying of fill-in notes to the solo part and this is accomplished only when the chord playing keys are enabled so that each chord playing key when depressed will cooperate with a key depressed in the solo manual to supply fill-in notes for the solo part within an octave range of the solo note being played and, preferably, at a lower pitch than the solo note.

The gating arrangement which brings about the playing of the fill-in notes is so interconnected with the chord playing key switches and the solo key switches that the fill-in notes sounded will always be musically related both to the chord being played and to the solo note pertaining to the solo key which is depressed.

While the fill-in in each case is made up of two notes, it will be understood that more notes could be added if so desired, and that the idea of using electronic gates and keyers in the manner disclosed lends itself to elaborate extension of the system, but without, at the same time, involving any great cost because the gates employed are quite inexpensive and reliable.

It will be appreciated that the keying of all of the tone signals are accomplished by electronic keyers and, accordingly, all switch noise is eliminated during the keying operation and superior musical results are obtained.

FIG. 3 schematically illustrates an organ having circuitry according to the present invention embodied therein. The same reference numerals are employed that are employed in FIGS. 1 and 2. FIG. 3 will show that the chord playing keys consist of a group of the keys of the lower manual 28 as indicated at 130.

FIG. 3 shows only the two selector switches 108 and 116, but it will be understood that further control switches could be incorporated in the circuitry in conformity with the various modes of playing referred to. For example, circuit controls and additions to the circuit illustrated could be made in conformity with U.S. Pat. No. 3,708,604, issued Jan. 2, 1973.

The system of the present invention uses simple single pole, single throw, switches and is, thus, reliable and inexpensive and is easily serviced.

The chord played by each chord playing key is wired in at the factory but can easily be changed.

In "filling in," in the solo manual, the lowermost notes of the manual are not filled in but could have a single note fill-in, if desired.

Modifications may be made within the scope of the appended claims.

What is claimed is:

1. In an electronic organ having tone generator means with a plurality of terminals for providing respective tone signal frequencies, electroacoustic transducer means for converting said tone signals to sound, and solo and accompaniment manuals each having keys; a plurality of first keyers connecting respective

terminals of generator means to said transducer means, each keyer having a control terminal and transmitting tone signals in response to the supply of an enabling signal to said control terminal, each key of said solo manual when depressed supplying an enabling signal to the control terminal of a respective first keyer, and two-input gate means having outputs connected to supply enabling signals to the control terminals predetermined ones of said first keyers, each gate means being operable to develop an enabling signal at the output when supplied with an enabling signal at each input simultaneously, each gate means receiving an enabling signal at one input in response to the depression of a single key of said accompaniment manual and receiving an enabling signal at the other input in response to the depression of at least one key of said solo manual.

2. An electronic organ according to claim 1 in which said two-input gate means comprises groups of two-input gates with each group under the control of at least one key of a predetermined group of keys of the accompaniment manual, each gate of a said group of gates receiving an enabling signal at one input thereof in response to the depression of a respective key of said group of keys and receiving an enabling signal at the other input in response to the depressing of at least one key of the solo manual.

3. An electronic organ according to claim 2 which includes a two-input control gate for each of said group of gates, each control gate having an output connected to the said one input of each of the gates of the respective group of gates and supplying an enabling signal thereto when enabling signals are supplied simultaneously to both inputs of the respective control gate, each control gate receiving an enabling signal at one input in response to the depressing of the respective one of said group of keys, and selector means connected to the other inputs of said control gates and selectively operable for supplying an enabling signal to the other inputs of all of said control gates simultaneously.

4. An electronic organ according to claim 1 which includes a plurality of second keyers connecting respective terminals of said generator means to said transducer means and each having a control terminal and transmitting tone signals when the control terminal is supplied with an enabling signal, the control terminal of each second keyer adapted to be supplied with an enabling signal in response to the depression of a respective key of said accompaniment manual, a plurality of third keyer means each connecting a respective group of terminals of said generator means to said transducer means, each third keyer means having control terminal means and transmitting tone signals in response to the supply of an enabling signal to the control terminal means thereof, each said third keyer means adapted to be supplied with an enabling signal at the control terminal means thereof in response to the depression of a respective key of a predetermined group of the keys of said accompaniment manual, the tone signals controlled by each said third keyer means being related as chords, and each of the keys of said group of keys being a chord playing key, and selector means operatively connected to said second keyers and said third keyer means and adjustable to permit the supply of tone signals from either of said second keyers and third keyer means to said transducer means while preventing the supply of tone signals from the other thereof to said transducer means.

5. An electronic organ according to claim 4 which includes a source of enabling signals, a first switch operated by each key of the solo manual and interposed between said source of enabling signals and the control terminal of the respective said first keyer, second switch means operated by each key of the accompaniment manual and interposed between said source of enabling signals and the control terminal of the respective said second keyer, a said second switch means also being interposed between said source of enabling signals and the control terminal means of a respective said third keyer means for each chord playing key, and third switch means connected on one side to said second keyers and third keyer means and on the other side to said transducer means and adjustable for selectively connecting either one of said second keyers and third keyer means to said transducer means while disconnecting the other thereof from said transducer means.

6. An electronic organ according to claim 4 in which said selector means includes first and second electronic switches connecting said second keyers and said third keyer means respectively to said transducer means, each electronic switch having a control terminal and going conductive when an enabling signal is supplied to the control terminal thereof, and a selector operable for connecting either of said control terminals of the electronic switches to a source of enabling signals while simultaneously disconnecting the other of the said control terminals from the said source.

7. An electronic organ according to claim 2 in which each said gate of each group of gates has the output connected to the control terminal of at least one said first keyer for a note which is within the range of an octave below the note corresponding to the key of the solo manual which is operable when depressed for supplying an enabling signal to said other input of the respective said gate.

8. An electronic organ according to claim 4 in which each said gate means comprises a group of two-input gates each operable to develop an enabling signal at the output in response to the supply of enabling signals to both inputs simultaneously, the output of each gate being connected to the control terminal of at least one said first keyer, a two-input control gate for each group of gates each operable to develop an enabling signal at the output in response to the supply of enabling signals to both inputs simultaneously, the output of each control gate being connected to one input of each gate of the respective group of gates, a first switch for each of at least some of the keys of the solo manual operable when the respective key is depressed to supply an enabling signal to one input of one gate of each group of gates, a second switch for each chord playing key operable when the respective key is depressed to supply an enabling signal to one input of the control gate for the respective group of gates, and a selector switch connected to the other inputs of said control gates and having one position wherein an enabling signal is supplied to said other inputs and another position wherein the enabling signal to said other inputs is interrupted.

9. An electronic organ according to claim 8 in which at least some of the outputs of said gates of said groups of gates are connected to the control terminals of more than one of the said first keyers.

10. An electronic organ according to claim 8 in which the notes pertaining to keyers actuated by the said gates of said groups of gates are within an octave beneath the note corresponding to the key of the solo manual which controls the respective said gate.

11. An electronic organ according to claim 2 in which said other input of each gate of each group of gates is supplied with an enabling signal in response to the depressing of one of at least two chromatically adjacent keys of said solo manual.

12. An electronic organ according to claim 2 in which said other input of each gate of each group of gates is supplied with an enabling signal in response to the depressing of any of from two to five chromatically adjacent keys of said solo manual.

13. An electronic organ according to claim 8 in which said selector means and said selector switch can be operated in unison whereby said gates of said groups of gates are operable for actuating first keyers only when the tone signals controlled by said third keyer means are being supplied to said transducer means.

14. In an electronic organ; a tone generator having a plurality of terminals each supplying rectangular waves at a respective frequency, an electroacoustic transducer, a plurality of first and second two-input OR gates each having an output connected to said transducer and one input connected to a respective terminal of said generator, each OR gate transmitting tone signals only when the other input is at a logic 0, a source of logic 0 voltage, a plurality of normally open first switches each having one side connected to said source and the other side connected to the other input of a respective first OR gate, a plurality of normally open second switches each having one side connected to said source and the other side connected to the other input of a respective second OR gate, solo and accompaniment manuals each having keys, a respective first switch pertaining to each key of the solo manual and a respective second switch pertaining to each key of the accompaniment manual and each key when depressed closing the respective pertaining switch, a plurality of groups of third two-input OR gates each having an output connected to the said other input of at least one of said first OR gates, each third OR gate having one input connected to the other side of a said first switch different from the said switch connected to the first OR gate to which the respective third OR gate is connected, and means connected to the said other side of each said second switch pertaining to a key of a predetermined group of the keys of the accompaniment manual for supplying a logic 0 simultaneously to all of the other inputs of said third OR gates of a respective group thereof.

15. An electronic organ according to claim 14 in which each third OR gate has the output connected to the said other input of at least one first OR gate that controls a tone signal which is within the range of an octave below the tone signal controlled by the first OR gate having the said other input connected to the same said first switch as the other input of the respective third OR gate.

16. An electronic organ according to claim 14 in which said means comprises a fourth two-input OR gate for each group of third OR gates, the output of each fourth OR gate being connected to the other inputs of the respective group of third OR gates, one input of each fourth OR gate being connected to said other side of said second switch pertaining to a respective one of said group of keys, and selector means connected to the other inputs of said fourth OR gates for selectively supplying a logic 0 to all thereof simultaneously.

17. An electronic organ according to claim 16 in which the said other side of each of the said first switches pertaining to at least a predetermined number of adjacent keys of the solo manual is connected to the said one input of one said third OR gate of each group thereof.

18. An electronic organ according to claim 17 which includes isolating diodes between said other side of each of said first switches and said other input of each of the respective first and third OR gates and between the output of each said third OR gate and the said other inputs of the first OR gates which are connected thereto.

19. An electronic organ according to claim 16 which includes groups of further two-input OR gates each having an output connected to said transducer, one input of each further OR gate of a group thereof being connected to a respective one of a group of terminals of the generator making up tone signals for a chord, the other input of the gates of each group of further OR gates being connected to said other side of a said second switch pertaining to a respective key of said group of keys, and other selector means having one position wherein the outputs of said groups of further OR gates are prevented from being supplied to said transducer and another position wherein the outputs of said second OR gates connected to the said second switches pertaining to the keys of the accompaniment manual are prevented from being supplied to said transducer whereby each key of said group of keys is selectively operable when depressed for playing a single note or a chord.

20. An electronic organ according to claim 19 in which said first mentioned selector means and said other selector means can be operated in unison to make said third OR gates effective in respect of controlling the said first OR gates connected thereto only when each key of said group of keys is operable to play a chord.

21. An electronic organ according to claim 14 in which said rectangular waves are square waves.

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