United States Patent

[11] 3,590,129

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[54] **ELECTRONIC CHORD SELECTION DEVICE FOR A MUSICAL INSTRUMENT**
12 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **84/1.01,** 84/1.17
[51] **Int. Cl.** **G10h 1/00,** G10h 5/00
[50] **Field of Search** ..... 84/1.01, 1.17, 1.22, 1.24, 1.03, N, G

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Assistant Examiner—Stanley J. Witkowski
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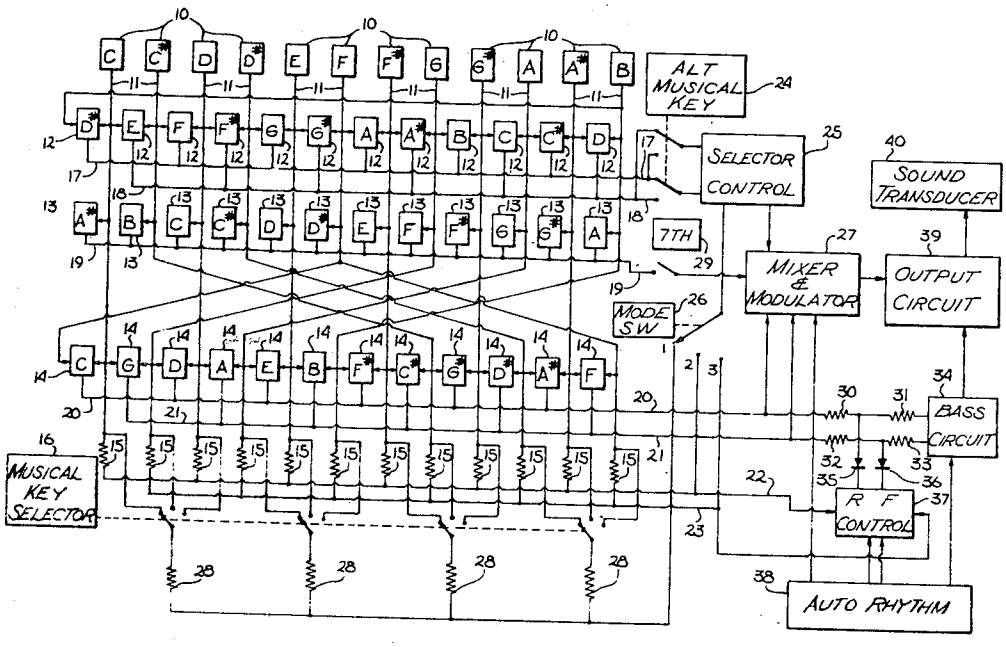
ABSTRACT: The 12 playing keys of an octave range on a standard keyboard each apply a set of chord tone signals to a chord modulator and the root and fifth parts also through input selection gates to a bass divider. Auxiliary controls or an automatic rhythm device drives the input selection gates to alternate the root and fifth parts in the bass and also drives the chord modulator and a bass keyer for various rhythmic patterns of chord and bass. A musical key selector picks any of six pairs of musical keys and controls the tone signals responsive to the playing keys so the chords produced are diatonic chords of the pair of selected musical keys. Other auxiliary controls allow the player to add or delete chord parts and to change the types of chords. Diode keyers feeding into current mixers allow multiple drives without introducing crosstalk and so minimize the number of keyers required.



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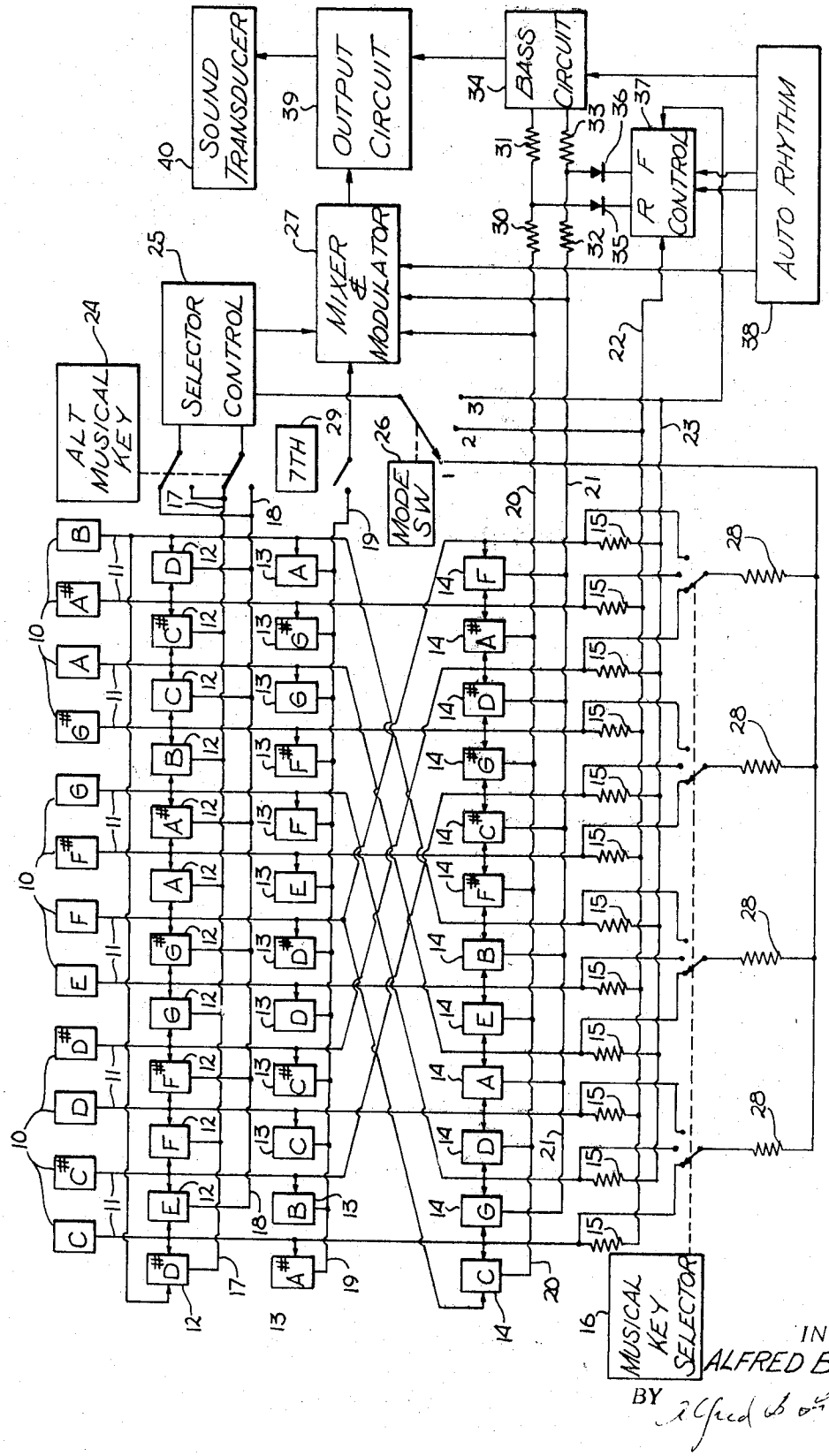

Fig. 1

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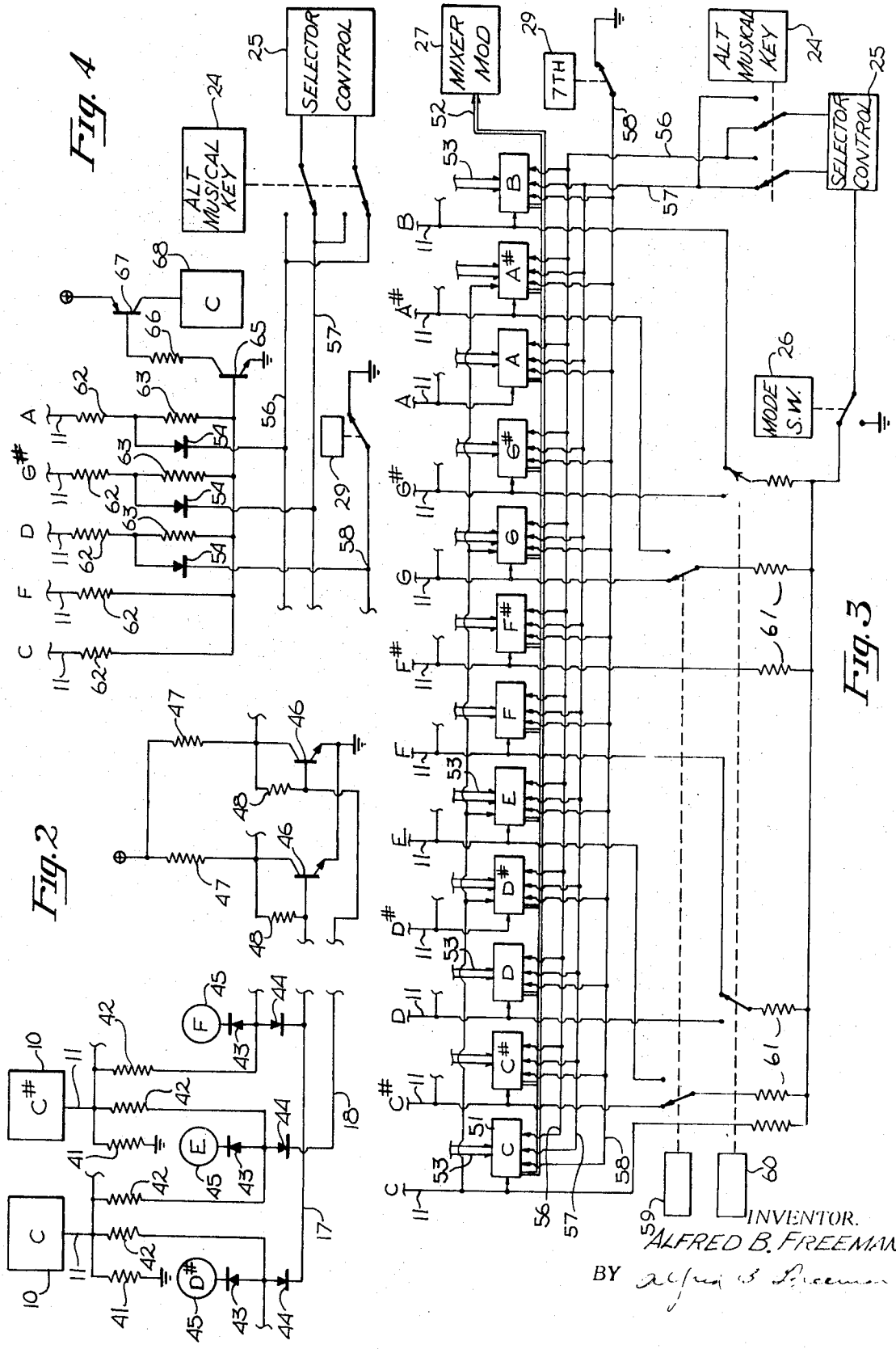
Fig. 4
Fig. 2
Fig. 3
SELECTOR CONTROL
ALT MUSICAL KEY
MIXER MOD
7TH
MODE S.W.
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ELECTRONIC CHORD SELECTION DEVICE FOR A MUSICAL INSTRUMENT

BACKGROUND THE INVENTION

1. Field of the Invention

The invention is directed to apparatus for playing chords and bass from single playing controls and for changing the chords produced by the controls to adapt for different musical keys.

2. Description of the Prior Art

U.S. Pat. No. 2,645,968 to J. M. Hanert discloses apparatus for playing chords from a set of buttons and for bringing the root and fifth parts of the chord out for alternate application to a bass divider. The large number of buttons to provide chords for all keys is confusing to the beginner and learning to play on the buttons does not assist learning to play in a more advanced manner on a standard instrument.

Another prior art device uses the playing keys of a standard keyboard to play chords in a special mode of operation. While somewhat more helpful in developing skills useful in normal playing, providing a sufficient number of chords for playing in all or even several musical keys imposes a distribution which complicates the chord playing for a beginner and defeats the original purpose.

SUMMARY OF THE INVENTION

The invention provides apparatus for playing chords and bass from the playing keys of the standard keyboard or from a limited number of chord buttons. A musical key selector determines the set of chords produced in response to playing key or button operation and the sets provided are tailored to the particular musical keys. The beginner is thus faced with a limited number of playing keys or buttons but still has all the chords necessary to play in the key. A very economical musical key selecting means is a feature of the invention.

In the case of the standard keyboard, the chords from the playing keys have roots corresponding to the notes normally associated with the playing keys. The chords will be major or minor depending upon the position in the selected musical key so the player only has to pick the playing keys for the chord roots out with the left hand similarly to the way he picks the melody notes out with the right hand. Playing action for more advanced playing only requires that he operate more playing keys at a time to individually select the notes of the desired chords. The invention also includes auxiliary controls which the player may operate to expand and change the chords produced by playing key operation beyond the diatonic set for the chosen musical key. Automatic rhythm means sounding root and fifth parts in the bass alternately and interupting the chord sounding rhythmically enhances the musical effects obtainable by a beginner.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial block and partial schematic diagram of am embodiment of the invention.

FIG. 2 is a schematic diagram of several dual input keyers which might be used in the apparatus of FIG. 1.

FIG. 3 is a partial block and partial schematic diagram of an alternative form of part of the apparatus of FIG. 1.

FIG. 4 is schematic diagram of another type of keyer which might be used with the apparatus of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The chord keying drivers **10** are designated with the root notes of their respective chords in FIG. 1. Drivers **10** may consist of the playing keys of an octave range of a standard keyboard together with switches connecting positive voltage outputs to lines **11** whenever the respective playing keys are operated. The switches might be interlocked so only one of lines **11** would receive voltage at a time. The playing keys might be replaced with chord buttons or drivers **10** might consist of other devices such as the bass keying drivers shown in my copending U.S. Pat. application Ser. No. 748,245 of a "-Bass Playing System" dated July 29, 1968. These bass keying drivers include interlocking means so only one operates at a time.

Each line **11** from a driver **10** goes to two of keyers **12**, one of keyers **13**, two of keyers **14**, one of resistors **15**, and a contact of musical key selector switch **16**. The keyers **12** control signals for notes which are the minor third and third parts of the chord, the keyer **13** the seventh part and the keyers **14** the root and fifth parts. The two alternate sets of keyers **12** connect to busses **17** and **18**, respectively, keyers **13** connect to bus **19**, and the two alternate sets of keyers **14** connect to busses **20** and **21**. Resistors **15** are also grouped in two alternate sets connecting to busses **22** and **23**, respectively.

Busses **17** and **18** connect through alternate musical key switch **24** to selector control **25** which inhibits one and passes the signal on the other to mixer and modulator **27**. With switch **24** in the position shown, selector control **25** changes the inhibit from bus **18** to bus **17** when it receives a control voltage on the line form mode switch **26**. With mode switch **26** in the position shown, the control input comes through resistors **28** from the poles of musical key selector switch **16**. With switch **16** also in the position shown, selector control **25** receives a positive voltage input through mode switch **26** only when drivers **10** for one of the notes C, A, F sharp, or D sharp are operated.

Mixer and modulator **27** thus receives signals from bus **18** when drivers **10** for notes C, A, F sharp, and D sharp are operated and from bus **17** when drivers **10** for the remaining notes are operated. With the just described control of busses **17** and **18**, drivers **10** for the notes or roots of C, C sharp, F, F sharp, G, and B will provide outputs from selector control **25** for the notes which are the third parts of the respective chords. Drivers **10** for the remaining notes D, D sharp, E, G sharp, A, and A sharp will provide notes which are the minor third parts of the respective chords. It will be recognized that these notes, when combined with the root and fifth parts in each case, will provide the major and minor chords of the diatonic sets for the musical keys of C and F sharp. If alternate musical key switch **24** is placed in its other position, busses **18** and **17** are reversed to selector control **25** and the thirds and minor thirds are likewise reversed. The chords provided with the root and fifth parts would then be for the musical keys of A and D sharp.

When musical key selector switch **16** is placed in its second position, resistors **28** connect to drivers **10** for the roots G, E, C sharp, and A sharp. The proper selection of thirds and minor thirds is then provided for the musical keys of E and A sharp for the shown position of switch **24** and for the musical keys of C sharp and G for the other position. The third position of switch **16** similarly provides for the musical keys of D and G sharp for the shown position of switch **24** and the musical keys of F and B in the other. If mode switch **26** is placed in its second position, selector control **25** is connected to bus **22** and will receive control voltage for inhibit reversal on operation of drivers **10** for the notes C, D, F sharp G sharp, and A sharp. This inhibits all minor thirds when switch **24** is in its shown position. If switch **24** is placed in its other position, all thirds will be inhibited. Placing mode switch **26** in its third position connects selector control **25** to bus **23** and reverses the third and minor third positions for switch **24**.

Seventh switch **29** connects bus **19** to mixer and modulator **27** when operated. This causes the seventh parts to be included in the output of mixer and modulator **27** which also receives the root and fifth parts from busses **20** and **21** connecting to the outputs of keyers **14**. Operation of drivers **10** thus produces signal outputs from mixer and modulator **27** which are either major or minor chords with sevenths if switch **29** is closed. If mode switch **26** is in its first position, the settings of switches **24** and **16** determine which drivers **10** will produce major chords and which minor. The set of chords al-

ways includes the major and minor chords making up the diatonic sets for two different musical keys. The six combinations of positions of switches **16** and **24** provide for all of the **12** musical keys in six pairs.

It will be noted that change of the position of switch **24** changes majors to minor and minors to major. All major and minor chords can thus be obtained from any setting of the other controls merely by changing switch **24** which can be a push to change foot switch or similar device which can be operated conveniently by the player. With switch **26** in its first position, diatonic chords of the selected musical keys would be obtained without further action. Player operation of switch **24** would make all other major and minor chords available. With switch **26** in position two or three, all chords would be either major or minor and changing position of switch **24** or changing switch **26** between positions two and three would reverse them. Switch **29** should also be convenient for player operation so the seventh parts can be included or deleted as desired.

Busses **20** and **21** also connect through resistors **30** and **31** and resistors **32** and **33**, respectively, to bass circuit **34**. Diodes **35** and **36** connect the junctions of the resistor pairs to opposite outputs of flip-flop **37** so the signal from one or the other of busses **20** and **21** will be clamped and the other will be effective to bass circuit **34**. Bass circuit **34** includes one or more frequency dividers to produce an output which is one or more octaves lower than the input and which becomes the bass part. Control busses **22** and **23** connect to opposite inputs of flip-flop **37** to set it to pass the root part whenever a driver **10** first operates. It will be noted that busses **22** and **23** connect to alternate drivers **10** as do keyers **14** to busses **20** and **21** to obtain this result.

Automatic rhythm device **38** also drives flip-flop **37** to alternate positions to alternately apply clamping voltages to diodes **35** and **36** and so pass the root and fifth parts alternately to the frequency dividers of bass circuit **34**. Bass circuit **34** includes a keyer or modulator which responds to the input from rhythm device **38** to pass the output bass signal with a percussion envelop. Rhythm device **38** further drives mixer and modulator **27** to apply rhythmic modulations on the chord parts for further accompaniment to the bass part patterns. The outputs of mixer and modulator **27** and bass circuit **34** go to output circuit **39** which will include an amplifier for driving sound transducer **40** and may include tone forming circuits and controls.

Keyers **13** may be of any suitable type which passes its respective tone signal while receiving a positive control voltage input. Diode keyers of this type are widely used in present day electronic organs. Keyers **12** and **14** must be responsive to control voltage inputs from two different sources for keying their respective tone signals. FIG. **2** shows a type of keyer for keyers **12** associated with the drivers **10** for C and C sharp which is suitable for all keyers **12** and **14** and for keyers **13** as well. Each line **11** is connected to ground through a small decoupling resistor **41** and to as many drive resistors **42** as keyers **12**, **13**, and **14** as are associated with it. Drive resistors **42** go to the junctions of back to back diodes **43** and **44** connected between the respective outputs of tone generators **45** and busses **17** and **18**. Busses **17** and **18** go to the bases of transistors **46** with collector load resistors **47** and bias and feedback resistors **48** which function as current mixers. The small voltage swing on the bases of transistors **46** and at the junction of diodes **43** and **44** is further reduced by decoupling resistors **41** so there is no appreciable crosstalk between drivers **10** sharing keyers.

In the arrangement of FIG. **3**, keyers **51** replace keyers **12**, **13** and **14** for the function of providing chord parts in the accompaniment range. Keyers **14** may or may not be used in combination with keyers **51** for keying root and fifth parts in the bass as in FIG. **1**. Each keyer **51** will key its respective note signal in each of several octave locations out on cable **52** to mixer and modulator **27** in response to control inputs from any of a number of drivers **10** received via cable **53**. Each keyer **51** receives control inputs via its cable **53** from the same drivers **10** as do all the keyers **12**, **13** and **14** for the same note in the arrangement of FIG. **1**. Line **11** for the driver **10** for C is shown going to keyers **51** for the notes C, D sharp, E, G, and A sharp. Connections from other drivers **10**, while not shown, would be in the same pattern.

Busses **56**, **57**, and **58** provide inputs to each of keyers **51** to inhibit their response to particular control inputs from drivers **10**. Busses **56** and **57** inhibit the inputs to keyers **51** which are to operate them for the minor third and third parts, respectively. Busses **56** and **57** are controlled from alternate musical key switch **24** and selector control **25** like busses **17** and **18** were controlled in the apparatus of FIG. **1**. Bus **58** inhibits inputs for the seventh parts except when ungrounded by operation of seventh switch **29**. With musical key selection switches **59** and **60** in their shown positions, lines **11** for the notes C, F, G, C sharp, F sharp, and B connect through resistors **61** and mode switch **26** to selector control **25**. The chords for those drivers **10** will then be major or minor depending upon the position of alternate key switch **24** while the chords for the remaining drivers will be minor or major, respectively. Selector control **25** grounds one side for inhibiting when receiving and input and the other side when not receiving an input.

Placing mode switch **26** in its other position removes any input signal from selector control **25** so one input remains grounded. All chords will then be either major or minor depending upon the position of alternate key switch **24**. Change of position of switch **59** changes C sharp and G to E and A sharp for connection through resistors **61**. This changes the chord sets from those for the musical keys of C and F sharp to F and B for one position of switch **24** and from the musical keys of A and D sharp to D and G sharp. Change of position of switch **60** changes F and B to D and G sharp to provide the sets of chords for the remaining four musical keys of G and C sharp and E and A sharp. Switches **59** and **60** will not be changed to their other positions at the same time.

FIG. **4** shows a possible embodiment for the keyer **51** for the note C in which lines **11** for drivers **10** for the notes C and F are connected by resistors **62** to the base of transistor **65**. Lines **11** for the notes D, G sharp and A also connect to the base of transistor **65** through resistors **62** and **63** while diodes **54** from the junctions of resistors **62** and **63** connect, respectively, to buses **58**, **57**, and **56**. It will be recognized that C is the seventh of D, the third of G sharp, and the minor of third of A. A positive voltage on the respective lines **11** causes transistor **65** to conduct unless the respective junction is clamped by the respective bus **56**, **57**, or **58** being held at ground potential. Resistor **66** connects the collector of transistor **65** to the base of transistor **67** so it will also be turned on by conduction of transistor **65**. Transistor **67** in turn drives a set of keyers **68** for the note C in several different octave locations. It will be recognized that a transistor might be saved by reversing the input polarity or the polarity required for the keyers **68**. It will further be recognized that this type of drive might be applied to keying systems such as those shown in my copending U.S. Pat. application Ser. No. 783,205 for an "Automatic Harmony Apparatus."

I claim:

1. In an electronic organ,
   - an array of playing keys encompassing an octave of notes of the musical scale,
   - a plurality of tine signal sources arranged in the order of the musical scale and including said octave of notes,
   - a first bus,
   - a second bus,
   - a first plurality of electronic gates each responsive to actuation of a selected one of said playing keys for passing a tone signal to said first bus which is an *n*th part of the note pertaining to that one of said playing keys,
   - a further plurality of electronic gates each responsive to actuation of selected one of said playing keys for passing to said second bus a tone signal which is a *m*th part of the note pertaining to that one of said keys

   where *n* and *m* are chordal components,

an output load,

a two condition selector for at will transferring tone signal from either one of said buses to said output load to the exclusion of tone signal from the other of said busses, and means responsive to actuation of selected ones of said playing keys to the exclusion of the others of said playing keys for selecting the condition of said two condition selector, wherein said *n*th part and said *m*th part are selected from at least one of

1. third and minor third parts and

2. fifth and root parts, of the notes represented by the actuated playing key.

2. The combination according to claim 1, wherein is further provided means for calling forth said fifth and root parts in a rhythmic pattern.

3, The combination according to claim 1, wherein is included a mode switch having three positions,

means for developing a control voltage according to the position of said mode switch in response to actuation of any one of four selected keys which are different for each of said positions of said mode switch, and

means responsive to said control voltage for actuating said selector.

4. in an electronic organ,

a sequence of playing keys encompassing an octave of musical notes,

means responsive to actuation of any one of said playing keys for generating tone signals representative simultaneously of a major and of a minor chord appropriate to that playing key,

means responsive to the identity of that playing key for automatically selecting those tone signals appropriate to only that one of said major and minor chords which is appropriate to that playing key,

an output transducer, and

means for applying the selected tone signals to said output transducer.

5. The combination according to claim 4, wherein said means for generating tone signals includes tone signal sources and control voltage responsive electronic gates connected in

series between said sources and said output transducer, and

wherein said means responsive to said playing keys includes means for applying said control voltage selectively to said electronic gates.

6. A chord organ, comprising

an octave of keys representing the roots of chords,

means responsive to actuation of each of said keys for generating a control voltage representing that key,

a plurality of tone signal sources,

a control voltage responsive normally nonconductive diode gate in series with each of said sources,

an output load comprising an acoustic transducer responsive to tone signal from said sources passed by said gates in response to said control voltages,

means connecting each of said control voltages to control a series of gates representing a group of chordal tone signals,

said last named tone signals being appropriate to both a major and minor musical chord simultaneously, and

means for selectively inhibiting that one of the tone signals of each of said groups which determines whether said musical key shall be major or minor.

7. The combination according to claim 6, wherein is further included means for selectively including and excluding a seventh chord component in and from each of said groups.

8. The combination according to claim 6, wherein is further included means for selectively including in each of said groups either a fifth or a root chord component.

9. The combination according to claim 6, wherein is further included means responsive to actuation of four selected ones of said keys for controlling said means for inhibiting.

10. The combination according to claim 6, wherein is further provided means for selecting which of said four keys shall effect said controlling of said means for inhibiting.

11. The combination according to claim 6, wherein is included means for rhythmically alternating tonal components of said chordal tone signals to form alternately constituted chords in rhythm.

12. The combination according to claim 6, wherein said tonal components are said fifth and root components.