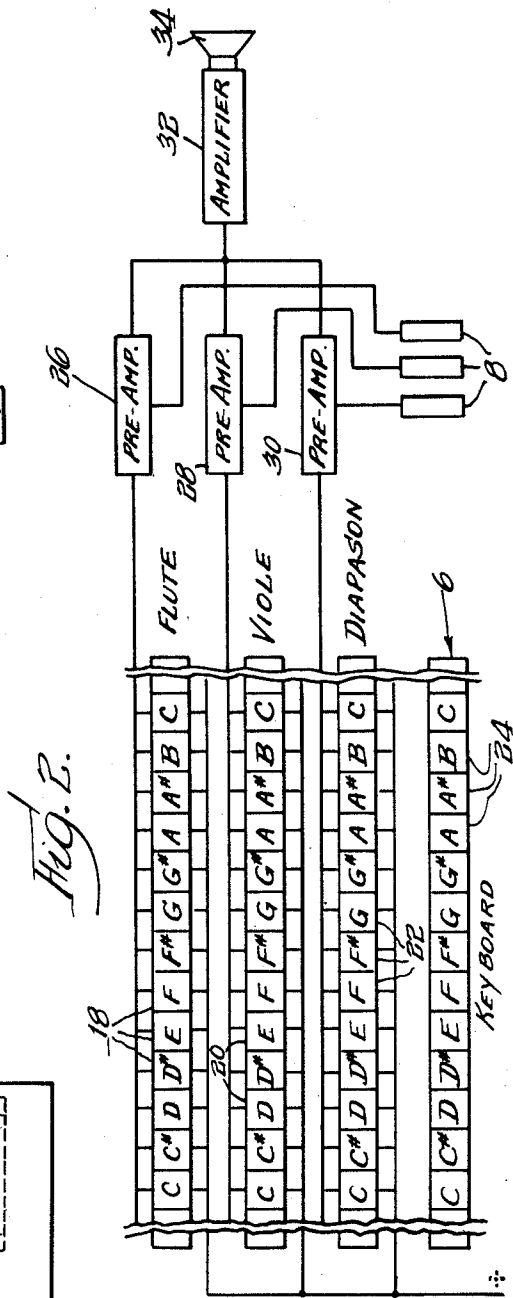
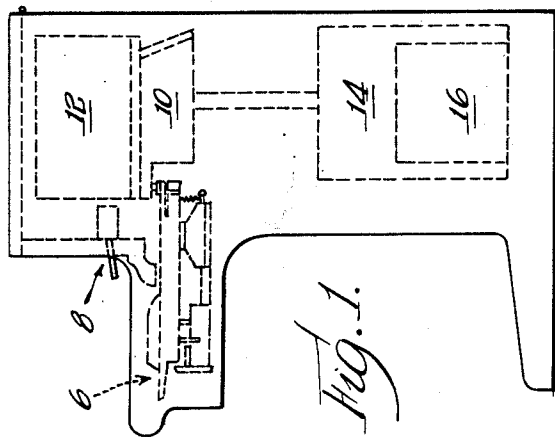
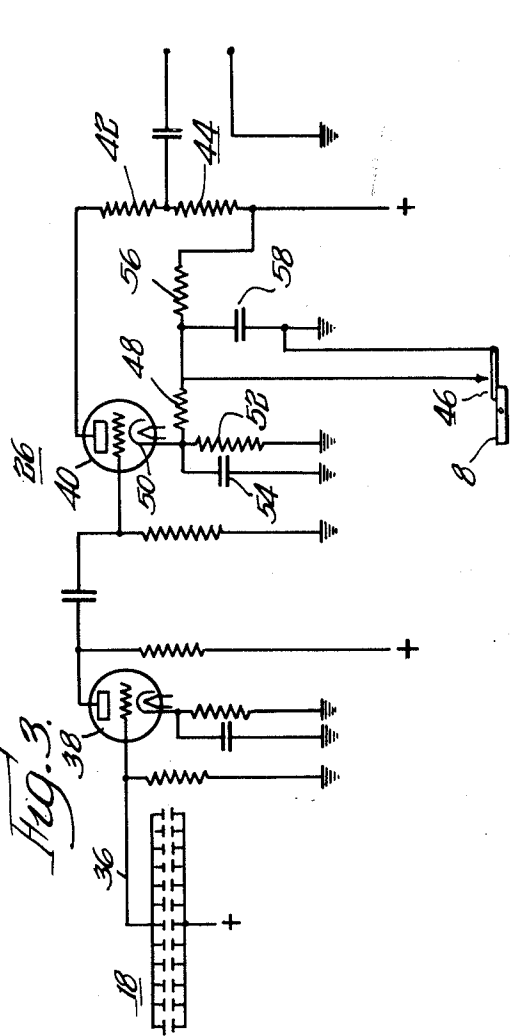


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ORGAN STOP CONTROL
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ORGAN STOP CONTROL

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This invention relates to electric organs, particularly of the type wherein a single key or pedal may serve to actuate or energize a plurality of tone generators which are selectively rendered effective in accordance with the desired stop or stops that are to be played.

In the copending application of Victor I. Zuck, Serial No. 719,896, filed January 2, 1947, Patent No. 2,570,178, issued October 2, 1951, there is disclosed an electric organ of the aforesaid type in which tone generators, such as vibrating reeds, are arranged in a plurality of sets respectively corresponding to the organ stops, and are actuated in tone groups among the several sets by operation of the organ keys. It is necessary to provide a switching means whereby only those tone generators which are in sets corresponding to the selected organ stops can furnish an audible output.

An object of the present invention is to provide an improved stop control to perform the switching function just described.

A further object is to provide an electronic stop control of novel design such that operation of a stop switch does not produce any abrupt changes in volume of the reproduced tones.

A still further object is to provide an electronic stop control of such character that opening and closing of the stop switches does not produce unpleasant effects in the music.

Still another object is to provide an improved electric organ having the foregoing features and in which each stop switch is arranged to control the bias of an amplifier tube in a preamplifier associated with the particular set of reeds pertaining to the selected stop.

The above and other features and advantages of the invention will be apparent from a study of the specification and the accompanying drawing wherein:

Fig. 1 is a side elevation of an electric organ adapted to utilize my present invention;

Fig. 2 is a block diagram of an electric organ embodying my invention; and

Fig. 3 is a schematic circuit diagram of a preamplifier adapted to function as part of a stop control in accordance with the principles of the invention.

Referring to Fig. 1, the organ set forth for illustrative purposes is a single-manual instrument of the vibrating-reed type having a keyboard 6, a set of stop tablets 8 disposed above the keyboard, a windchest 10 located behind the keyboard 6, a tone generating unit 12 comprising a plurality of vibrating-reed capacitors, an

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air compressor 14 communicating with the windchest 10, and an amplifying section 16.

The vibrating-reed capacitors (which may be referred to simply as "reeds") in the tone generating unit 12 are arranged in banks or sets as indicated in Fig. 2. Thus, there are provided a bank of reeds 18 designated "flute," a second bank of reeds 20 designated "viole" and a third bank of reeds 22 designated "diapason." For simplicity, it will be assumed that each bank of reeds corresponds to a similarly designated organ stop, although in practice the reeds in each bank may produce the tones for a number of stops. Also, there may be combination stops, or several sets of pickups from the same tone generators, but for the purpose of explaining the present invention as expeditiously as possible such arrangements will not be considered.

The keys 24 in the keyboard 6 control air valves or pallets (not shown) between the windchest 10 and the tone generating unit 12. The various keys 24 and the reeds 18, 20 and 22 in the several sets thereof are designated in Fig. 2 according to the tones of the chromatic scale. Each key 24 controls the admission of air from the windchest 10 to all of the reeds pertaining to that particular tone. For example, if the key 24 pertaining to the tone A in a given octave is actuated, it causes all of the reeds 18, 20 and 22 capable of producing that tone A to be set in vibration. Such an arrangement greatly reduces the number of pallets and pallet operating mechanisms required in an organ.

The stop tablets 8, of which only three are shown in Fig. 2, respectively control the operation of the preamplifiers 26, 28 and 30 respectively associated with the banks of reeds 18, 20 and 22. A common electrical output conductor leads from the reeds of each bank (that is to say, of each organ stop) to an input of the related preamplifier. Actuation of a particular stop tablet 8 renders the associated preamplifier 26, 28 or 30 effective to pass signals from the associated reed bank to a final amplifier 32 which feeds the loudspeaker or loudspeakers 34, the manner in which this is accomplished being explained presently. The various preamplifiers as 26, 28 and 30 and the amplifier 32 together constitute the amplifying section 16, Fig. 1.

In Fig. 3 there is illustrated a preamplifier unit of the type contemplated herein. Direct-current polarizing voltage is impressed upon one of the plates of each reed capacitor in the bank such as 18. The other plates of the capacitors are connected through a common conductor 36 to the

grid input terminal of a tube 38 in the first stage of the preamplifier as 26. The output of tube 38 is coupled in a conventional manner to the input of a tube 40 in the second stage of the preamplifier. The output of tube 40 is delivered to a voltage divider comprising the series-connected resistors 42 and 44. The output voltage of the preamplifier is taken across the load resistor 44.

Each stop tablet 8 is arranged to actuate a switch as 46, Fig. 3. One terminal of the switch 46 is grounded while the other terminal is connected through a resistor 48 to the cathode 50 of the amplifier tube 40, this cathode being connected to ground through a biasing resistor 52. A capacitor 54 is connected in shunt with the resistor 52. The resistors 48 and 52 are included in a voltage divider which also includes a resistor 56 connected to the source of plate voltage. A capacitor 58 is connected between ground and the junction of the resistors 48 and 56, thus being connected also across the contacts of the switch 46.

The operation of the illustrated apparatus will be described insofar as it concerns the "flute" bank of reeds 18 and the preamplifier 26, it being understood that the operation is similar insofar as other reed banks and preamplifiers are concerned. When the switch 46, Fig. 3, controlled by the stop tablet 8 is open, current flows from the source of plate voltage through the voltage divider network comprising resistors 56, 48 and 52 to ground. The voltage drop across the resistor 52 under these conditions maintains the potential of the cathode 50 sufficiently high to render the tube 40 inoperative. Hence, no signals will be passed from the bank of reeds 18 to the amplifier 32, Fig. 2. When the stop tablet 8 is depressed to close the switch 46, however, the resistor 48 is connected in parallel with the resistor 52 and the capacitor 54 between the cathode 50 and ground. The elements just mentioned comprise a timing circuit which permits the voltage on the cathode 50 gradually to diminish over a predetermined time interval to a level where the tube 40 is rendered effective to amplify and pass signals from the reed bank 18. The tube 40 then operates as a normal self-biased amplifier.

The timing arrangement just described insures that there will be no abrupt change in sound produced by the organ as an incident to closing a stop switch such as 46. The volume of the reproduced sounds originating in the bank of reeds 18, for example, is built up in a smooth, natural manner to produce a pleasing effect upon the listener. Obviously the rate at which the timing circuit functions may be varied by changing the values of the circuit parameters.

When the stop switch 46, Fig. 3, is opened, the resistor 56 and capacitor 58 act as a timing circuit causing the potential of the cathode 50 to rise gradually toward its normal high level at which the tube 40 ceases to function. Thus, opening of the switch 46 does not cause an abrupt cessation of the reproduced sounds originating in the bank of reeds 18. Instead, the volume of such sounds gradually is reduced over a predetermined time interval depending upon the values of the circuit parameters.

It should be noted that both of the above described timing circuits have some effect on the response of the preamplifier when the switch 46 is opened or when it is closed. However, the timing circuit including resistor 48 and capacitor 54 is primarily effective when the switch 46 is

closed, while the timing circuit comprising the resistor 56 and capacitor 58 is primarily effective when the switch 46 is opened. Practical design considerations may require that these timing circuits operate fairly rapidly, but it is possible to avoid any undesirable effects as a result of such rapid action by properly proportioning the resistors 42 and 44 in the output circuit of the tube 40.

From the foregoing description it is apparent that I have provided an electronic stop control for organs which fulfills the above stated purposes of the invention. This stop control will be found particularly useful in situations where several banks of reeds are actuated simultaneously and a selection is to be made of the reed banks which are to be effective in furnishing the output of the organ. However, it should be understood that the invention is not necessarily limited to such applications, as it may have utility in other types of organs as well.

Various changes may be made in the specific embodiment set forth for purposes of illustration without departing from the spirit of the invention, and it is intended that such modifications as may readily occur to persons skilled in the art shall be included in the scope of the following claims.

The invention is hereby claimed as follows:

1. In an electric organ of the type wherein a plurality of tone generators related to various stops is adapted to be operated simultaneously by a single key, a plurality of tone generators arranged in sets, a plurality of electronic amplifying devices each having an input, means for rendering said amplifying devices inoperative, means for connecting each input to only one set of tone generators to control the passage of signals from a set of a plurality of tone generators pertaining to a given organ stop, biasing potential means, a plurality of organ stop switches, means interconnecting each electronic amplifying device with one switch, means interconnecting each switch with said biasing potential means for respectively and independently applying said bias to one of said amplifying devices to render said respective amplifying device operative.

2. An electric organ as claimed in claim 1, having timing means interconnected with each electronic amplifying device to delay the response of each electronic amplifying device to operation of its related switch.

3. An electric organ as claimed in claim 2, wherein said timing means comprises at least one resistance-capacitance timing circuit.

4. An electric organ as claimed in claim 1, wherein said means for rendering said amplifying devices inoperative is a source of cut-off potential rendered ineffective by operation of said switch.

5. An electric organ as claimed in claim 4, wherein the switch means associated with each amplifying device has one position in which said source of cut-off potential is applied to said amplifying device to render said device non-conductive, and another position in which said cut-off potential is removed from said amplifying device and said biasing potential means is connected to said amplifying device to render said device conductive.

6. An electric organ as claimed in claim 5, wherein a resistance-capacitance timing means is in circuit with said source of cut-off potential when said switch means is in said one position, said timing means delaying the response of said

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amplifying device when said switch is moved to said other position.

7. An electric organ as claimed in claim 5, having a timing means to delay the response of said amplifying device to movement of said switch to said one position, said timing means comprising a capacitance and a resistance in series with said capacitance and said source of cut-off potential, said capacitance being shunted by said switch when said switch is in said other position. 10

8. An electric organ as claimed in claim 1, wherein a source of cut-off potential is connected to each respective amplifying device by a separate voltage divider, each of said voltage dividers including a plurality of resistance elements, the switch means associated with each respective amplifying device having one position in which all of said resistance elements are connected in series with each other to thereby apply said cut-off potential to said amplifier, said switch means having another position in which at least two resistance elements of said voltage divider are placed in parallel to render effective said biasing potential means and render ineffective said cut-off potential. 20

9. An electric organ as claimed in claim 1, wherein said biasing potential means comprises a cathode bias resistance element connected in the cathode circuit by operation of said switch. 25

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10. An electric organ as defined in claim 1, wherein a source of cut-off potential is connected to each respective amplifying device by a separate voltage divider, one end of said voltage divider being connected to ground, the other end of said voltage divider being connected to a point which is positive with respect to ground, each respective amplifying device having a cathode connected to said voltage divider intermediate the ends thereof to normally render said amplifying device inoperative, said switch means having one side connected to said voltage divider intermediate said cathode connection and said positive point, the other side of said switch means being connected to ground, closure of said switch means being effective to render said amplifying device operative.

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