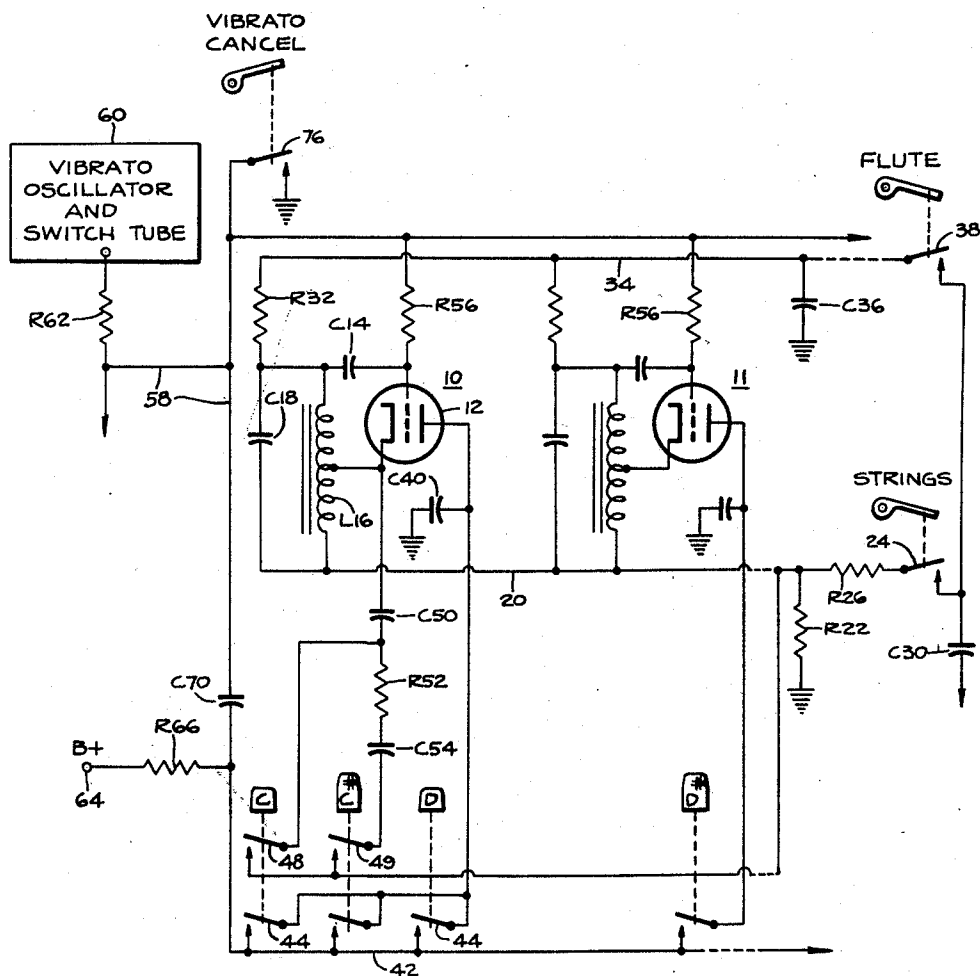


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 OSCILLATORS AND CIRCUITRY FOR A MUSICAL INSTRUMENT
 WITH RAPID STARTING CHARACTERISTICS
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OSCILLATORS AND CIRCUITRY FOR A MUSICAL INSTRUMENT WITH RAPID STARTING CHARACTERISTICS

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The invention relates generally to electrical musical instruments in which the electrical tone signals are generated by electronic oscillators which are normally not oscillating, but are caused to commence oscillating by supplying an operating potential to one of the electrodes of the electron discharge device through playing key operated switch means.

In instruments of this type in which vibrato pulses are applied to the control grids of the electron discharge device, as shown, for example, in the patent to J. M. Hanert, No. 2,645,968, it was thought to be desirable (if not necessary) to use a multi-component mesh in the circuit by which plate current is supplied, to assure prompt commencement of the operation of the oscillator. Because this mesh had to be a part of each oscillator, and because many oscillators must be provided (24 in the instrument of said patent), the aggregate cost of these plate current meshes and their assembly was a sizable part of the cost of the complete instrument.

Furthermore, the use of the plate current meshes resulted in undesired sparking at contacts of the key operated switches through which the plate current was supplied.

It is therefore an object of the invention to provide unitary circuit means for supplying the vibrato signal to the grids of a number of oscillators, and for an instant, upon closure of one or more key operated switches, to reduce somewhat the vibrato potential applied to the grids of the oscillators, thereby facilitating starting of the oscillator.

Other objects will appear from the following description, reference being had to the accompanying drawing which is a schematic circuit diagram of representative portions of electrical musical instruments embodying the invention.

In the drawing, but two oscillators 10 and 11 are shown, it being understood that the other oscillators are similar to the two illustrated. Each oscillator comprises an electron discharge device 12 which is preferably a triode or one-half of a double triode. The control grid is connected through capacitor C14 to one end of an inductance element L16 and to a capacitor C18. The other terminals of the capacitor C18 and inductance L16 are connected to a conductor 20 which is connected to ground through a resistor R22 and connected to a tablet operated switch 24 by resistor R26. When the switch 24 is closed, string-like signals derived from the oscillator are transmitted through a capacitor C30 to the power amplifier and speaker, these parts being similar to those shown in the aforesaid Patent No. 2,645,968. Similarly, flute-like signals are derived from the oscillators through resistors R32 from the resonant circuit of the oscillator to a conductor 34, which has a filtering capacitor C36 connected between it and ground, and is also connected to a switch 38 by which the flute-like signal may be transmitted to the output through the capacitor C30.

The cathodes of the oscillators are connected to taps on inductances L16, while the anodes thereof are con-

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nected to ground through capacitors C40, and are adapted to be connected to a conductor 42 upon closure of any one of three switches 44, which are operated respectively by keys C, C#, and D. The oscillator 10 is so constructed as to be capable of being tuned to any one of the three pitches mentioned, such tuning being effected, as for the notes C, and C#, by closure of switches 48 and 49 which respectively tune the oscillator a full tone and a semitone lower than the pitch D at which the oscillator 10 is designed to operate when the D key is depressed. The switch 48, upon closure, adds a capacitor C50 to the tuning circuit of the oscillator, while closure of the switch 49 results in adding a resistor R52 and capacitor C54 to the resonant tuning circuit of the oscillator.

A vibrato signal is supplied to the grid of each oscillator through a resistor R56 connected between the grids and a conductor 58. The conductor 58 is connected to a vibrato oscillator and switch tube mechanism 60 through a resistor R62.

Plate current is supplied to the conductor 42 from a B+ terminal 64 of the power supply through a relatively low value resistor R66. Thus, when a playing key is operated, a short negative pulse is transmitted from conductor 42 through a capacitor C70 to conductor 58, and this pulse is thus impressed upon the control grids of all of the oscillators, momentarily to reduce the grid voltage so as to facilitate the starting of the oscillator with which an associated key has been operated. This pulse is of such short duration that even though several keys are successively depressed, and held depressed, the oscillators which are in operation at the time the last key is depressed will not be affected sufficiently to be noticed.

Whenever the vibrato is not desired, a vibrato cancel tablet may be operated to close switch 76 to connect the conductor 58 to ground.

The short negative pulse is effective to cancel the positive vibrato voltage for a short enough instant of time to "shock excite" the oscillators into oscillation. Furthermore, since there is very little capacitance in the plate circuit (compared with the oscillators shown in said prior Patent No. 2,645,968), there is less tendency for the switches 44 to arc or spark as they are closed and opened.

The oscillator 11 is the same as the oscillator 10, except that this oscillator is designed to supply signals of only one pitch, whereas for economy's sake, the oscillator 10 is provided for supplying either of three adjacent semitone pitches.

While we have shown and described a preferred embodiment of our invention, it will be apparent that numerous variations and modifications thereof may be made without departing from the underlying principles of the invention. We therefore desire, by the following claims, to include within the scope of the invention all such variations and modifications by which substantially the results of the invention may be obtained through the use of substantially the same or equivalent means.

We claim:

1. In combination, a plurality of audio frequency oscillators each comprising an electron discharge device having a cathode, control grid, and anode electrodes, and a resonant circuit connected between at least two of said electrodes to determine the frequency of oscillation; means for generating pulses of vibrato periodicity; conducting means connecting the output of said pulse generator to the control grids of all of the oscillators; a source of anode current; an anode current supply conductor; a relatively low impedance connecting the source of the anode current to the anode current supply conductor; a plurality of normally open manually operable switches connected between the anode current supply conductor and the said anodes respectively; and a capacitor connected between said anode current supply conductor

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and said conducting means connecting the vibrato pulse generator to said control grids.

2. In combination, an audio frequency oscillator comprising an electron discharge device having cathode, control grid, and anode electrodes, and a resonant circuit connected between at least two of said electrodes to determine the frequency of oscillation; a generator of pulses of vibrato periodicity; conductor means connecting the output of said generator to the control grid; an anode current supply conductor; a source of anode current; a relatively low value resistor connected between the source of anode current and the anode current supply conductor; a switch manually operable to connect the anode current conductor to the anode; and a capacitor connected between the anode current supply conductor and the conductor means connecting the output of the vibrato generator to the control grid.

3. In combination, a plurality of audio frequency oscillators each comprising an electron discharge device having a cathode, control grid, and anode electrodes and a resonant circuit connected to at least two of said electrodes to determine the frequency of oscillation, means for generating pulses of vibrato periodicity, conducting means connecting the output of said pulse generator to one of the electrodes of each of the oscillators, a source of anode current, an anode current supply conductor, a relatively low impedance connecting the source of the anode current to the anode current supply conductor, a plurality of normally open manually operable switches connected between the anode current supply conductor and the said anodes respectively, and a capacitor connected between said anode current supply conductor and said conducting means connecting the vibrato pulse generator and said electrodes.

4. In combination, a plurality of audio frequency oscillators each comprising an electron discharge device having a cathode, control grid, and anode electrodes and a resonant circuit connected between at least two of said

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electrodes to determine the frequency of oscillation, means for generating pulses of vibrato periodicity, conducting means connecting the output of said pulse generator to corresponding electrodes of each of the oscillators, a source of anode current having two terminals, an anode current supply conductor, a relatively low impedance connecting one terminal of the source of the anode current to the anode current supply conductor, a plurality of normally open manually operable switches connected to complete a circuit between the anode current supply conductor and the other terminal of the source, and a capacitor connected between said anode current supply conductor and said connecting means between the vibrato pulse generator and said corresponding electrodes of each of the oscillators.

5. In combination, an audio frequency oscillator comprising an electron discharge device having cathode, control grid, and anode electrodes, and a resonant circuit connected between at least two of said electrodes to determine the frequency of oscillation; a generator of pulses of vibrato periodicity, means connecting the output of said generator to one of said electrodes, an anode current supply conductor, a source of anode current having two terminals, a relatively low value resistor connected between one terminal of the source of anode current and the anode current conductor, a switch manually operable to connect the anode current conductor to one of the anode current conducting electrodes of the electron discharge device, and a capacitor connected between the anode current conductor and the conductor connected to the output of the vibrato pulse generator.

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