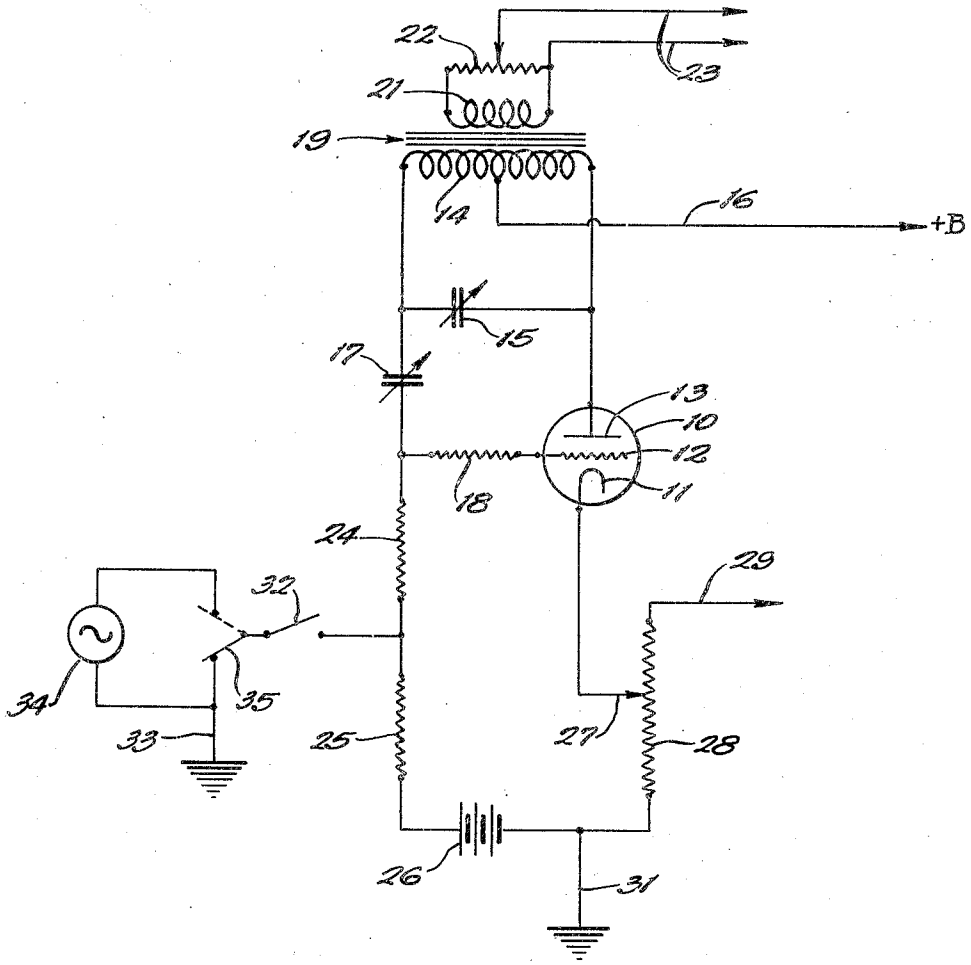
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ELECTRICAL MUSICAL INSTRUMENT

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Inventor:
Thomas H. Long,
By Dawson, Brothers & Spangenberg,
Attorneys.

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ELECTRICAL MUSICAL INSTRUMENT

Thomas H. Long, Elkhart, Ind., assignor to C. G. Conn, Ltd., Elkhart, Ind., a corporation of Indiana

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This invention relates to electrical musical instruments and more particularly to electric oscillators adapted for use in instruments of the electric organ type.

In electrical instruments it has been customary to provide a tremolo effect by periodically altering the frequency of the tone. In instruments of the type employing electric oscillators as tone generators this has generally been accomplished by using an oscillator capable of frequency variations and periodically varying its frequency in response to voltage supplied by a low frequency tremolo generator. The difficulty of this construction is that any oscillator capable of frequency variations in response to changes in bias on the amplifier tube tends to be unstable and to change its frequency in response to any change in tube characteristics such as that caused by normal aging. Furthermore this arrangement produces a tremolo effect in all tones whereas ordinarily it is desired only in those tones which are rich in harmonics such as string tones and not in relatively pure tones such as flute tones.

It is accordingly an object of the invention to provide an oscillator whose frequency is substantially independent of variations in tube characteristics.

It is another object of the invention to provide an electrical musical instrument in which a tremolo effect may be produced without substantially affecting the frequency of the tones.

Another object is to produce an instrument in which a tremolo effect is produced by periodically varying the quality or wave form of the tones.

Still another object is to provide an instrument in which a tremolo effect is produced only in those tones which are relatively rich in harmonics.

The above and other objects and advantages of the invention will be more readily apparent from the following description when read in connection with the accompanying drawing, in which the single figure is a diagrammatic view of an oscillator for an electrical musical instrument embodying the invention.

The oscillator circuit as shown is substantially similar to that more particularly described and claimed in the patent to McKellip et al. No. 2,340,002 for producing tone frequency currents of two different characters from a single oscillator circuit. The circuit, as shown, comprises an electron discharge tube 10 having a cathode 11, a control grid 12 and an anode or plate 13. The anode is connected to a resonant tank circuit including an inductive winding 14 having a capacitor 15 connected across it. The winding 14 comprises in effect a split winding, and the B supply for the plate is supplied to the mid point thereof through a lead 16. The tank circuit is connected to the control grid 12 through a blocking condenser 17 and a stabilizing resistor 18. In the construction shown the resistor 18 together with other circuit elements to be described serves the purpose of stabilizing the frequency of the oscillator so that it will not be subject to any substantial frequency variations.

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Tone frequency currents are derived from the tank circuit through a transformer indicated generally at 19 for which the winding 14 comprises the primary. The transformer has a secondary winding 21 which is connected across a potentiometer resistance 22 so that the amplitude of the output can be adjusted. The output is transmitted through wires 23 one of which variably engages the resistance 22 to a suitable signal reproducing system as shown, for example, in said Patent No. 2,340,002. The tone frequency currents derived from the tank circuit through the transformer 19 are substantially pure sine wave currents to produce a flute tone.

The grid and cathode are connected by a circuit including a pair of resistors 24 and 25 in series with the resistor 18 and with a source of C bias 26. The cathode is connected to a wiper 27 movable over an output resistor 28 which may be connected through a lead 29 to the tone reproducing means. The lower end of the resistor 28 is grounded at 31, as shown. As explained in the McKellip patent, the tone frequency currents derived from the resistor 28 will be rich in harmonics and will produce tones similar to string tones. It will be understood that the several tone currents can be mixed as desired to obtain different tone effects.

The bias impressed on the control grid 12 by the C bias source 26 is sufficient to bias the tube to cut off so that it will normally not conduct. For keying the circuit to start it oscillating when desired, a key switch 32 is provided to connect the point between resistors 24 and 25 to ground at 33. When the switch 32 is closed, the bias source will be shunted to remove the bias from the control grid so that the tube will conduct and the circuit will start to oscillate.

To provide a tremolo effect a low frequency tremolo generator 34 which may be a low frequency oscillator is provided. One side of the generator is connected to ground at 33 and the other side is adapted to be connected in series with the keying switch 32 by a switch 35. With the switch 35 in the full line position shown,

the tremolo generator is out of the circuit and no tremolo effect will be produced. When the switch **35** is moved to its dotted line position, the tremolo generator will be in effect connected across the resistor **25** so that it will be effective.

In the circuit as illustrated I have found that by selection of a proper value for the resistance **18**, the circuit will be highly stabilized and will be made substantially independent of variations in tube characteristics or of changes in bias on the tube. In fact if the resistance **18** is made too large the circuit can be made to reverse its normal direction of frequency change for a given change in tube characteristics. In one example using a 12AH7 tube with a plate voltage of about 105 volts and a frequency between 60 and 120 C. P. S. I have found that the resistor **18** should be from about 470,000 to 820,000 ohms. For lower frequencies the value of the resistor should be somewhat higher. While the effect of changes in tube characteristics can be completely eliminated by careful selection of the resistor **18**, I have found that the value of this resistor is not extremely critical and that an approximately correct value of the resistor will eliminate about 98% of the effect of tube characteristic changes.

Preferably the tremolo generator is so designed as to produce a voltage fluctuation on the order of not to exceed about five volts which is insufficient to effect the frequency of the oscillator. I have found however that when the tremolo voltage is impressed on the circuit in the manner shown, it will produce a periodic variation in the quality or the wave form of the tone frequency currents derived from the grid cathode circuit through the resistor **28**. This periodic change in quality produces an effect on the listener which is very pleasing and which is somewhat similar to the effect produced by the usual frequency changes accompanying a tremolo. While the generator will vary the quality of the tone frequency currents derived from the grid cathode circuit, it will not appreciably effect the currents derived from the tank circuit. This is highly desirable since it is ordinarily desired only to have a tremolo in those tones which are rich in harmonics such as the string tones or mixed tones and not in the relatively pure tones such as flute tones.

While one embodiment of the invention has been shown and described in detail herein, it will be understood that this is illustrative only and is not intended as a definition of the scope of the invention, reference being had for this purpose to the appended claims.

What is claimed is:

1. In an electrical musical instrument, an oscillator circuit including an electron discharge tube having a cathode, an anode and a control grid, means in the circuit to stabilize it so that the oscillator will oscillate at a substantially constant frequency, means to supply a bias to the control grid to bias the tube to cut-off, a shunt circuit around the biasing means including a switch adapted to be closed to start the oscillator, a low frequency generator, and means to connect the generator in the shunt circuit.

2. In an electrical musical instrument, an oscillator circuit including an electron discharge tube having a cathode, an anode, and a control grid, a circuit connecting the cathode and the control grid, means for deriving tone frequency current from the circuit, a low frequency tremolo generator, and means for connecting the generator in the cathode-grid circuit to change the wave form of the derived tone frequency current.

3. In an electrical musical instrument, an oscillator circuit including an electron discharge tube having a cathode, an anode, and a control grid, a circuit connecting the anode and grid, means for deriving tone frequency current from said circuit, a circuit connecting the grid and cathode, means for deriving tone frequency current of a different character from the last named circuit, a low frequency generator, and means to connect the generator in the grid-cathode circuit to change the wave form of the tone frequency current derived from the grid-cathode circuit while maintaining substantially constant the frequency of oscillation of the oscillator circuit.

4. In an electrical musical instrument, an oscillator circuit including an electron discharge tube having a cathode, an anode, and a control grid, a circuit connecting the anode and grid and including a resistor to stabilize the frequency of oscillation of the tube, a grid-cathode circuit including a pair of resistors in series, means to derive tone frequency currents from the grid-cathode circuit, a low frequency tremolo generator, and means to connect the generator across one of said pair of resistors.

5. In an electrical musical instrument, an oscillator circuit including an electron discharge tube having a cathode, an anode, and a control grid, a tuned circuit connected to the anode, means including a series resistor connecting the tuned circuit to the control grid, means to derive tone frequency currents from the tuned circuit, a circuit including two resistors in series connecting the grid and cathode, means to derive tone frequency currents from the last named circuit, a low frequency tremolo generator, and means to connect the generator between the cathode and a point between the two resistors to vary the wave form of the last named tone frequency currents without substantially affecting their frequency.

6. In an electrical musical instrument, an oscillator circuit including an electron discharge tube having a cathode, an anode, and a control grid, a circuit connecting the cathode and the control grid, a resistor in series in the circuit, means for deriving tone frequency current from the circuit, a low frequency tremolo generator, and means to connect the tremolo generator across said resistor.

7. In an oscillator, a three electrode electron discharge device having a cathode, an anode, and a control grid, a tank circuit operably connected to the anode and to the control grid, a frequency stabilizing resistance in series to the grid, a circuit including a resistance in series connecting the cathode through said first named resistance to the control grid, and means for deriving a signal from the last named resistor.

THOMAS H. LONG.

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