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L. DE FOREST

ELECTRICAL MEANS FOR PRODUCING MUSICAL NOTES

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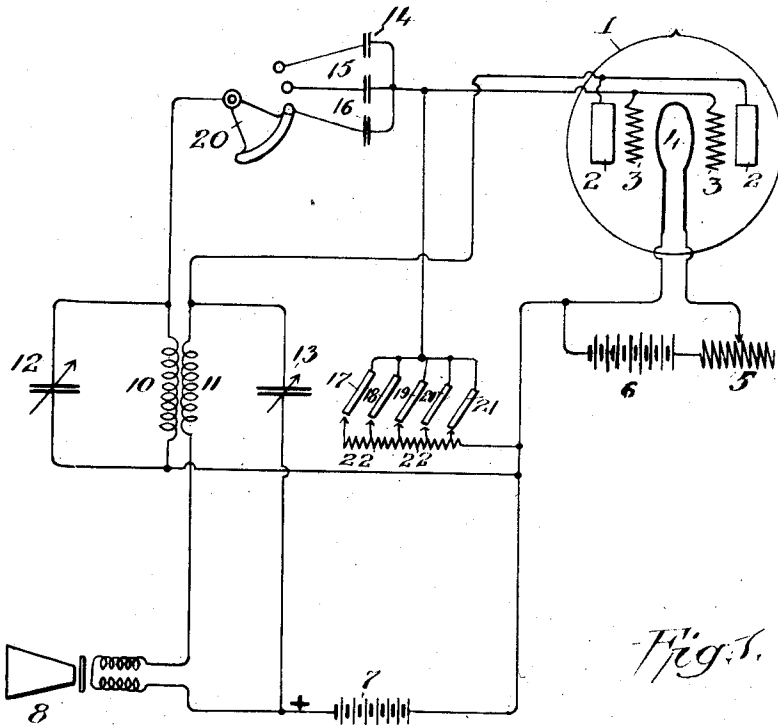


Fig. 1.

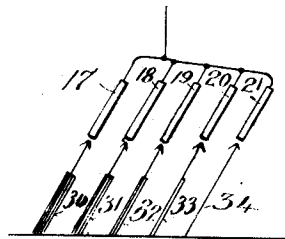


Fig. 2.

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by his Atty
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UNITED STATES PATENT OFFICE.

LEE DE FOREST, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO DE FOREST PHONOFILM CORPORATION, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF DELAWARE.

ELECTRICAL MEANS FOR PRODUCING MUSICAL NOTES.

Application filed April 24, 1915. Serial No. 23,700.

To all whom it may concern:

Be it known that I, LEE DE FOREST, a citizen of the United States, residing in the city of New York, county of Bronx, and State of New York, have made a certain new and useful invention in Electrical Means for Producing Musical Notes.

My invention relates to electrical means for producing musical notes or other sounds. The object of the invention is to provide means for electrically reproducing sustained musical notes of any desired pitch.

Further objects of the invention will appear more fully hereinafter.

The invention consists substantially in the combination and location of parts and the circuit arrangements employed in connection therewith, all as will be more fully hereinafter set forth, as shown in the accompanying drawing, and finally pointed out in the appended claims.

Referring to the drawing,—

Fig. 1 is a diagrammatic view showing one arrangement for accomplishing the objects and purposes of my invention.

Fig. 2 is a detail view of a modified switch arrangement as used in connection with my invention.

In accordance with my invention I employ an exhausted glass bulb 1, such as an audion, which, in the form shown, contains the usual hot filament electrode 4 and the cold plate electrodes 2 and the input or grid electrodes 3, preferably, but not necessarily located between the filament and plate electrodes, as shown. A source of current, such as a battery 6, heats the filament electrode and a variable controlling resistance 5 is included in the filament circuit to control the amount of current from the source 6. For the purposes of illustration I have shown and described herein a double plate and grid type of audion, but my invention in its broad scope as defined in the claims, is not to be limited or restricted thereto. The grid or input electrode is connected to the variable capacity, which in the particular form shown, but to which I am not to be limited, comprises the condensers 14, 15, and 16, one, two or all of which may be connected in the circuit by means of the suitable switch device 20. In the form shown these condensers are connected in parallel, and one terminal of the parallel circuit is connected to

one leg of the filament circuit through a circuit containing one winding 10 of a transformer. Shunted around the coil 10 is a variable capacity such as a variable condenser 12.

The other winding 11 of the transformer is connected to the plate electrodes 2 of the audion 1, and through the coils of a telephone receiver or reproducer indicated at 8 to one terminal, preferably the positive terminal of the flux battery 7, the other, preferably the negative terminal of which is connected to the filament circuit, preferably on the same side thereof as is connected one terminal of the coil 10 as hereinbefore described. In shunt around the secondary coil 11 of the transformer, or in shunt around the secondary coil 11 and the coil of the receiver or reproducer 8 which are connected in series in the form shown, is another capacity for which I find it preferable to employ a variable condenser 13. It will be readily seen and understood that while certain advantages to be hereinafter described are obtained by thus associating a variable capacity around the secondary coil of the transformer, it is not essential for the objects and purposes of my invention, and I am not, therefore, to be limited or restricted in this detail.

Connected between the grid and filament electrodes of the audion is a series of high resistance paths, indicated at 22, 22, preferably non-inductive, comprising, for example, ground glass, graphite marks or other high resistance materials. The total resistance of this leak path should be from 5,000 to 10,000 ohms. Several taps are taken from the leak path and each tap is adapted to complete the electric circuit between the grid and the filament electrode by means of the switches 17, 18, 19, 20, 21, etc., one switch being provided for each tap. The switches may be of any construction, but preferably in the form of piano keys, adapted to close their respective circuits by light pressure of the fingers.

I have found that when an audion is connected as above described, periodic current charges are set up in the grid-filament circuit and also in the associated plate-filament circuit, capable of producing in a telephone receiver or other suitable sound reproducer, sustained musical notes of a remarkable

clearness and purity of tone. The pitch or periodicity of these sounds, depends, among other things, upon the inductance in the associated circuits, the capacities of the various condensers and also in the amount of resistance in the high resistance leak path. I am enabled, therefore, by varying these elements at will, to produce any desired note or tone in the receiver or reproducer 8. The general pitch of the instrument is once determined by the shunt condensers 12, 13, or by the blocking variable capacities 14, 15, 16, connected in series or series parallel with the grid. The simplest method of producing a scale or gamut, of any desired intervals, is then to properly adjust or graduate the resistance of the leak paths 22, 22, which can be done simply by making heavier or lighter marks with a hard graphite pencil.

20 A modified form of a simple tuning arrangement is shown in Fig. 2 where key 17, for example, closes a low resistance path 30; key 18 closes a path 31 of somewhat higher resistance; and key 19 one of still higher resistance, as 32, etc.

In this way, closing key 17 will produce a note of higher pitch than will closing key 18, closing key 19 will produce a lower note than will closing key 18 etc., while closing any two keys together will raise the pitch of the resultant note over that produced by closing either key alone.

Many other ways will at once suggest themselves to those skilled in the art for producing notes of desired pitch. By associating two or more such oscillating audions and circuits, an endless variety of notes, chords and tonal variations may be obtained, therefore, while I have shown and described but one instrument, it will be understood that any number of instruments may be associated with each other, in the broad scope of my invention, and thus produce many novel and distinctively beautiful musical effects.

By gradually varying a condenser, for example, 12 or 13, the change of pitch is made continuous, and thus, a siren note having a wide range of pitch is obtained.

50 Having now described the objects and nature of my invention, and one arrangement for the accomplishment thereof, what I claim as new and useful and desire to secure by Letters Patent, is,—

55 1. An electrical tone producer including an audion having plate, grid and filament electrodes, a series oscillating circuit connecting the plate and filament electrodes, a circuit connecting the grid and filament electrodes, and a resistant leak path comprising a plurality of resistance elements, means for connecting any number of said resistances be-

65 tween said circuits, means for inductively associating the circuits with each other, and a sound producing device included in said plate-filament circuit.

2. An electrical tone producer including an audion having plate, grid and filament electrodes, a series oscillating circuit connecting the plate and filament electrodes, a circuit connecting the grid and filament electrodes, and a resistance leak path comprising a plurality of resistance elements, means for connecting any number of said resistances between said circuits, means for inductively associating the circuits with each other, and an electro-responsive device included in one of said circuits for converting the current variations into sound waves.

3. An electrical tone producer comprising an audion having plate, grid and filament electrodes, and circuits associated therewith having means whereby said audion and circuits become a source of sustained oscillations, and means comprising a plurality of resistances selectively included in one of said circuits for varying the current flowing therethrough, and an electro-responsive device included in one of said circuits for translating said current variations into sound waves.

4. An electrical tone producer comprising an audion having plate, grid and filament electrodes, a circuit connecting said grid and filament electrodes, and a circuit connecting said plate and filament electrodes, means included in said circuits whereby said audion and circuits become a source of continuous oscillations, and means comprising a plurality of resistance elements selectively connected in one of said circuits for varying the current flowing therethrough, and an electro-responsive device included in one of said circuits for translating said current variations into sound waves.

5. An electrical tone producer comprising an audion having plate, grid and filament electrodes, and circuits associated therewith having means whereby said audion and circuits become a source of sustained oscillations, and means comprising a plurality of resistances selectively inserted in one of said circuits for varying the current flowing therethrough, and an electro-responsive device included in one of said circuits for translating said current variations into sound waves, and independent means included in another of said circuits for regulating the pitch of the tones produced.

120 In testimony whereof I have hereunto set my hand on this 21st day of April A. D., 1915.

LEE DE FOREST.