

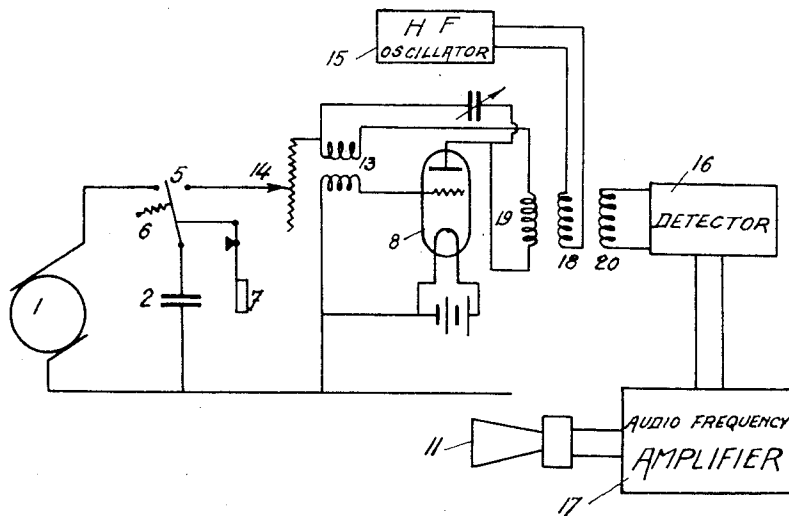
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ELECTRIC PIANO HARP

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UNITED STATES PATENT OFFICE

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ELECTRIC PIANO HARP

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The production of sustained musical sounds by means of the combination of two high frequency oscillators employing three-electrode tubes has been heretofore known in the art as a heterodyne system. The current resulting from the beat between the two oscillations thus produced is rectified and caused to actuate a loud speaker through the medium of an audio frequency amplifier. The present invention has for its object the production, by means of damped musical sounds, analogous to those of the piano or harp, the damping being subject to regulation as desired.

In carrying the invention into effect the supply circuits of one of the two high frequency oscillators are modified in such manner that it can only produce damped oscillations, which are caused to combine with the sustained oscillations of the second oscillator. The current resulting from this combination is fed to a rectifier of suitable type, and is then amplified in an audio-frequency amplifier, the output of which serves to supply a loud speaker.

The accompanying drawing illustrates diagrammatically one method of carrying the invention into effect. Referring to the drawing, the current source 1 is arranged to charge a condenser 2, the discharge of which is employed to feed the plate circuit of a high frequency oscillator composed of a three-electrode tube 8, the coupling arrangement 13 serving in a known manner to produce sustained high frequency oscillations when the potential applied to the plate of the three electrode tube is sufficiently high.

In order that these high frequency oscillations may be damped, that is to say, may have an amplitude decreasing periodically, the source of electrical energy supplying the plate of the tube comprises according to the invention a condenser 2 maintained in a charged condition by the source 1 of continuous current as long as a key 7 of a commutator 5 provided with a return spring 6 is not depressed. When the key 7 is depressed, the condenser 2 is discharged aperiodically into the plate circuit of the valve 8 at a rate which may be adjusted by means of a resistance 14. It will

be observed that a result is thus obtained which is equivalent to that produced by a source of plate potential of which the tension progressively diminishes, and that consequently the valve 8 produces a train of damped oscillations each time the key 7 is depressed. These oscillations are caused to combine with sustained oscillations produced by a second oscillator 15 of ordinary type, by means for example of a transformer with three windings, one winding 19 being inserted in the oscillating circuit of the valve 8, another winding 18 being supplied with energy by the oscillator 15, and a third winding 20 serving to supply a loud speaker 11 through the intermediary of a rectifier 16 and an audio-frequency amplifier 17.

It is to be understood that the invention comprises numerous variations from the arrangement above described which are included in the following claims.

Claims:

1. Apparatus for producing a damped musical sound, comprising a generator of sustained oscillations of inaudible frequency, a generator of damped oscillations of inaudible frequency, means for combining the oscillations produced by said generators, and means for transforming the resultant of combining said sustained oscillations and said damped oscillations into sound.

2. Apparatus for producing a damped musical sound comprising a generator of sustained oscillations of inaudible frequency, a generator of damped oscillations of inaudible frequency comprising a thermionic valve arranged as an oscillator, and means for supplying the anode of the said valve with a rapidly decreasing potential, means for combining the oscillations supplied by said generators, and means for transforming the resultant of combining said sustained oscillations and said damped oscillations into sound.

3. Apparatus for producing a damped musical sound comprising in combination a generator of sustained oscillations of inaudible frequency, a generator of damped waves of inaudible frequency comprising a thermionic tube oscillator means for supplying the anode of the said tube with a rapidly

decreasing potential, means for regulating the rate of decrease of said potentials, means for combining the oscillations supplied by said generators, and means for transforming
 5 into sound the resultant of combining said sustained oscillations and said damped oscillations.

4. Apparatus for producing a damped musical sound comprising in combination a
 10 generator of sustained oscillations of inaudible frequency, a thermionic tube generator of oscillations of inaudible frequency, a source of rapidly decreasing potential supplying the plate circuit of the said tube generator,
 15 a variable resistance interposed in the circuit of said source of potential, means for combining the oscillations supplied by said generators, and means for transforming the resultant of combining said sustained oscillations and said damped oscillations into sound.

5. Apparatus for producing a damped musical sound comprising in combination a generator of sustained oscillations of inaudible frequency, a thermionic tube generator arranged to produce oscillations of inaudible frequency which differ from the first said inaudible frequency by an audible frequency, a condenser, a source of continuous
 30 current arranged to charge said condenser, means for connecting said condenser alternately to the charging source and to the plate circuit of the said tube generator, a variable resistance connected in the circuit of the condenser and the anode of said tube through which said condenser discharges, a circuit in which the oscillations of the two generators are superposed, means for rectifying the resultant beats of audible frequency, means for
 40 amplifying said rectified beats and means for transforming the amplified current into acoustic vibrations.

6. In an electric generator of damped acoustic vibrations, a source of undamped
 45 high-frequency oscillations, a source of damped high frequency oscillations, a detector, the input circuit of said detector being coupled to the output circuits of both of said sources, and means for transforming the
 50 output of said detector into sound.

7. In an electric generator of damped acoustic vibrations, a source of undamped high frequency oscillations, a source of damped high frequency oscillations comprising an electron tube and a circuit including resistance for producing damped oscillations connected to said electron tube, a detector, the input circuit of said detector being coupled to the output circuits of both of
 60 said sources, and means for transforming the output of said detector into sound.

8. In an electric generator of damped acoustic vibrations, a source of undamped high frequency oscillations, a source of
 65 damped high frequency oscillations comprising

ing an electron tube oscillator, a source of potential, a condenser, a resistance, and means for alternately connecting said condenser to said source of potential and to the plate and cathode of said electron tube oscillator through said resistance, a detector, the input circuit of said detector being coupled to the output circuits of both of said sources, and means for transforming the output of said detector into sound.

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