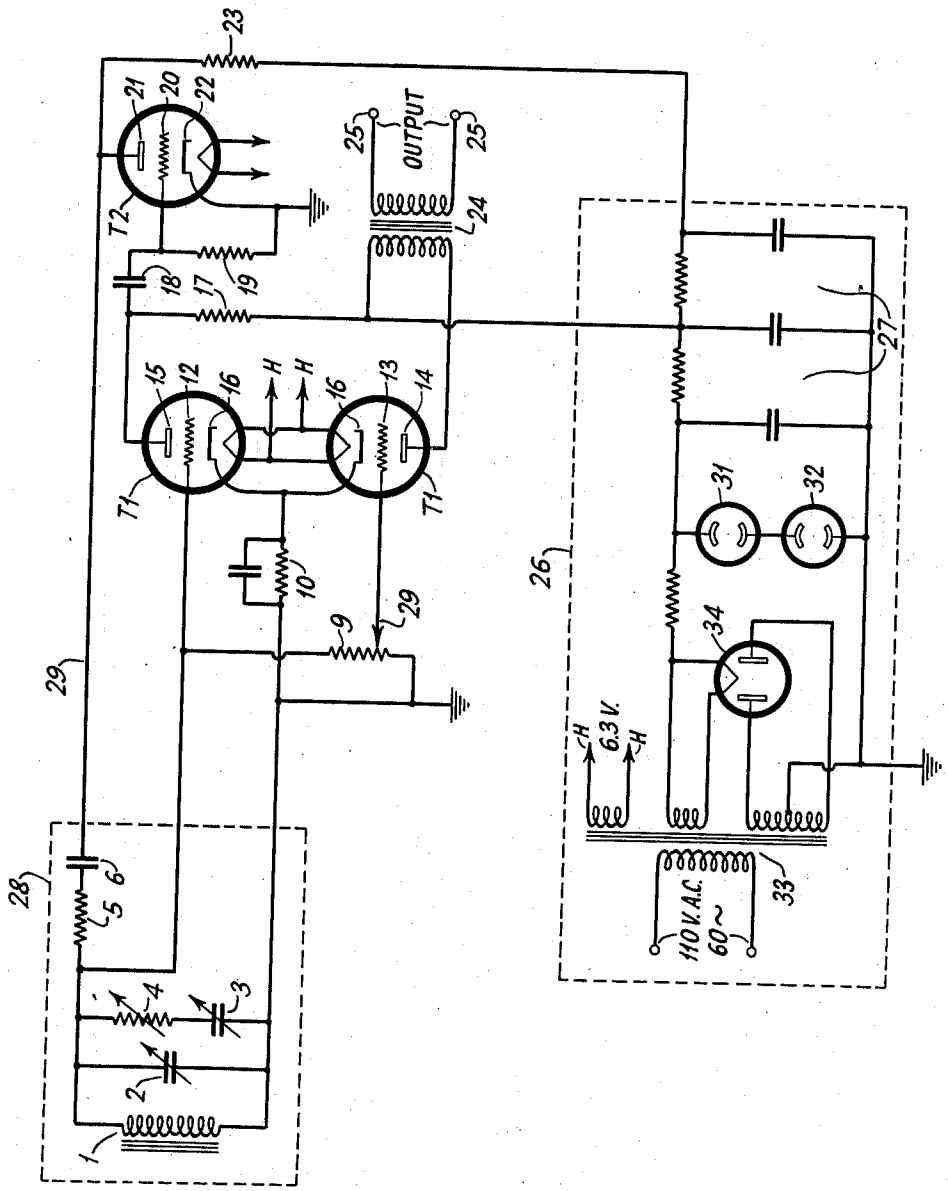
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CONSTANT FREQUENCY OSCILLATION GENERATOR

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CONSTANT FREQUENCY OSCILLATION GENERATOR

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2 Claims. (Cl. 250—36)

This invention relates to vacuum tube oscillation generators, and has for its primary object to provide an oscillation generator which can produce oscillations of constant audible frequency and constant amplitude. Further objects are: To provide such a generator which is substantially free from the generation of harmonic frequencies; to produce oscillations which are substantially constant regardless of the usual fluctuations in power supply voltages within a range of plus and minus 10%; to produce oscillations which are substantially constant with changes in ambient temperature in a range between 50° and 100° F.; and to provide a simple, accurate and economical tone source of almost any desired audible frequency.

The foregoing objects are, in general, achieved in accordance with the present invention by the provision of a pair of cascaded amplifier tubes, one of said amplifiers serving the dual purpose of limiting the amplitude and reversing the phase of the energy fed back to the other amplifier. A stabilizing resistance is provided in the feed-back path between the output circuit of the limiter tube and the resonant input circuit of the other tube of the pair for preventing changes in the vacuum tube circuit constants from affecting the resonant circuit.

One advantage of the present invention is that the limiter and phase inverter amplifier tube improves the stability of the frequency and amplitude of the system, while at the same time simplifies the construction of the resonant circuit.

Other objects, advantages and features will appear from a reading of the following description, which is accompanied by a drawing wherein the single figure illustrates a complete oscillation generation system in accordance with the invention, including a power supply system.

Referring to the drawing, there is shown a multi-vacuum tube tone oscillation generator comprising a pair of amplifier tubes T1 and T2. Although T1 is here shown as two tubes, it will of course be obvious that it may be a twin-triode tube having two space discharge paths. From one of the anodes 15 of T1 feed-back energy is supplied to the amplitude-limiter driving tube T2 and from the other anode 14 of T1 output energy is supplied through a suitable transformer 24 to a utilization circuit 25.

A conventional type of power supply system 26, employing a suitable transformer 33, a full wave rectifier 34, a pair of voltage regulator tubes 31, 32, and a resistor-capacitor filter 27, serves to pass operating potentials to the various portions of the oscillation circuit.

T1 comprises, in effect, two Class A amplifiers for producing linear amplification of the energy impressed on grids 12 and 13. The usual cathode resistor and condenser combination 10, 11 provides the automatic bias for the grids 12 and 13. Coupled to the grid 12 and cathode 16 is a tuned oscillatory circuit comprising an iron-core inductance 1 having in shunt therewith a main tuning condenser 2. A variable resistor 4, in series with a vernier condenser 3, both in shunt to the tuned circuit 1, 2, serves to change the frequency of oscillations produced in the generator. The anode 15 of one of the space paths of amplifier T1 is connected through a blocking condenser 18 to the grid 20 of the amplitude-limiter drive tube T2. A suitable potentiometer 9 in the grid circuits of the twin-space path amplifier T1 is used to vary the alternating current potential applied to grid 13 through its movable member 29', thus governing the level of the energy supplied to the transformer 24. Potentiometer 9 also serves to provide a leakage path to ground for grid 12 and 13.

The feed-back of energy from the anode or output electrode 21 of tube T2 to the grid input electrode 12 of one space path of T1 over path 29 is in such phase and of such magnitude as to overcome the losses in the circuit and produce oscillations. Putting it another way, it may be said that the voltage gain of the tubes T1 and T2 is unity or greater between grid 12 of tube T1 and the anode 21 of tube T2.

Serially connected in the feed-back path 29 is a coupling condenser 6 and a stabilizing resistor 5. Resistor 5 is relatively high compared with the anode resistance of tube T2, and makes the resistance which the tuned circuit 1, 2 sees when looking toward the anode 21 substantially independent of the electrode voltages. We thus have a resistance stabilized oscillation generator.

Tube T2 is biased to function as an overloaded drive tube, thus limiting the amplitude of the energy fed back over path 29. The grid 20 is connected to ground through resistor 19, and the energy supplied to this grid from the anode 15 of tube T1 is sufficient to cause the anode current in tube T2 to rise to a point of saturation on the positive half of the cycle, and to drop to zero on the negative half of the cycle, thereby producing the effect of amplitude limiting.

Suitable positive potentials are supplied from the power supply system 26 to the anodes 14 and 15 of the twin space path amplifier T1 through the

resistor 17 and the primary winding of audio transformer 24, respectively, and to the anode 21 of tube T2 through resistor 23.

The operation of the oscillation generator is as follows: Any voltage appearing across the tuned circuit 1, 2 is impressed on the grids 12, 13 and cathode 16 of the amplifier T1, whereupon it develops a voltage on the anode 15 substantially 180° out of phase with the original voltage. This developed voltage is transmitted to the grid 20 of the amplitude-limiter tube T2 through condenser 18. Tube T2 functions not only as a limiter but also produces on the anode 21 a voltage which is again reversed substantially 180° with respect to the voltage on grid 20, but now in phase with the original voltage on grid 12. It will thus be seen that the tube T2 functions both as a limiter and as a phase inverter.

It has been found that the combination of a resistance-stabilized oscillator with the amplitude and phase reversing tube in the feed-back circuit has produced an oscillation generator of remarkable constancy of frequency and output, and one which is simple and economical to construct.

In one embodiment used in practice, the elements contained within the dotted box 28, consisting of resonant circuit 1, 2, vernier adjustment elements 3, 4, stabilizing resistor 5, and coupling condenser 6, were built up in an assembly separate and apart from the tube circuit per se. Plugs were used on this assembly while cooperating jacks were employed in the tube circuit for connecting the elements together. With this embodiment, the frequency remained constant within .012%, while the output level remained absolutely constant, so far as could be observed with the measuring instruments employed.

It will be appreciated, of course, that anyone skilled in the art can make various modifications in the circuit of the invention without departing from the spirit and scope of the appended claims. For example, certain resistors such as 17 and 23 can be replaced by suitable inductance coils; resistor 4 and vernier 3 can be omitted; while inductance 1 can be made to be variable, etc.

What is claimed is:

1. A constant frequency, constant amplitude oscillation generation system comprising two sets of linear amplifier elements each having an input and an output circuit, a frequency controlling circuit connected to the input circuits of both sets of linear amplifier elements, a feed-back circuit from the output circuit of one set of amplifier elements to said frequency controlling circuit, said feed-back circuit including an electron discharge device whose grid is biased to give saturated output current upon the application of a slight positive potential to said device from said last set of amplifier elements, said device having input potentials applied to its grid from said last output circuit and having its anode coupled to said frequency determining circuit through a stabilizing resistance, whereby the phase of the energy in the anode circuit is reversed relative to the energy in the grid circuit, a utilization circuit coupled to the output circuit of said other set of amplifier elements, and a potentiometer in the input circuit of said last set of amplifier elements for regulating the level of the energy supplied to said utilization circuit.

2. A constant frequency, constant amplitude oscillation generation system comprising two sets of linear Class A amplifier elements each having an input and an output circuit, a parallel tuned frequency controlling circuit comprising inductance and parallel capacitance connected to the input circuits of both sets of linear amplifier elements, a feed-back circuit from the output circuit of one set of amplifier elements to said frequency controlling circuit, said feed-back circuit including an electron discharge device whose grid is biased to give saturated output current upon the application of a slight positive potential to said device from said last set of amplifier elements, said device having input potentials applied to its grid from said last output circuit and having its anode coupled to said frequency determining circuit through a stabilizing resistance, whereby the phase of the energy in the anode circuit is reversed relative to the energy in the grid circuit, said resistance being high compared to the anode resistance of said electron discharge device, a utilization circuit coupled to the output circuit of said other set of amplifier elements, and a potentiometer in the input circuit of said last set of amplifier elements for regulating the level of the energy supplied to said utilization circuit.

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