Oct. 10, 1939. G. E. JONES, JR 2,175,694

OSCILLATOR

Filed July 30, 1938

Fig. 1

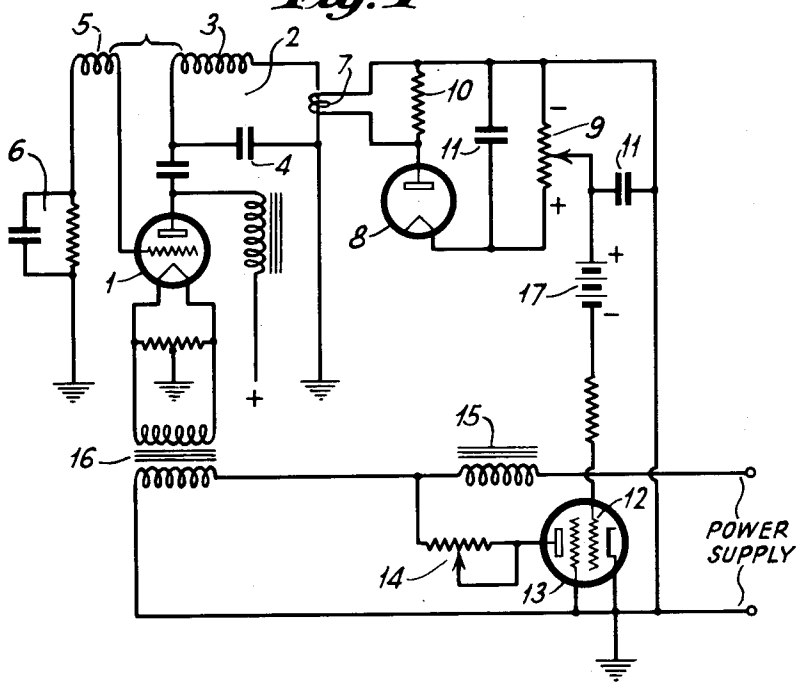
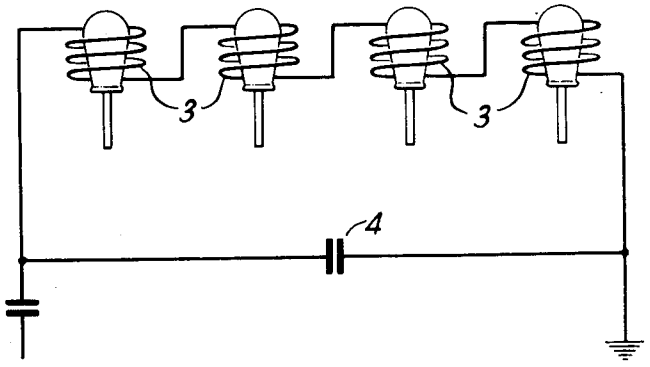


Fig. 2



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Patented Oct. 10, 1939

2,175,694

UNITED STATES PATENT OFFICE

2,175,694

OSCILLATOR

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Application July 30, 1938, Serial No. 222,128

4 Claims. (Cl. 250—36)

My invention relates to oscillators of the thermionic type, particularly to means for controlling the high frequency current of such oscillators.

In some high frequency generators it is desirable to maintain the current amplitude at a predetermined level with changes in load or drain upon the generator. In high frequency induction heating for example, such as high frequency induction heating in manufacture of the metal parts of electron discharge devices, the drain upon the generator changes as the amount of metal in the field of the induction coil is changed. To maintain the current at a predetermined and fixed level manual control means are usually provided for adjusting the grid bias or plate potential of the oscillator.

An object of my invention is an oscillator which will deliver a predetermined and constant high frequency current irrespective of the load placed upon the oscillator.

In accordance with my invention a portion of the undulatory or high frequency output of an oscillator is rectified and the direct current component of the rectified current is impressed upon the grid of a gaseous discharge device, the anode-cathode path of which is connected across the filament supply line to the cathode of the oscillator tube. The direct current component may thus control the amount of filament power delivered to the oscillator cathode and maintain within narrow limits the output high frequency current.

The characteristic features of my invention are defined with particularity in the appended claims and one embodiment is described in the following specification and shown in the accompanying drawing which shows diagrammatically in Figure 1 the circuit of my improved oscillation generator, and in Figure 2 a detail view of one type of load circuit.

The tube of my improved oscillator has been shown by way of example as a triode 1 with an output circuit including a high voltage source connected to the anode through a choke coil, and a tank circuit 2, with a parallel induction loading coil 3 and tuning condenser 4, capacitively coupled to the anode. To maintain high frequency oscillations a grid circuit is provided with a feedback coil 5 connected in series with the usual parallel grid leak resistor and condenser 6.

In industrial applications where the high frequency is fed to a variable load as where the turns of the tank circuit inductance surrounds a furnace to inductively heat metal bodies, it is important that the current remain constant at a predetermined level. In the manufacture of radio tubes for example inductance 3 may be divided into a number or series of connected coils, each coil being mounted upon an exhaust machine to heat the radio tubes as they are indexed into their various exhausting positions on the machine, as schematically represented in Figure 2. The high frequency current should be maintained constant even though the number of tubes being heated may change.

An increase in the inductive load placed on the oscillator will, if the voltage parameters of the circuit remain constant, cause a decrease in the high frequency output current. To prevent changes in the output current flowing in the induction coil, I provide according to my invention means for controlling the emissivity of the oscillator cathode in response to high frequency output current. A small portion of the high frequency current is picked up by an antenna or a coil 7 inductively coupled to the tank circuit and is rectified by diode 8 to produce across the terminals of potentiometer 9 a direct current proportional to the amplitude of the tank current. Resistor 10 and condensers 11 are preferably of such size as to remove the ripple component from the rectified direct current.

The voltage across the selected portion of the potentiometer is impressed upon the control grid 12 of gaseous discharge device 13, the anode-cathode path of which, connected in series with a variable resistor 14, shunts the power supply line to the filament of the oscillator. Upon the initiation of a gaseous discharge resistor 14 is effectively connected across the filament power supply, the resistance of the gaseous discharge path being small. A large current flowing through resistor 14 and through the iron core choke coil 15 serves to reduce the voltage across the windings of the filament transformer 16, reduce the temperature of the filament, reduce its emission and decrease the amplitude of the generated high frequency current. The grid of gas tube 13 is normally biased with battery 17 to prevent a gaseous discharge, so that the gas tube remains inert while the current of generated oscillations remains below a predetermined level.

In operation the plate current, grid bias and filament temperature may be adjusted to deliver high frequency current of selected amplitude when the induction coil 3 has maximum load as when its turns surround a full quantity of metal

to be heated. If the inductive load is reduced as by removing some of the metal, the amplitude of tank current tends to increase. The resulting increase in direct current voltage across potentiometer 9, normally balanced against the voltage of battery 17, raises the potential of grid 12 in a positive direction sufficient to start a gaseous discharge through tube 13. The filament current absorbed in the shunt circuit 13—14 reduces the emission of filament and the high frequency current output of the oscillator. The thermal inertia of the oscillator filament and the stabilizing action of the filter elements in the rectifier circuit serve to prevent sudden changes in oscillator output. As the oscillator output drops below the point where the voltage at 9 will maintain the gaseous discharge in tube 13, the gaseous discharge ceases, the oscillator filament voltage raises, and the oscillator output increases. This cycle of operation repeats, maintaining the total oscillator output substantially constant and at the level initially selected. By moving the sliding contact on potentiometer 9 downward a smaller voltage change across 9, corresponding to a lesser decrease in tank circuit, is necessary to initiate the gaseous discharge in the filament supply gas tube. In one oscillator constructed according to my invention, the gaseous tube is operated to keep the potential of the tungsten filament of the oscillator tube at 60% normal with no load and at 95% normal with full load.

When the filament power supply is alternating current the gaseous discharge is easily started and stopped by small changes in control grid voltage at 12. That is, when the plate voltage of the gas tube is energized with alternating current, the difference between the starting and stopping voltages on its control grid is small, thus making the gas tube sensitive to small changes in oscillator current.

When the oscillator 1 comprises a tube of the type commercially known as 1903 with oscillation circuits selected to deliver in the tank inductance 150 amperes of high frequency current, good results have been obtained with a diode 8 of the type commercially known as 1–V with potentiometer 9 of 10,000 ohms, condensers 11 of 2 microfarads, battery 17 of 45 volts, resistor 14 of 1,000 ohms and tube 13 of the type commercially known as the thyratron FG–105.

An oscillation generator constructed according to my invention will deliver in the tank circuit a predetermined and constant level of high frequency current, the level of the current being easily adjusted and fixed by potentiometer 9. My improved oscillator is easy and inexpensive to construct, is easy to operate and inexpensive to manufacture.

I claim:

1. An oscillator comprising a cathode with power supply lines and input and output electrodes, a tank circuit coupled to the output electrodes and a feedback circuit connected to the input electrodes to sustain high frequency oscillations, means for maintaining at a predetermined level the amplitude of the high frequency current in the tank circuit comprising a grid controlled gaseous discharge device connected across said supply line and means for initiating a gaseous discharge in response to an increase in tank current.

2. An oscillator including an electron discharge device with coupled input and output circuits and a cathode, means for automatically controlling the amplitude of oscillatory output current comprising a diode coupled to said output circuit for rectifying a portion of the said current, means for absorbing part of the power supplied to said cathode and means for controlling the amount of the absorption in response to the amplitude of the rectified current.

3. An oscillator with a cathode and a load circuit, means for automatically controlling the amplitude of oscillatory current in said load circuit comprising a rectifier circuit coupled to said load circuit, a grid controlled gaseous discharge device with its output electrodes coupled across the power supply line to said cathode and connections to impress the rectified current upon the grid of said gaseous discharge device.

4. An oscillator with coupled input and output circuits to sustain high frequency oscillations, a power supply circuit for the cathode of said oscillator, a grid controlled gas discharge device with the anode-cathode space connected across said power supply circuit, a rectifier and a resistance connected in series and coupled to said output circuit, and means for impressing the voltage across said resistance upon the grid of said gas tube.

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