Dec. 15, 1925. 1,566,245

Q. A. BRACKETT

RADIO TELEPHONE SYSTEM

Filed Sept. 2, 1921

Fig. 1.

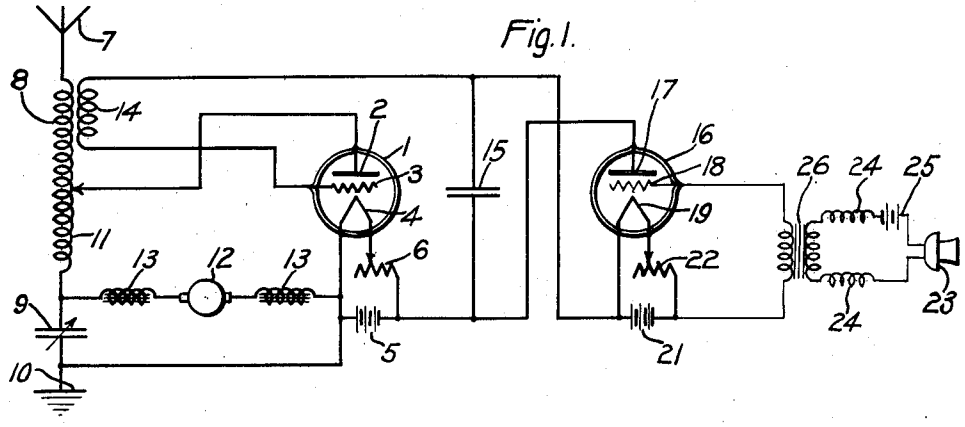


Fig. 2.

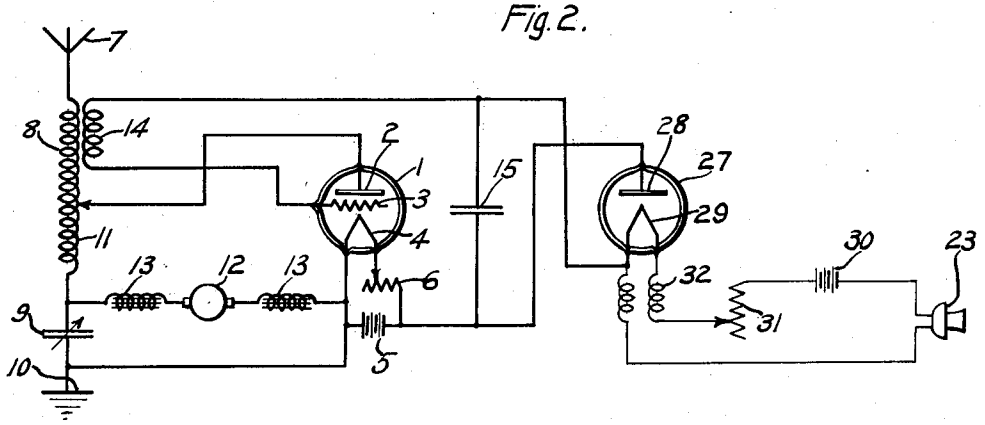
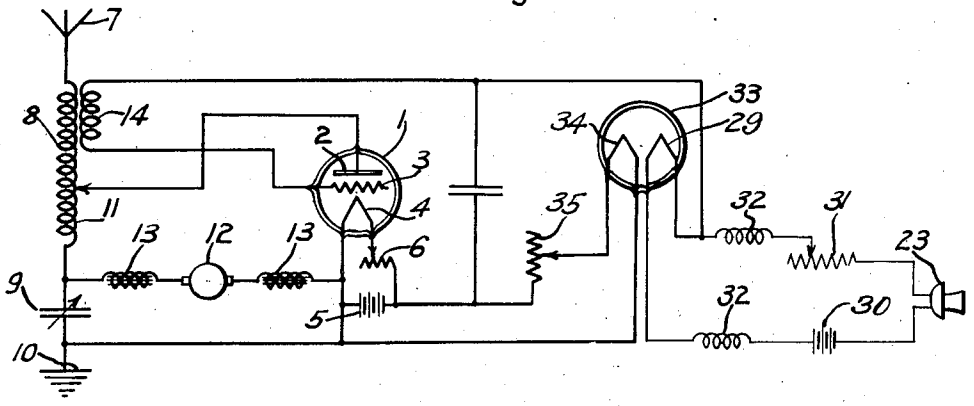


Fig. 3.



WITNESSES:

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UNITED STATES PATENT OFFICE.

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RADIOTELEPHONE SYSTEM.

Application filed September 2, 1921. Serial No. 497,949.

To all whom it may concern:

Be it known that I, QUINCY A. BRACKETT, a citizen of the United States, and a resident of Springfield, in the county of Hampden and State of Massachusetts, have invented a new and useful Improvement in Radiotelephone Systems, of which the following is a specification.

My invention relates to wireless signaling systems and more especially to means for controlling the transmission of radiant energy.

In its broad aspect, the object of my invention is to provide an improved modulating system for use in connection with vacuum-tube oscillation generator systems, whereby the radio-frequency currents generated thereby may be modulated in accordance with sound waves.

More especially, the object of my invention is to provide means for controlling the grid leak of an oscillator tube in accordance with modulating currents, thereby admitting of the radiation of modulated energy.

In my invention, I provide an improved modulating system in which a three-electrode tube is provided with the customary grid condenser and a grid leak, the latter comprising a thermionic device, the impedance of which is adapted to be varied in accordance with sound waves or other signals to be transmitted.

Other objects of my invention, as well as details of construction, whereby my invention may be practiced, will be apparent in the following description and claims, when read in connection with the accompanying drawings, wherein:

Fig. 1 is a diagrammatic view of circuits and apparatus embodying my invention.

Fig. 2 is a similar view, but showing alternative means for controlling the value of the grid leak in accordance with sound waves, and

Fig. 3 is a view similar to that of Fig. 2, but showing an alternative type of modulator tube.

Referring to Fig. 1, an oscillator tube 1 comprises an anode 2, a controlling grid 3 and a cathode 4, which may be energized by means of a source of energy 5 through a resistor 6, operatively associated with an antenna circuit and adapted to generate radio-frequency currents in a manner well known to the art. The antenna circuit comprises an antenna 7, a tuning coil 8, a variable condenser 9 and a ground lead 10.

A plate-filament circuit of the oscillator tube 1, which comprises a portion 11 of the tuning coil 8 and the variable condenser 9, may be energized from a source of direct-current energy 12 through reactors 13 which are connected to opposite plates of the condenser 9.

A grid-filament circuit comprises a feedback coil 14, which is operatively connected to coil 8, a condenser 15 for maintaining a negative charge upon the grid 3 and an adjustable grid-leak device 16 which is connected in shunt relation to the condenser 15.

The adjustable grid-leak device 16 comprises a three-electrode tube, of well known form, having an anode 17, a control electrode 18 and a cathode 19 contained therein. The cathode 19 is energized from a source of energy 21 through a resistor 22. The hot cathode 19 and the anode 17 of the tube 16 are connected to opposite plates of the condenser 15 which are connected, respectively, to the grid 3 and to the hot cathode 4 of the oscillator tube 1. The variations in intensity of the sound waves may be translated into corresponding modulating currents by means of a circuit which includes a microphone transmitter 23, radio-frequency choke coils 24 and a source of energy 25. The transmitter modulations are impressed upon the grid 18 of the tube 16 as potential variations through the transformer 26.

The arrangement shown in Fig. 2 differs from that of Fig. 1 in the means for varying the impedance of the space-current path which is shunted around the grid condenser 15. In the modification just mentioned, I have provided a thermionic device 27 comprising an anode 28, which is connected to the filament side of the condenser 15, and a hot cathode 29 which is connected to the grid side of the condenser 15. The hot cathode 29 may be energized by means of a source of direct-current energy 30, which is connected to the hot cathode 29 through the mocrophone transmitter 23, a battery 30, a resistor 31 and choke coils 32. The choke coils 32 have been so connected as to keep the radio-frequency currents from traversing the source of energy 30 and the microphone transmitter 23, thereby elim-

inating the capacity effects in the elements just mentioned.

Although a one-way leak, such as disclosed in the previous figure, will operate satisfactorily, the grid leak of the modification is of the two-way type. In Fig. 3, I have shown a simple form of thermionic tube 33 which serves as a two-way grid leak. This thermionic tube 33, it will be noted, differs from that shown in Fig. 2 in that the anode 28 has been replaced by a hot cathode 34 which is similar to the hot cathode 29. The hot cathode 34 may be energized from the source of energy 5 through a resistor 35.

In operation, referring to Fig. 1, upon a supply of energy to the oscillator tube 1, and upon a proper adjustment of the constants of the circuits associated therewith, sustained oscillating currents are generated in a manner well known to the art.

The impedance of the tube 16 or, in other words, the rate of leakage of the negative charge from the grid 3 is then adjusted to such value that, upon speaking into the telephone transmitter 23, the radio-frequency currents, which are generated by the tube 1, are modulated in accordance with the potential variations impressed upon the grid 18 of the tube 16.

Referring to Fig. 2, the operation of the grid leak differs from that of Fig. 1 in that the impedance of the space-current path is varied through the control of the filament temperature. In order to render the device properly responsive to such current variations as are produced in the transmitter 23, it is apparent that a relatively fine filament should be employed.

Referring to Fig. 3, the operation of this system is similar to that of Fig. 2.

The thermionic tubes comprising the grid leaks shown in the drawings may be either of the vacuum type or of the gas filled type, depending upon whether a high resistance grid leak or a low resistance grid leak is desired. The temperature variations in the filament 29 necessary to produce effective modulation may be lowered by employing a tube filled with some gas such as hydrogen having the special characteristics found valuable in flash light telegraphy.

In its broadest aspect, my modulating system is applicable as a repeater or an amplifier in any electrical signaling system employing either unidirectional or oscillatory carrier-currents. My invention may be also adapted to wireless telegraph communication by replacing the telephone transmitter 23 by a telegraph key, as will be obvious to those skilled in the art.

While I have described three forms of my invention, many minor changes, alterations and modifications may be made without departing from the spirit thereof. I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art or are specifically set forth in the appended claims.

I claim as my invention:—

1. In a system of modulation, an antenna, an evacuated electrical device comprising a cathode, an anode and a controlling grid operatively associated with said antenna and adapted to produce oscillating currents therein, a space-current device having a space-current path connected in shunt relation to said cathode and to said grid, a source of modulating currents and means for varying the electron emission from one of said electrodes in accordance with said modulating currents, said space-current device having a gas contained therein tending to reduce the temperature variations necessary for effective modulation.

2. In a system of modulation, an antenna, an evacuated electric device comprising a cathode, an anode and a controlling grid operatively associated with said antenna and adapted to produce oscillating currents therein, a space-current device having a space-current path connected in shunt relation to said cathode and to said grid, a source of modulating currents and means for varying the electron emission from one of said electrodes in accordance with said modulating currents, said space-current device including hydrogen gas whereby the temperature variations necessary for effective modulation may be decreased.

3. In a radio device, a vacuum-tube generator, a grid condenser associated therewith, a grid leak for said condenser, said grid leak including a pair of electron-emitting electrodes.

4. In a radio device, a vacuum-tube generator, a grid condenser associated therewith, a grid leak for said condenser, said grid leak including a gas-filled tube and a pair of electron-emitting electrodes therein.

5. In a radio device, a vaccum-tube generator, a grid condenser associated therewith, a grid leak for said condenser, said grid leak including a gas-filled tube, a pair of electron-emitting electrodes therein, and signal-controlled means for varying the space-current resistance between said electrodes.

In testimony whereof, I have hereunto subscribed my name this twenty-sixth day of August, 1921.

QUINCY A. BRACKETT.