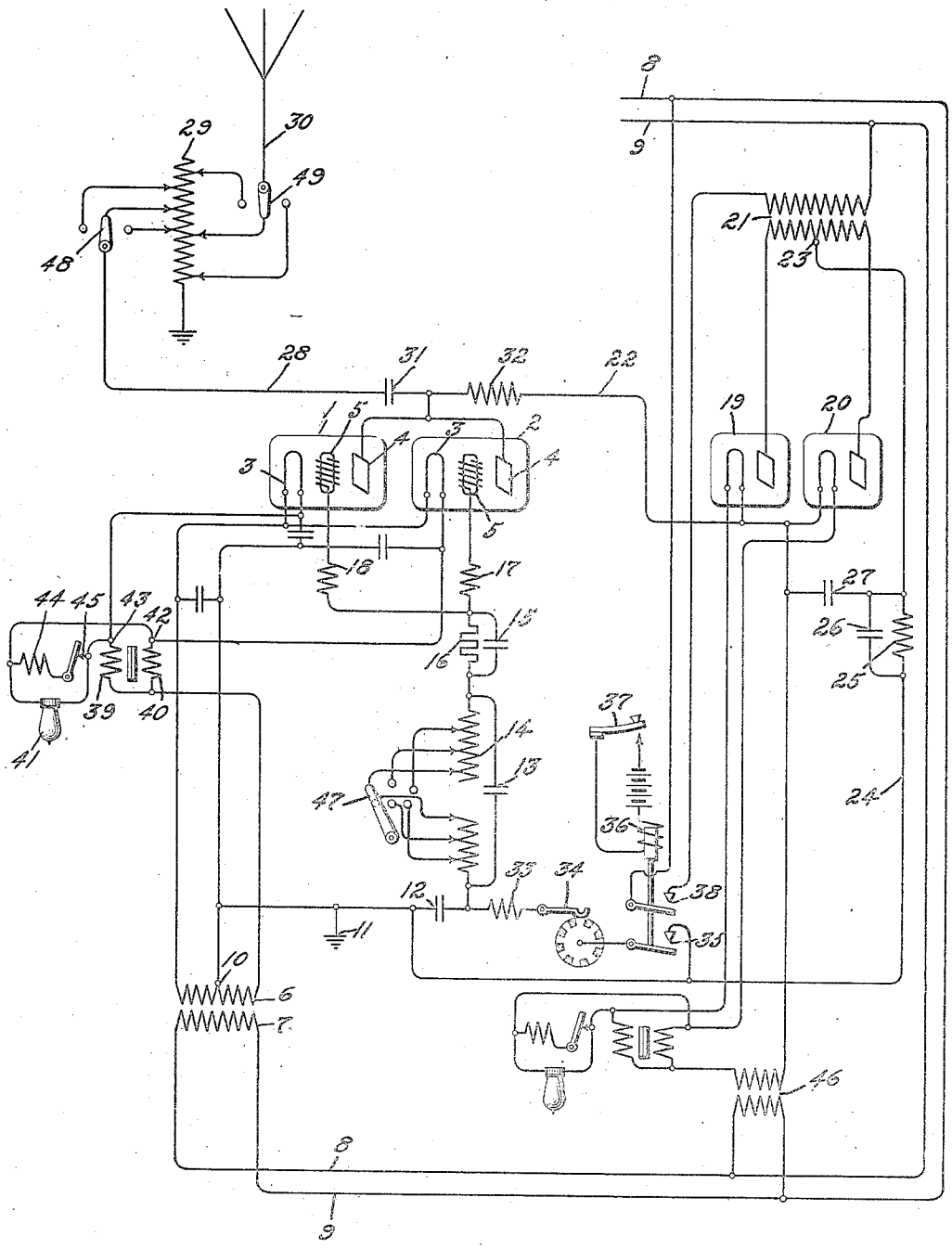
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W. R. G. BAKER

HIGH FREQUENCY SIGNALING SYSTEM

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Inventor:
Walter R. G. Baker,
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His Attorney.

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HIGH-FREQUENCY SIGNALING SYSTEM.

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To all whom it may concern:

Be it known that I, WALTER R. G. BAKER, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in High-Frequency Signaling Systems, of which the following is a specification.

My present invention relates to high frequency signaling systems, and more particularly to systems employing vacuum tubes as generators of high frequency oscillations.

One of the objects of my invention is to provide a simple and efficient arrangement for producing high frequency oscillations by means of vacuum tubes and supplying them to a transformer circuit. Another object of my invention is to provide a safe and reliable means for controlling the current output in accordance with signals to be transmitted.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims, my invention itself, however, both as to its organization and method of operation will best be understood by reference to the following description taken in connection with the accompanying drawing in which I have indicated diagrammatically one circuit organization whereby my invention may be carried into effect.

I have indicated in the drawing two electron discharge vacuum tube devices 1 and 2, which are employed for the generation of high frequency oscillations. These devices each comprise the usual filamentary cathode 3, a plate or anode 4, and a grid electrode 5. Current for heating the cathodes 3 is supplied by the secondary 6 of a transformer, the primary 7 of which is supplied by A C distribution lines 8 and 9. The midpoint 10 of the transformer secondary 6 is grounded at 11. A grid circuit for the devices 1 and 2 includes a condenser 12, a second condenser 13, which is shunted by variable inductance 14, a grid condenser 15, which is shunted by grid leak resistance 16, and two small choke coils 17 and 18, which are connected in the individual leads to the two grids. The plate or anode circuits of the devices 1 and 2 are supplied with current by means of rectifiers 19 and 20 these rectifiers serving to rectify the alternating current impressed upon the plate electrodes from transformer 21, which is supplied with current from distribution mains 8, 9. The cathodes of rectifiers 19 and 20 are connected to the anodes 4 of the electron discharge devices 1 and 2, by a conductor 22. The midpoint 23 of the secondary of transformer 21 is grounded at 11 by means of the conductor 24, a smoothing reactance 25 shunted by a condenser 26 being included in the ground connection. A shunt condenser 27 may also be employed to assist in smoothing out the rectified current.

The potential impressed upon the anodes 4 of electron discharge devices 1 and 2 in this manner is preferably high in order that a large output may be obtained with the comparatively small currents which normally flow through the usual form of electron discharge device. Under these circumstances high frequency oscillations will be produced in the oscillating grid circuit made up of inductance 14 and capacity 13 without any necessity of a feed-back coupling between the grid and plate circuits. The production of oscillations will occur by reason of the negative resistance or dynatron action of the device accompanying the emission of secondary electrons from the grid electrode 5. It has been discovered that with properly constructed tubes this dynatron action will take place even though the average potential of the grid electrode 5 is negative with respect to the cathode 3. The efficiency of the operation is in fact improved by such an arrangement. The condenser 15 shunted by resistance 16 forms a simple and efficient arrangement for maintaining the average potential of the grid electrode 5 negative with respect to the cathode.

When high frequency oscillations are produced in the grid circuit the grid potential oscillates accordingly and this produces corresponding variations in the current in the plate or output circuit. The oscillations thus set up in the plate or output circuit may in the case illustrated be supplied through the conductor 28 to a predetermined point in the inductance 29, which is associated with the antenna 30. A condenser 31 is included in series with the conductor 28 to prevent the rectified current supplied to the device from being short-circuited through inductance 29 and a radio fre-

quency choke coil 32 is included in series with the conductor 22 to prevent the radio frequency currents produced from being short-circuited through the rectifiers 19, 20.

In order to interrupt the current supplied to the antenna 30 to produce telegraphic signals, the condenser 12 may be shunted by a circuit which includes a choke coil 33, a rotary contact maker 34 and a contact 35 of a relay 36, which is operated by means of a key 37. When the key 37 is closed and relay 36 operates to close contact 35, the condenser 12 will be shunted by a comparatively low resistance circuit whenever contact is made by the rotating contact maker 34. Whenever this shunt circuit is closed oscillations will be produced and supplied in the antenna. On the other hand when this shunt circuit is open the grids 5 of devices 1 and 2 will immediately assume so high a negative potential that production of oscillations will be interrupted. The rotating device 34, therefore, furnishes a convenient means for transmitting interrupted continuous wave signals. In case it is desired to transmit continuous wave signals the rotary device 34 may be omitted and current will be supplied to the antenna 30 as long as the key 37 is closed.

It will be apparent that by the arrangement thus far described, the load will be taken by the rectifiers 19, 20 when oscillations cease, and the apparatus will then be subjected to the full potential of the secondary of transformer 21. To overcome this difficulty a second contact 38 is provided for the relay 36, and when the key 37 is opened this contact is opened and power supplied to the rectifiers 19, 20 is interrupted simultaneously with the opening of the shunt circuit around key condenser 12.

It is desirable in the operation of transmitting equipment of the type described that an operator should be immediately informed whenever the filament of one of the electron discharge devices burns out or when the filament current becomes interrupted. I have indicated in the drawing one way in which such an indication may be given. Current is supplied to the filaments 3 of the two devices 1 and 2 in parallel, and in the individual supply conductors to the two filaments I insert two inductively related windings 39 and 40. An indicating lamp 41 is connected to the terminals 42, 43 of said windings, which are adjacent the cathodes 3. When current is being supplied to both filaments points 42 and 43 will be at the same potential and no current will flow through the lamp 41. As soon as one of the filaments is interrupted, however, a potential difference is produced between the points 42 and 43, and the lamp 41 will be illuminated. Lamp 41 may also be shunted by coil 44 through which current will pass when the lamp 41 is illuminated, and this coil may serve to operate a vibratory contact 45 which will control any desired form of audible signal.

The cathodes of the rectifiers 19 and 20 are supplied with heating current by means of a transformer 46, which is connected to the supply mains 8, 9 and an indicating device is provided to indicate a burn out of the filaments of either rectifiers 19 or 20.

Inasmuch as no coupling is provided between the grid and plate circuits of devices 1 and 2 except for the internal coupling of the circuits inside the tubes, the frequency of the oscillations produced will be principally determined by the inductance and capacity of the grid circuit, and will be substantially independent of the antenna constants. The frequency of the oscillations produced may be adjusted by varying either inductance 14 or capacity 13 in the grid circuit. I have indicated variable connections to the inductance 14 and the switch 47 whereby three different predetermined wave lengths may be obtained. A switch 48 may be provided for performing similar adjustments to the supply portion of the inductance 29 and a switch 49 for performing complementary adjustments in the antenna inductance for the various wave lengths. Switches 47, 48 and 49 are preferably so arranged that they may all be operated simultaneously thus permitting of the change of wave length from one predetermined value to another by a single movement of a switch handle.

While I have shown and described a preferred embodiment of my invention it will be understood that many modifications in the form of apparatus employed as well as in the various circuit connections, may be made without departing from the scope of my invention as set forth in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. The combination in a high frequency current generating system of a three electrode electron discharge device having plate and grid circuits associated therewith, means for generating oscillations in said grid circuit independently of any coupling between the circuits, and a series condenser in said grid circuit which is shunted by a resistance for maintaining the average potential of the grid negative with respect to the cathode.

2. The combination in a high frequency current generating system of an electron discharge device having a cathode, an anode and a grid, an oscillating grid circuit associated therewith, means for generating oscillations in said grid circuit independently of any coupling between the grid circuit and other circuits of the device, an oscillating circuit connected between the cathode and

anode of said device and a separate circuit containing a source of potential between the cathode and anode.

3. The combination in a high frequency signaling system of an electron discharge device having a cathode, an anode and a grid, an oscillating antenna circuit connected between the cathode and anode of said device, a second circuit containing a source of potential connected between the cathode and anode of said device, an oscillating grid circuit associated with said device and means for generating oscillations in said grid circuit independently of any coupling between the circuits.

4. The combination in a high frequency signaling system of an electron discharge device having a cathode, an anode and a grid, an oscillating antenna circuit connected between the cathode and anode of said device, a second circuit containing a source of potential connected between the cathode and anode of said device, an oscillating grid circuit associated with said device, means for generating oscillations in said grid circuit independently of any coupling between the circuits, and a series condenser in said grid circuit which is shunted by a resistance for maintaining the average potential of the grid negative with respect to the cathode.

5. The combination in a high frequency signaling system of an electron discharge device having a cathode, an anode, and a grid, means for producing high frequency oscillations by said device and supplying them to a transmitting circuit comprising a source of alternating current and a rectifier for rectifying the current from said source for the operation of said electron discharge device, and means for simultaneously interrupting the supply of current to said rectifier and causing the production of oscillations to stop independently of the interruption in the power supply.

6. The combination in a high frequency signaling system of an electron discharge device having a cathode, an anode and a grid, an oscillating grid circuit associated with said device, means for producing oscillations in said grid circuit independently of any coupling between the grid circuit and other circuits of the device, a condenser in said grid circuit for preventing the production of oscillations and means for simultaneously shunting said condenser and supplying current to the device.

7. The combination in a high frequency signaling system of an electron discharge device having a cathode, an anode and a grid, an oscillating grid circuit associated with said device, means for producing oscillations in said grid circuit independently of any coupling between the grid circuit and other circuits of the device, a condenser in said grid circuit for preventing the production of oscillations, a shunt circuit for said condenser, a source of alternating current, a rectifier for rectifying the current from said source for the operation of said electron discharge device, and means for simultaneously interrupting the current supply to said rectifier and opening said shunt circuit.

8. The combination with a pair of electron discharge devices each of which has a filamentary cathode, of a transformer for supplying current to the cathodes of the two devices in parallel, two inductively related windings connected in individual current supply conductors to said cathodes and a signaling device connected to the terminals of said windings adjacent the two cathodes.

In witness whereof, I have hereunto set my hand this 3rd day of January, 1922.

WALTER R. G. BAKER.