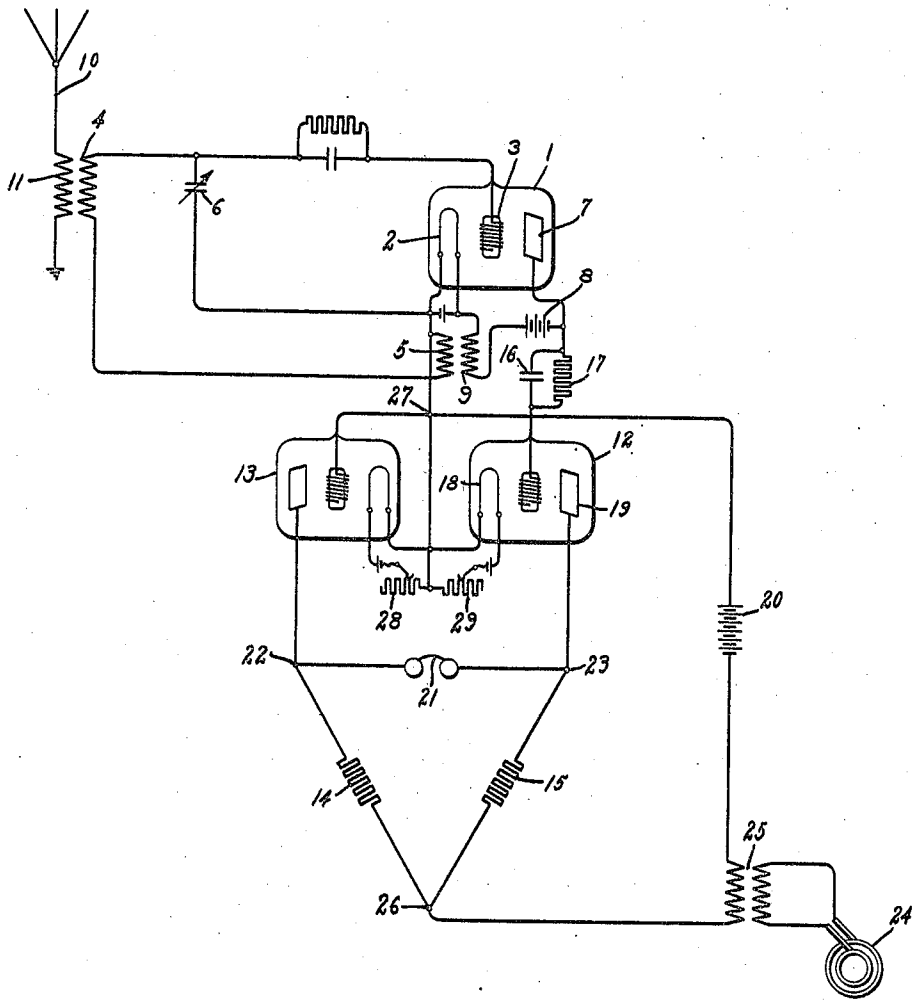
E. F. W. ALEXANDERSON.
RADIO RECEIVING SYSTEM.
APPLICATION FILED JUNE 5, 1919.

1,373,931. Patented Apr. 5, 1921.



Inventor:
Ernst F. W. Alexanderson,
by Albert G. Davis
His Attorney.

UNITED STATES PATENT OFFICE.

ERNST F. W. ALEXANDERSON, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

RADIO-RECEIVING SYSTEM.

1,373,931. Specification of Letters Patent. Patented Apr. 5, 1921.

Application filed June 5, 1919. Serial No. 302,003.

To all whom it may concern:

Be it known that I, ERNST F. W. ALEXANDERSON, 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 Radio-Receiving Systems, of which the following is a specification.

My present invention relates to radio receiving systems, and more particularly to systems for receiving continuous wave signals.

The object of my invention is to provide an efficient and sensitive system for receiving continuous wave signals which will at the same time be highly selective and which will also produce a high degree of amplification of the signals received.

In carrying my invention into effect I provide at a receiving station a means for producing sustained high frequency oscillations. This means for producing high frequency oscillations is so adjusted that it is normally inoperative. It is also so arranged that when signals of a desired frequency are received in the system the local means for producing high frequency oscillations will be set into operation to produce oscillations of the same frequency as the signaling oscillations, the production of these oscillations continuing as long as signals are being received. If the high frequency oscillations thus produced are rectified or detected, a continuous current will be produced, the duration of which will correspond to the length of the dots and dashes of the telegraphic signals received. Such a current will not produce any indication in the ordinary telephone receivers, which are customarily used for reception. I therefore provide additional means for producing a desired indication of the signals which are received.

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

As indicated in the drawing, my receiving system comprises an electron discharge device 1 having associated therewith a grid circuit which includes the cathode 2 of the device, the grid 3, inductances 4 and 5, and a variable condenser 6, for the purpose of tuning the circuit of frequency of the signals which are to be received. A plate circuit for this device comprises a cathode 2, an anode 7, a source of current 8 and an inductance 9. Inductances 5 and 9 are so coupled together that the system is normally on the verge of oscillating. It is well known that the operation of such a system for the production of high frequency oscillations depends upon the transfer of enough energy from the plate circuit to the grid circuit to make up for the losses in the grid circuit. If the coupling is so arranged that the amount of energy which normally would be transferred is too small to produce oscillations a slight increase in the energy in the grid circuit will cause the device to act to produce high frequency oscillations. The small amount of energy required is supplied by means of signaling oscillations received upon the antenna 10 and impressed by means of the coil 11 upon the coil 4 in the grid circuit. Since the energy supplied to the grid circuit must have a proper phase relation to the current in the plate circuit in order to cause the device to act as an oscillator, it is apparent that if the received signals are of different frequency from the frequency for which the oscillating system is tuned, this phase relation will not be suitable for the production of high frequency oscillations. Therefore, the system will not be caused to produce oscillations by signaling currents of other than the desired frequency and will be highly selective for currents of the one particular frequency for which it is tuned. The high frequency oscillations produced by the device will be of much greater magnitude than the oscillations received upon the antenna 10 by reason of the amplifying properties of the electron discharge device 1.

In order to produce an audible indication

by means of the high frequency oscillations produced in the manner above described, the potential changes set up between the cathode 2 and anode 7 of the device 1 are applied to the grid circuit of an electron discharge detector 12, the plate circuit of which is included in one arm of a Wheatstone bridge, the other arms of which are made up of electron discharge device 13 and resistances 14 and 15. The grid circuit of the detector 12 includes the usual condenser 16 shunted by resistance 17, and by means of this arrangement the resistance between the cathode 19 and anode 19 of the detector 12 will be varied in accordance with the signals received. In other words, the current flowing through the detector 12 from the direct current source 20 will vary at a periodicity corresponding to the length of the individual dots and dashes making up the signals which are received. These current changes will of course produce no audible indication in the telephone receiver 21 which is connected between the terminals 22 and 23 of the bridge. The bridge is normally so balanced that no current whatever will flow through the receiver 21. When the signals are received the resistance of the detector 12 which forms one arm of the bridge is varied in the manner described and current will be caused to flow through the receiver 21. In order that an audible indication may be given in the receiver I provide a source of current of audible frequency 24, which is impressed by means of the transformer 25 between the two terminals 26 and 27 of the bridge. When the bridge is unbalanced in the manner described current of this audible frequency will flow through the receiver 21 and give the desired indication of the signals which are being received.

I have indicated a second electron discharge device 13 as forming the arm of the bridge opposite the detector 12 because of the fact that the provision of this device renders the bridge more easily balanced. The desired balancing may be conveniently effected by a variation of the resistances 28 and 29 through which heating current for devices 12 and 13 is supplied.

It will be apparent to one skilled in the art that my invention is by no means limited to the precise circuit arrangement shown, but that many modifications in the connections used as well as in the apparatus employed 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 radio receiving system of normally inoperative means for generating high frequency oscillations at a receiving station, means for receiving continuous high frequency signaling waves and means actuated by received high frequency signaling waves for setting into operation said means for producing high frequency oscillations at the receiving station and thereby producing high frequency oscillations of the same frequency as the received waves.

2. The combination in a radio receiving system of means for receiving continuous wave signals and controlling thereby the generation of a current which changes at a frequency below audibility, a source of current of audible frequency, a receiver and means actuated by the current changes below audibility for causing current from said audible frequency source to actuate said receiver.

3. The combination in a radio receiving system of normally inoperative means for producing high frequency oscillations at the receiving station, means for receiving continuous high frequency signaling waves and means actuated by received high frequency signaling waves for setting into operation said means for producing high frequency oscillations at the receiving station and thereby producing high frequency oscillations of the same frequency as the received waves, means for producing by the high frequency oscillations locally produced a current which changes at a frequency below audibility and means actuated by said current of a frequency below audibility for producing a desired indication of signals.

4. The combination in a radio receiving system of normally inoperative means for producing high frequency oscillations at the receiving station, means for receiving continuous high frequency signaling waves and means actuated by received high frequency signaling waves for setting into operation said means for producing high frequency oscillations at the receiving station and thereby producing high frequency oscillations of the same frequency as the received waves, means for producing by the high frequency oscillations locally produced a current which changes at a frequency below audibility, a source of current of audible frequency, a receiver, and means actuated by the current changes below audibility for causing current from said audible frequency source to actuate said receiver.

5. The method of receiving and detecting continuous wave radio telegraphic signals which consists in utilizing the received signals for causing the generation at the receiving station of high frequency oscillations of the same frequency as the received signals, producing by means of the locally generated high frequency oscillations a current which varies at a frequency below audibility and utilizing said low fre-

quency current to cause a local source of audio frequency current to produce an audible indication.

6. The method of receiving and detecting continuous wave radio telegraphic signals which consists in utilizing received signals to produce a current which varies at a frequency below audibility and utilizing the current thus produced to cause a local source of audio frequency current to produce an audible indication.

In witness whereof, I have hereunto set my hand this 3rd day of June, 1919.

ERNST F. W. ALEXANDERSON.