Dec. 29, 1925 1,567,566

Q. A. BRACKETT

RECEIVING SYSTEM

Filed April 12, 1921

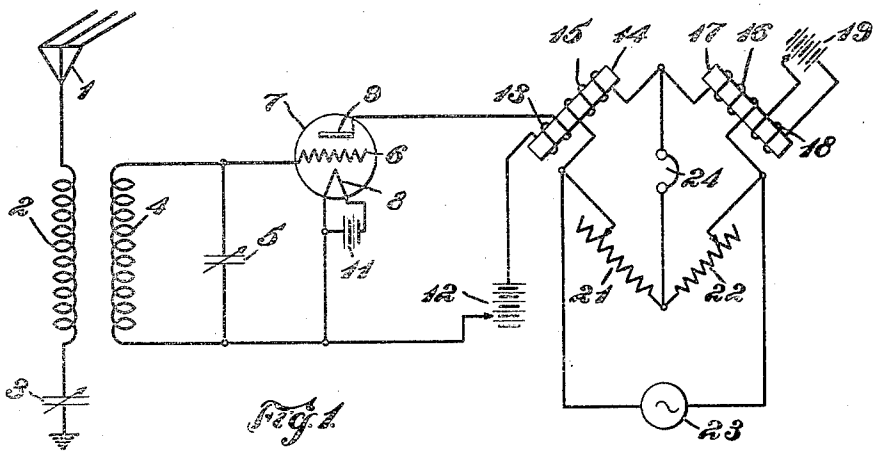


Fig. 1.

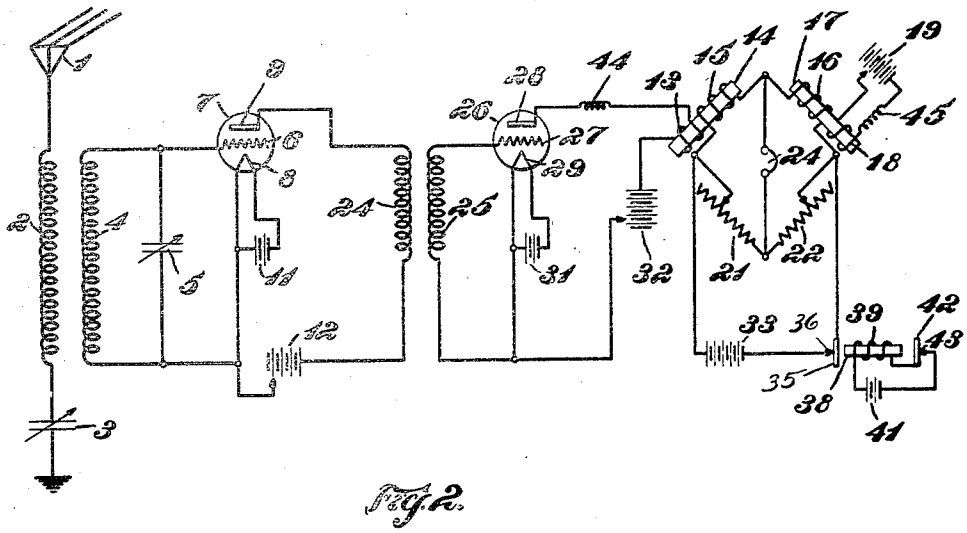


Fig. 2.

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UNITED STATES PATENT OFFICE.

QUINCY A. BRACKETT, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

RECEIVING SYSTEM.

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To all whom it may concern:

Be it known that I, QUINCY A. BRACKETT, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Receiving Systems, of which the following is a specification.

My invention relates to means for detecting current effects and it relates more particularly to detectors for undamped radio signal currents such as are employed in radio telegraphy.

One object of my invention is to provide a system for detecting signal current in which a local audio-frequency circuit is affected by the incoming signal.

Another object of my invention is to detect signal currents by causing them to unbalance a circuit which, under normal conditions, is balanced.

According to my invention, a source of unidirectional signal current is utilized to change the permeability of an iron core associated with an inductance device. The inductance device is located within a circuit comprising a local source of alternating current. When no signal current is being received the inductance device, on account of its iron core, offers a relatively large impedance to the passage of the alternating current. However, when a received signal changes the magnetization of the iron, the impedance of the inductance device is either increased or decreased according to the direction of current flow and the point on the permeability curve at which the inductance device normally operates.

In one form of apparatus embodying my invention, a receiving circuit catches radio oscillations, and a three-electrode vacuum tube amplifies and rectifies the oscillations. The rectified amplied signal current, through a magnetizing coil, produces changed permeability effects in an iron core common to a balancing inductance device located in one arm of a Wheatstone bridge. A local source of audi-frequency current is connected across one diagonal of the bridge and telephone receivers across the other diagonal. The bridge is normally balanced but when a signal is received the magnetizing coil in the plate circuit of the vacuum tube effects permeability changes in the iron core of the balancing inductance device, whereby the Wheatstone bridge is thrown out of balance, producing audible vibrations in the telephone receivers corresponding to the frequency of the local source.

In the drawings:

Figure 1 is a diagrammatic view of circuits and apparatus embodying my detecting system, in a preferred form.

Fig. 2 is a similar view showing a modified system employing two amplifying tubes and employing an interrupted direct-current source instead of an alternating-current source.

In Fig. 1, I have shown an antenna circuit comprising an antenna 1, an inductance coil 2 and a variable condenser 3. By varying the variable condenser 3, the antenna circuit may be tuned to any desired frequency. In inductive relation to the inductance coil 2 is an inductance coil 4 of a receiving circuit, comprising a variable condenser 5 shunted across the inductance coil 4, whereby the receiving circuit may be tuned to the desired frequency. One lead from the inductance coil 4 passes to a grid 6 of a three-electrode vacuum tube 7, having a filament element 8 and a plate element 9. The filament 8 is connected to the other lead from the inductance coil 4 and is heated by a suitable "A" battery 11. Located in the plate circuit of the three-electrode vacuum tube 7 is a plate battery 12 from which a direct current of the desired value may be obtained.

The plate circuit of the tube 7 likewise includes an inductance coil 13. The inductance coil 13 is wound on an iron core 14 which passes through the interior of a balancing inductance device 15 located in one arm of a Wheatstone bridge. Located in an adjacent arm of the Wheatstone bridge is an inductance device 16 wound upon an iron core 17. A magnetizing coil 18 may also be wound upon the core 17 and may be energized from a battery 19. The purpose of the core 17, the magnetizing coil 18 and the battery 19 is to give the inductance device 16 the same impedance characteristics as the inductance device 15 under ordinary conditions.

In the two other arms of the Wheatstone bridge are located resistances 21 and 22 for balancing the bridge. Connected across one diagonal of the Wheatstone bridge is a

source of audio-frequency current 23, and connected across the other diagonal are telephone receivers 24. Adjustment is so made that normally there will be no potential difference between the points connected through the telephone receivers 24, but, when the impedance of the inductance device 15 is altered by an incoming signal, the bridge becomes unbalanced and audio-frequency current will then flow through the telephone receivers 24.

In the operation of my system, incoming oscillating signal currents are caught by the antenna circuit and are transmitted, through the inductive coupling between the coils 2 and 4, to the receiving circuit 4, 5. By means of adjustment of the variable condenser 5, the receiving circuit is tuned to the period of the received oscillations. The received oscillations produce changes in the potential of the grid 6 of the electron tube 7, and cause rectified signal-current oscillations to be generated in the plate circuit of that tube. Normally, constant direct current flows in the plate circuit of the tube and the inductance coil 13 produces a constant unidirectional magnetizing effect in the core 14 of the inductance device 15. Normally, the impedance of the inductance device 15 is balanced by the impedance of the inductance device 16. However, when rectified signal-current oscillations pass through the magnetizing coil 13, changes are produced in the magnetization of the core 14, and hence, corresponding changes are produced in the impedance of the inductance device 15. The bridge is, consequently, thrown out of balance, and audio-frequency current from the source 23 flows through the telephone receivers during the time when the signal-current oscillations are being received.

In the modification shown in Fig. 2, I have shown the plate circuit of the amplifying tube 7 coupled, through an inductance coil 24, to an inductance coil 25 located in the grid circuit of an amplifying tube 26. The amplifier 26 has a grid element 27, a plate element 28 and a filament element 29, the latter being heated by a suitable "A" battery 31. The amount of current supplied to the plate circuit of the amplifying tube 26 is controlled by adjustment of a plate battery 32, corresponding to the adjustment of the plate battery 12 in the arrangement shown in Figure 1.

The Wheatstone bridge is similar to that shown in the system illustrated in Fig. 1, with the exception that, instead of employing a source of audio-frequency current to supply power across the diagonal of the Wheatstone bridge, I have shown a source of direct-current 33 in which the circuit to the Wheatstone bridge is broken by a circuit-interrupting mechanism.

The circuit-interrupting mechanism comprises a movable armature 35 of spring metal contacting with a contact member 36, both in the circuit comprising the direct-current source 33. The armature 35 is adapted to be attracted by a magnet core 38, energized by a magnetizing coil 39 in a circuit comprising a battery 41, a vibratory armature 42, and a contact member 43. The armature 42 is periodically attracted by the core 38, and the circuit through the magnetizing coil 39 is broken, whereby the core 38 is demagnetized. Since the magnet core 38 is magnetized and demagnetized periodically, the core 38 periodically attracts the armature 35 against the spring action of the metal to break the circuit leading to the Wheatstone bridge. The current flowing through the Wheatstone bridge consists of rapid successive pulses of direct current instead of sinusoidal alternating current, as shown in the system illustrated in Fig. 1.

In the operation of the embodiment shown in Fig. 2, the received signals are amplified by the electron tube 7, and reproduced, through the inductive coupling of the coils 24 and 25, in the grid circuit of the amplifier tube 26. The amplified changes in the grid potential produce an amplified rectified signal current in the plate circuit of the amplifier tube 26. The connection of the tube 7 to the tube 26 is an ordinary one for cascading amplifier tubes and is illustrated merely as an alternative arrangement which may be employed, instead of a single tube, for the amplification of the received current. The functioning of the Wheatstone bridge is similar to that described in connection with Fig. 1, except that interrupted direct current is employed, instead of alternating current, to obtain an audible note in the receivers.

It is to be understood that I may use any amplifying device other than electron tubes, and that either the audion or the Fleming valve may be employed. The system which I have shown is merely by way of illustration and to show a concrete application of the principles of the invention in order that those skilled in the art may readily understand its functioning.

In Fig. 2, I have shown choke-coils 44 and 45, which may be included in circuit with the magnetizing coils 13 and 18, respectively, for the purpose of preventing the short-circuiting of the audio-frequency modulations. It is obvious that choke-coils, or equivalent means for preventing short-circuiting, may be applied to the embodiment shown in Fig. 1.

I have accomplished the amplification of received signal currents by utilizing such currents to affect a local audio-frequency circuit. By my invention, undamped waves

may, therefore, be received without any heterodyning whatever.

Since I have not shown all the possible modifications of my invention that may occur to those skilled in the art, I desire that my invention shall be limited only by the prior art and the scope of the appended claim.

I claim as my invention:

In a signal receiving device, a Wheatstone bridge, equal inductors, one in each of two arms of said bridge, iron cores, one for each of said inductors, means for supplying flux for maintaining said cores at equal degrees of permeability, said means including distinct sources of direct current, one for each core, and means for superposing a signal current on one of said direct currents.

In testimony whereof, I have hereunto subscribed by name this 31st day of March, 1921.

QUINCY A. BRACKETT.