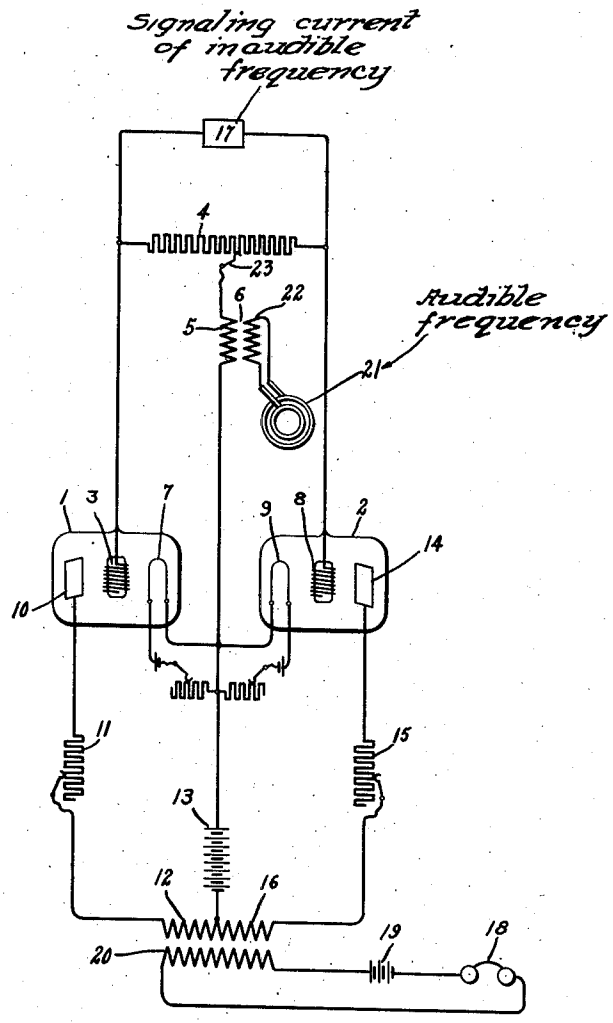
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SIGNALING SYSTEM

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Inventor:
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UNITED STATES PATENT OFFICE.

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SIGNALING SYSTEM.

Application filed June 5, 1919. Serial No. 301,965.

My present invention relates to systems for detecting changes in electric current or potentials, and more particularly to a system for receiving signals and producing an audible indication of the signals received.

The object of my invention is to provide a system for producing a desired indication by means of currents of inaudible frequency, and especially signaling currents of a frequency below audibility.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. The 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 way in which my invention may be carried into effect.

My improved system, as indicated in the drawing, comprises electron discharge relays 1 and 2, the relay 1 having associated therewith a grid circuit which comprises the grid 3, a portion of resistance 4, secondary 5 of the transformer 6, and the cathode 7 of the relay. The grid circuit of relay 2 comprises the grid 8, a portion of the resistance 4, the secondary 5 of the transformer 6 and the cathode 9 of the relay. The plate circuit of the relay 1 comprises the anode 10, variable resistance 11, coil 12, a source of direct current 13 and the cathode 7. The plate circuit of relay 2 includes the anode 14, variable resistance 15, coil 16, a source of direct current 13 and the cathode 9 of the relay. The source of signaling current of inaudible frequency is represented by numeral 17. It will be understood that the current supplied by this source may be derived from any form of signaling circuit desired and the current supplied may be any current of which an indication is desired. A receiving device which in the present case is shown as the usual telephone receiver 18, has in circuit therewith a source of direct current 19 and a coil 20 which is oppositely coupled to the coils 12 and 16. A source of current of audible frequency 21 is supplied to the primary 22 of the transformer 6 and thereby is impressed upon the grid circuits of the two relays.

The operation of the system described is as follows:

When the source 17 of signaling current is inactive the currents of audible frequency impressed upon the grid circuits from the source 21 will cause currents of audible frequency to flow in the plate circuits of the two relays. These currents will flow through coils 12 and 16, but since the coils 20 are oppositely coupled to these coils no effect will be produced in the receiver 18 if the currents are so balanced as to be neutralized in the coil 20. The desired balancing effect may be secured by varying the connection of the sliding contact 23 to the resistance 4 as well as by variation of resistances 11 and 15 in the plate circuits or by varying the coupling of coil 20 to coils 12 and 16. When the system is balanced in this way and signaling currents are impressed upon the system from the source 17, the signaling currents thus impressed will cause a drop of potential across the resistance 4 and thus produce changes in the potentials of the grids 3 and 8. Since the source 17 is oppositely connected to the two grid circuits the potentials of the two grids will be varied differently, that is, when one grid is made positive the other grid will be made negative, and vice versa. As a result the audible frequency currents flowing in the plate circuits will be varied correspondingly, that is, when the audible frequency current in one plate circuit is caused to increase the audible frequency current in the other plate circuit will be caused to decrease. As a result the balance of the system will be upset and audible frequency current will be impressed on the coil 20 and cause the receiver 18 to be actuated to give an audible indication. This will continue as long as the signaling current flows from the source 17 and will be interrupted whenever the current from 17 is interrupted or whenever the current from the source 17 reverses in direction.

The system which I have described is adapted to a great variety of uses, among which is the reception of continuous wave radio telegraphic signals, which, as is well known, will produce no audible indication in the ordinary receiving and detecting devices unless they are combined with locally produced waves according to the well known

heterodyne method, or are broken up into groups by various methods. My invention permits of the reception of such signals without recourse to the expedients mentioned.

My invention is also of utility in producing a desired indication of other currents or potentials than those which are used for the specific purpose of transmitting intelligible signals and by the terms "signaling system" and "signaling current" as used in the above specification and the claims which follow I mean to include any system in which a desired indication is produced by means of an electric current or potential. By the terms "current of inaudible frequency" and "current of frequency below audibility" I also mean to include a constant direct current.

While I have indicated a single circuit arrangement whereby my invention may be carried into effect, it will be apparent that many modifications may be made in the circuit arrangement, in the apparatus used and the specific purpose for which the invention is employed 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. An apparatus for rendering signaling waves of inaudible frequency intelligible as signals of audible frequency independent of the frequency of said waves comprising a plurality of devices having input and output circuits, means for oppositely subjecting the input circuits to the received energy, a signal translating device having equal and opposite couplings to the output circuits when no signal is received, and a source of current of audible frequency associated with a circuit of each device.

2. An apparatus for rendering signaling waves of inaudible frequency intelligible as signals of audible frequency independent of the frequency of said waves comprising a plurality of thermionic devices each comprising an anode, cathode and grid, means for changing the potentials of said grids in opposite senses by received energy, a signal translating device, a coupling between said device and each of the anode circuits, and a source of current of audible frequency associated with a circuit of each device, said couplings producing equal and opposite effects upon said signal translating device when no signal is received and effecting in the circuit of said signal translating device a current of frequency independent of the frequency of said waves and corresponding with the frequency of said source.

3. The combination in a system for rendering intelligible as signaling currents of audible frequency, signaling currents of radio frequency, of two electron discharge relays having plate and grid circuits, a source of current of audible frequency associated with said relays in such a way that currents of a frequency corresponding to that of the source will flow in the plate circuits of said relays, a receiving device associated with the plate circuits of said relays and so related thereto that it will normally be unaffected by the audible frequency currents flowing in said plate circuits, and means for connecting the source of signaling current oppositely to the grid circuits of the two relays whereby the currents in the plate circuits will be varied and audible frequency currents of a frequency independent of that of the radio frequency currents will be caused to flow in said receiving device.

4. The method of rendering undamped waves of radio frequency intelligible as signals of audio frequency independent of the frequency of said waves, which consists in subjecting detector input circuits to the received energy, producing in the detector output circuit currents of audible frequency, and subjecting a signal translating instrument to equal and opposite effects of the currents in said output circuits when no signal is received and to a current, when a signal is received, of frequency independent of the frequency of the received waves and corresponding with the frequency of said source of current.

5. Apparatus for rendering undamped waves of radio frequency intelligible as signals of audio frequency independent of the frequency of said waves comprising a plurality of devices having input and output circuits, means for subjecting the input circuits to the received energy, a signal translating instrument having equal and opposite couplings to the output circuits when no signal is received, and a source of current of audible frequency arranged to produce audible frequency currents in the output circuits.

6. Apparatus for rendering undamped waves of radio frequency intelligible as signals of audio frequency independent of the frequency of said waves comprising a plurality of thermionic devices each comprising an anode, cathode and grid, means for changing the potentials of said grids in opposite senses by received energy, a signal translating instrument, a coupling between the same and each of the anode circuits, and a source of current of audible frequency arranged to produce audible frequency currents in the anode circuits, said couplings producing equal and opposite effects upon said signal translating instrument when no signal is received and effecting in the circuit of said signal translating instrument when a signal is received a current of frequency independent of the frequency of said waves and corresponding with the frequency of said source.

7. Apparatus for rendering undamped waves of radio frequency intelligible as signals of audio frequency independent of the frequency of said waves comprising a plurality of thermionic devices each comprising an anode, cathode and grid, means for changing the potentials of said grids in opposite senses by received energy, a signal translating instrument, a coupling between the same and each of the anode circuits, and a source of current of audible frequency arranged to produce audible frequency currents in the anode circuits, said couplings producing equal and opposite effects upon said signal translating instrument when no signal is received and effecting in the circuit of said signal translating instrument when a signal is received a current of frequency independent of the frequency of said waves and corresponding with the frequency of said source, said anode circuits being in part in common.

8. The method of rendering undamped waves of radio frequency intelligible as signals of audio frequency independent of the frequency of said waves, which consists in subjecting detector input circuits to the received energy, subjecting a detector circuit to a source of current of audible frequency, and subjecting a signal translating instrument to equal and opposite effects of the detector output circuits when no signal is received, and to a current when a signal is received, of frequency independent of the frequency of the received waves and corresponding with the frequency of said source of current.

9. Apparatus for rendering undamped waves of radio frequency intelligible as signals of audio frequency independent of the frequency of said waves comprising a plurality of devices having input and output circuits, means for subjecting the input circuits to the received energy, a signal translating instrument having equal and opposite couplings to the output circuits when no signal is received, and a source of current of audible frequency associated with a circuit of each device.

10. Apparatus for rendering undamped waves of radio frequency intelligible as signals of audio frequency independent of the frequency of said waves comprising a plurality of thermionic devices each comprising an anode, cathode and grid, means for changing the potentials of said grids in opposite senses by received energy, a signal translating instrument, a coupling between the same and each of the anode circuits, and a source of current of audible frequency associated with a circuit of each device, said couplings producing equal and opposite effects upon said signal translating instrument when no signal is received and effecting in the circuit of said signal translating instrument when a signal is received a current of frequency independent of the frequency of said waves and corresponding with the frequency of said source.

11. Apparatus for rendering undamped waves of radio frequency intelligible as signals of audio frequency independent of the frequency of said waves comprising a plurality of thermionic devices each comprising an anode, cathode and grid, means for changing the potentials of said grids in opposite senses by received energy, a signal translating instrument, a coupling between the same and each of the anode circuits, and a source of current of audible frequency associated with a circuit of each device, said couplings producing equal and opposite effects upon said signal translating instrument when no signal is received and effecting in the circuit of said signal translating instrument when a signal is received a current of frequency independent of the frequency of said waves and corresponding with the frequency of said source, said anode circuits being in part in common.

In witness whereof, I have hereunto set my hand this 21st day of May, 1919.

IRVING LANGMUIR.