July 15, 1924.

1,501,726

C. W. RICE

SIGNALING SYSTEM

Filed June 5, 1919

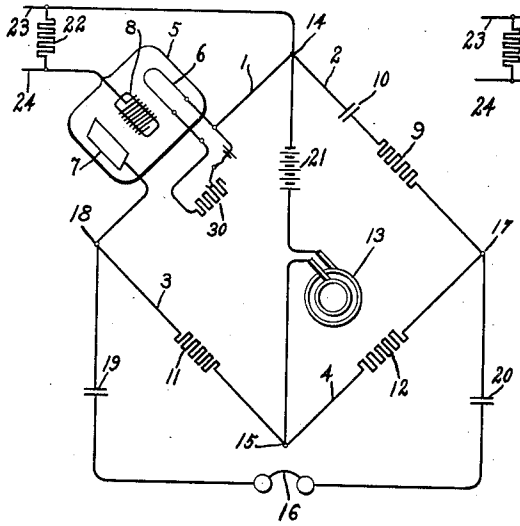


Fig. 1

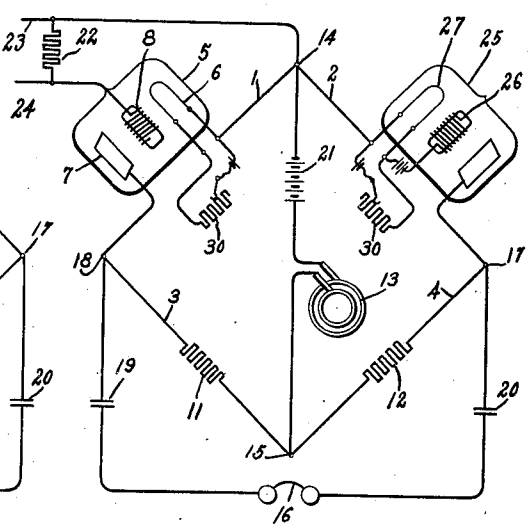


Fig. 2

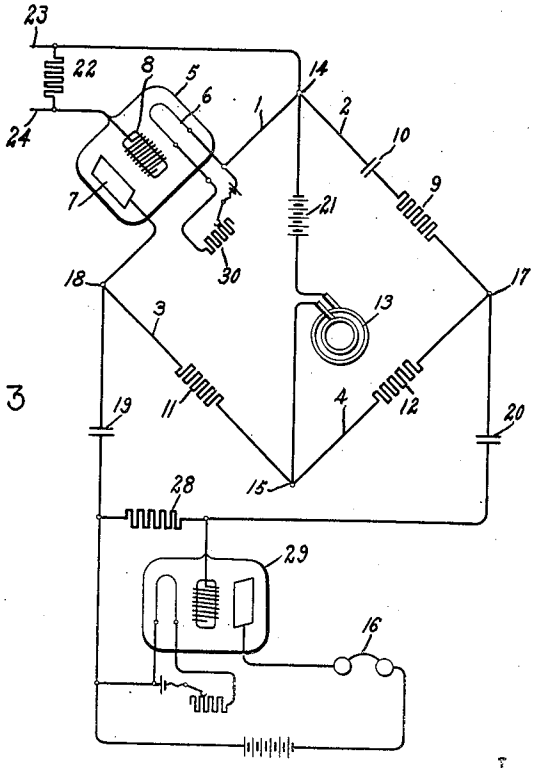


Fig. 3

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UNITED STATES PATENT OFFICE.

CHESTER W. RICE, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

SIGNALING SYSTEM.

Application filed June 5, 1919. Serial No. 301,987.

To all whom it may concern:

Be it known that I, CHESTER W. RICE, 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 Signaling Systems, of which the following is a specification.

My present invention relates to signaling systems 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 an audible indication by means of signaling 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 in Figs. 1, 2 and 3 three different ways in which my invention may be carried into effect.

My improved system as indicated in the drawing makes use of a Wheatstone bridge having the usual four arms 1, 2, 3 and 4. Arm 1 includes the plate circuit of an electron discharge relay 5 having a cathode 6, an anode 7 and a grid 8 enclosed in an evacuated envelope. Arm 2, as indicated in Figs. 1 and 3, is made up of a resistance 9 and a condenser 10, and arms 3 and 4 are made up of resistances 11 and 12 respectively. A source of current 13 of audible frequency is connected to the opposite terminals 14 and 15 of the bridge and a signal indicating device, which in the present case is the usual telephone receiver 16, is connected to the other two opposite terminals 17 and 18. Condensers 19 and 20 are preferably inserted in series with the receiver. A source of direct current 21 is included in series with the source of audible frequency current 13 for the purpose of supplying the normal constant current for the operation of the electron discharge relay 5. The electron discharge relay is provided with a grid circuit which includes the grid 8, a resistance 22 and the cathode 6 of the device. The arms of the bridge are so adjusted that under normal conditions a balance is obtained and no current will flow through the receiver 16. The signaling current supplied from the conductors 23 and 24 is then caused to flow through resistance 22 and thus produce a variation in potential of the grid 8. As a result the resistance of the electron discharge relay 5 is varied and the balance of the bridge is upset. Current from the source 13 will then flow through the receiver 16, producing an audible indication therein as long as the signaling current continues to flow. This indication will be interrupted whenever the signaling current is changed or whenever it reverses in direction.

In the form of my invention shown in Fig. 2, the arm 2 of the bridge is also made up of an electron discharge relay 25, the grid 26 of which may if desired be permanently connected to the cathode 27. In some cases the use of a second electron discharge relay will enable the desired balance of the bridge to be obtained more readily. By varying the potential of the grid by means of a source of potential 30 the resistance of relay 25 may be varied and the desired balancing of the bridge obtained. In some cases where the signaling current is of extremely small intensity the resultant variation in the balance of the bridge may be too small to produce a sufficient flow of current through the receiver 16 to produce the desired indication. In such case the audible frequency current may be caused to flow through a resistance 28 which is included in the grid circuit of an electron discharge amplifier 29, the receiver 16 in this case being included in the plate circuit of this amplifier. The final balancing of the bridge may be effected conveniently by variation of resistances 30 which are included in the filament heating circuits.

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 devices unless they are combined with locally produced waves according to the well known heterodyne method or broken up into groups by the so-called "ticker" method. My invention permits of the reception of such signals without recourse to the expedients mentioned.

While I have indicated three modifica-

tions of one general type of 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. The combination in a signaling system of a source of signaling current of inaudible frequency, a Wheatstone bridge, a source of current of audible frequency connected to two opposite terminals of said bridge, a receiving device connected to the other two opposite terminals of said bridge, said bridge being normally so adjusted that no audible frequency current will flow through said receiving device, an electron discharge relay in one arm of said bridge and means actuated by the signaling current for varying the resistance of said relay and thereby causing an audible frequency current to flow in said receiving device.

2. The combination in a signaling system of a source of signaling current of inaudible frequency, a Wheatstone bridge, a source of current of audible frequency connected to two opposite terminals of said bridge, a receiving device connected to the other two opposite terminals of said bridge, said bridge being normally so adjusted that no audible frequency current will flow through said receiving device, an electron discharge relay having a plate circuit included in one arm of said bridge, a grid circuit for said relay and means for impressing the signaling current upon said grid circuit.

3. The combination in a signaling system of a source of signaling current of inaudible frequency, a Wheatstone bridge, a source of current of audible frequency connected to two opposite terminals of said bridge, a receiving device connected to the other two opposite terminals of said bridge, said bridge being normally so adjusted that no audible frequency current will flow through said receiving device, two electron discharge relays in two of the arms of said bridge, and means actuated by the signaling current for varying the resistance of one of said relays and thereby causing an audible frequency current to flow in said receiving device.

4. The combination in a signaling system of a source of signaling current of inaudible frequency, a Wheatstone bridge, a source of current of audible frequency connected to two opposite terminals of said bridge, a receiving device connected to the other two opposite terminals of said bridge, said bridge being normally so adjusted that no audible frequency current will flow through said receiving device, two electron discharge relays having plate circuits included in two of the arms of said bridge, a grid circuit for one of said relays and means for impressing the signaling current upon said grid circuit.

5. Apparatus for amplifying electrical currents comprising a Wheatstone bridge having a tri-electrode device connected by its plate and filament electrode in one of the branches of the bridge, with the circuit carrying the current to be amplified connected between the grid and filament, and an indicator connected across said bridge.

6. Apparatus for amplifying electrical currents comprising a Wheatstone bridge having two tri-electrode devices connected by their plate and filament electrodes in two of the branches of the bridge with the circuit carrying the current to be amplified connected between the grid and filament of one of said devices and an indicator connected across said bridge.

In witness whereof, I have hereunto set my hand this 23rd day of May, 1919.

CHESTER W. RICE.