Sept. 5, 1944. R. E. GRAY 2,357,398

TRANSMITTER HAVING IMPULSE MODULATION

Filed Dec. 19, 1941

FIG.1.

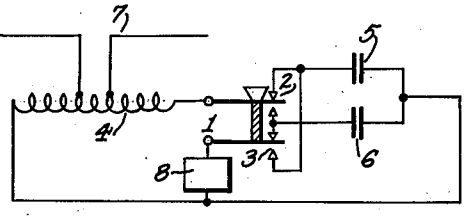


FIG.4.

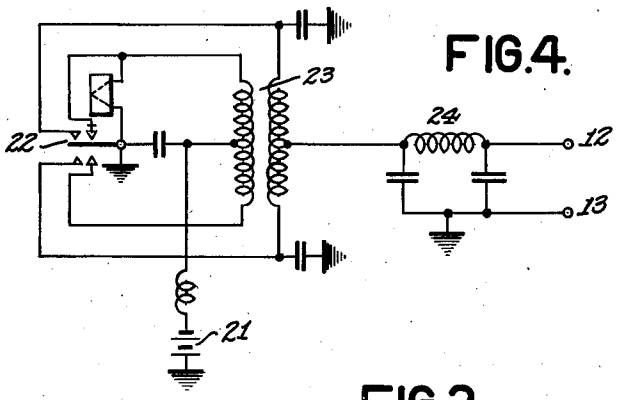
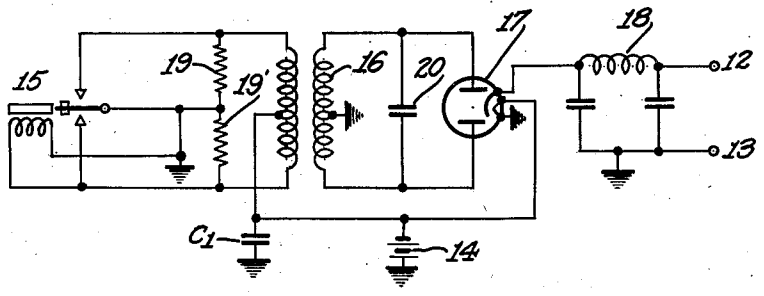


FIG.3.



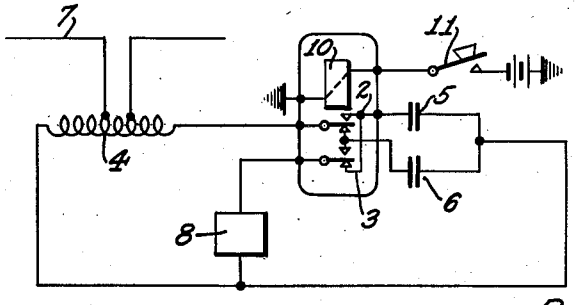


FIG.2.

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TRANSMITTER HAVING IMPULSE MODULATION

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5 Claims. (Cl. 250—17)

The present invention relates to impulse modulated transmitters which are particularly applicable to telegraph systems that use impulse modulation.

The main object of the invention is the providing of transmitters for impulse modulation systems that are sturdy, that occupy little space and that do not comprise thermionic tubes. Such transmitters are specially suitable for use as portable senders of telegraphic signals.

An impulse modulated telegraph sender that incorporates characteristic features of the invention is disposed so as to emit starting and terminating impulses of signals that consist of wave trains produced in an oscillatory circuit associated with the radiating antenna, the impulses being generated by a manipulation effected on the oscillatory circuit.

According to another characteristic feature of the invention, the manipulation may be manual and may be applied to the oscillatory circuit, either manually or by means of a relay located in a vacuum.

According to another feature of the invention, means are provided for changing the wavelength of the starting and terminating impulses in such a way as to insure greater independence of the interferences in the radio connection, and a greater secrecy of the signals at the same time.

In one example of an embodiment, a tubeless transmitting device for an impulse modulated telegraph system comprises a two-way key which, in one position, controls the connection of a condenser in an emitting antenna oscillatory circuit (comprising an inductance and this condenser) and another condenser of the same value in a high frequency charging circuit, the connections of the two condensers being reversed in the other position of the key. The discharges of the condensers send the brief starting and terminating impulses of each signal into the antenna and, if desired, the relative capacities of the condensers may be regulated in order to insure a definite change of frequency between the said starting and terminating impulses.

The invention will be explained in detail in the following description of examples of embodiment illustrated in the appended drawing, in which

Fig. 1 illustrates schematically the circuit of a transmitter, the manual control of which is applied directly to the oscillatory circuit according to the features of the invention;

Fig. 2 illustrates a modification of the circuit of Fig. 1 in which the manual control is transmitted to the circuit by a relay located in a vacuum, and

Figs. 3 and 4 illustrate schematically two examples of high voltage sources that can be used advantageously in the circuits of the transmitters of Figs. 1 and 2.

Referring to Fig. 1, a manipulating key 1 provided with two two-way contacts 2 and 3 may connect alternately in an oscillatory circuit the inductance 4 and one of the condensers 5 or 6 in a way that is explained further on. An antenna 7 is directly branched at suitable points of the inductance 4. A source of high voltage 8 is connected between contact 3 of key 1 and an intermediate point of the connection that permanently couples inductance 4 to the two condensers 5 and 6.

The mode of operation can be explained as follows: In one of its positions, key 1 connects one or other of condensers 5 and 6 to the inductance 4 and connects the other condenser to the high voltage source 8. In the position shown in the drawing, for example, key 1 connects at its contact 2 the condenser 5 in closed circuit with the inductance 4, while at its contact 3 it connects condenser 6 to the terminals of the high voltage source 8. In this way, condenser 6 is charged almost instantaneously over the source 8, while condenser 5 is discharged over inductance 4. In the other position of the key, the connections of condensers 5 and 6 are reversed, and it is condenser 5 that is charged by the source 8, while condenser 6 is discharged into inductance 4.

Inductance 4 and condenser 5 or 6 that is connected to it constitute a high frequency circuit that is tuned to the desired frequency or transmission. The oscillatory discharge of the condenser over the inductance sends out a high frequency energy impulse which is radiated by the antenna 7.

It can thus be seen that an impulse is sent with each change of position of key 1, so that manipulation of the key upward and downward, or vice versa depending on the normal position, causes the sending of a pair of impulses spaced in time and of the duration required for marking a dot or a dash. These impulses consequently define the beginning and termination of each telegraphic signal.

The emitted signals can be received with any receiver adapted to receive impulse modulated signals. Receivers of this kind are well known per se and do not call for any particular description.

It is evident that if it is desired to maintain a certain amount of secrecy, or only to increase the independence with respect to the interferences that characterize impulse modulation systems, the impulses of each pair may be transmitted on a different frequency by selecting unequal values for condensers 5 and 6 in a predetermined ratio.

Fig. 2 illustrates a modification of the circuit of Fig. 1 in which key 1 is replaced by a two contact relay 10, the operation of which effects the same connections as key 1 in the circuit. This

relay is placed in an extreme vacuum, such as an electron discharge tube vacuum in order to avoid sparks and its contacts when it is operating. It is controlled, as shown, by a simple manual key 11 that is inserted in its exciter circuit. The installation of relays of this kind in a vacuum is known per se and is consequently not described in detail.

The high voltage source 8 of Figs. 1 and 2 may be of any suitable kind. However, in order to have the entire apparatus retain the advantages of simplicity it enjoys from the above described arrangements, it is preferable to provide this source as a high voltage vibratory system fed by a low voltage battery. Figs. 3 and 4 show two examples of known circuits of this kind of high voltage feeding systems, and these can be used directly in transmitters such as those described above, the terminal 12 of each of these circuits being connected to contact 3 of key 1 or relay 10, and the terminal 13 of these circuits to the point of permanent connection of source 8 to the oscillatory circuit.

In the circuit of Fig. 3, a low voltage battery 14, e. g. of 6 volts, has its direct current transformed into alternating current by the vibrating contact 15, and this alternating current has its voltage increased by the transformer 16 whereupon it is rectified by the diode which rectifies the two alternations 17 and which has its plates connected to the two ends of the secondary of transformer 16. The rectified high voltage current is transmitted through a filter 18 to the terminals 12 and 13 to which the circuit of the described transmitter is connected.

The equal resistances 19—19' and the condenser 20 are provided for the purpose of preventing sparks at the vibrating contact 15, while the condenser C1 is provided for absorbing transient currents that might cause interferences in the output current.

The circuit of Fig. 4 illustrates a simpler form of the vibratory high voltage source. The current of battery 21 is transmitted to a vibrating armature 22 which is provided with two pairs of contacts that are respectively connected to the ends of the primary and secondary windings of the step-up transformer 23, so that the direct current of battery 21, after having been transformed into alternating current and raised in voltage, is immediately rectified in the secondary of the transformer. After filtering in 24, this high voltage rectified current is applied to the terminals 12 and 13 and consequently to the oscillatory circuit of Figs. 1 and 2.

Although the invention has been described for the particular case of certain examples of embodiment, it is evident that it is by no means limited to the same, particularly as regards the actual form of the control key of the oscillatory circuit and the high voltage feed of this circuit. It is, on the contrary, capable of numerous modifications and adaptations without departing from its scope.

What is claimed is:

1. Radio transmitter for producing signals defined by the lapse of time extending from the transmission of a first single train of damped oscillations to the transmission of a second single train of damped oscillations, including an inductance having a predetermined reactance, means for producing in said inductance both said trains of damped oscillations in discrete temporal relationship, a radiator and means for transferring said oscillations from said inductance to said radiator, said oscillation producing means including a plurality of condensers, a source of charging current therefor, and signalling means having a plurality of positions and so connected to said charging source, said condensers and said inductance that in each position assumed by said signalling means, one pre-charged condenser is connected directly to at least a portion of said inductance to form an oscillatory circuit, whereby the respective reactances of said condenser and said portion of said inductance determine the periodicity of the first train of damped oscillations resulting from said connection, and at the same time the remaining condensers are connected to said charging source, said signalling means being likewise connected so that the assumption of another position thereby will cause the connection to said inductance of a second pre-charged condenser, so as to produce in the oscillatory circuit formed thereby a second train of damped oscillations, of a periodicity likewise predetermined by the respective reactances of said second condenser and said portion of said inductance to which it is connected, the time elapsing between successive positions of said signalling means being under manual control and being variable in extent, whereby a predetermined signal may be transmitted.

2. An impulse modulated transmitter according to claim 1, wherein said signalling means comprises a vacuum relay and also including a manually operable signal key so connected as to control the actuating circuit of said vacuum relay.

3. An impulse modulated transmitter according to claim 1, wherein said first and second condensers are of different capacities, whereby the respective shock excited damped periodic oscillations constituting the starting and terminating impulses, respectively, of a signal are of different frequencies.

4. An impulse modulated transmitter in which the signal elements are defined in duration by starting and terminating impulses, comprising an inductance, first and second condensers, a charging voltage source for said condensers, a connection from one end of said inductance to one armature of each of said condensers, a connection from one terminal of said voltage source to both said last mentioned condenser armatures, and a two position switching device which in one position connects the other end of said inductance to the other armature of said first condenser and connects the other terminal of said voltage source to the other armature of said second condenser and which in the other position connects the said other end of said inductance to said other armature of said second condenser and connects the said other terminal of said voltage source to the said other armature of said first condenser, and whereby said first condenser connected to said charging source acquires a static charge and upon connection to said inductance, discharges therethrough so as to produce a first train of damped waves constituting said starting impulse and having a periodicity predetermined by the electrical constants of said condenser and said inductance, the connection of said second condenser in like fashion to said inductance producing a second similarly determined train of waves constituting said terminating impulse, the time consumed in moving said switching device from one position to the other being under manual control so as to define a signal by temporal characteristics, said transmitter also including means for transferring said respective trains of damped waves from said

inductance to the transmission medium upon which said signals are to be carried.

5. Transmitter of the type wherein signals are defined and characterized by the length of time between two discrete electrical impulses, including a two-position signalling key, two capacities and means for charging each capacity in each of the respective key positions, an inductance and means for withdrawing energy therefrom for transmission purposes, and connection means between said key and said inductance for connecting, in each key position, a single pre-charged condenser in shunt to at least a portion of said inductance so as to form an oscillatory circuit of a frequency determined by the reactance of the elements thereof, whereby a damped pulse of oscillatory energy occurs when said key makes contact at each position thereof.

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