Jan. 29, 1935. A. S. FITZ GERALD 1,989,510

SIGNAL TRANSMITTER

Filed April 20, 1932

Fig. 1.

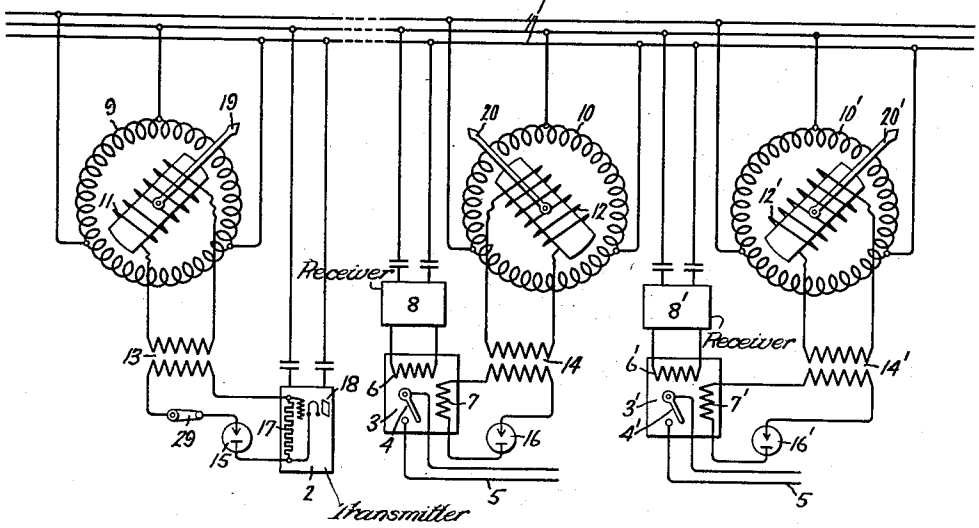


Fig. 2.

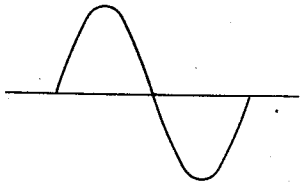


Fig. 3.

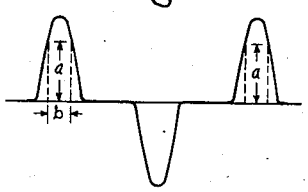


Fig. 4.

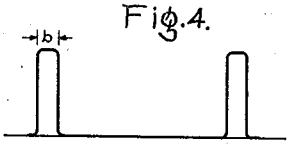
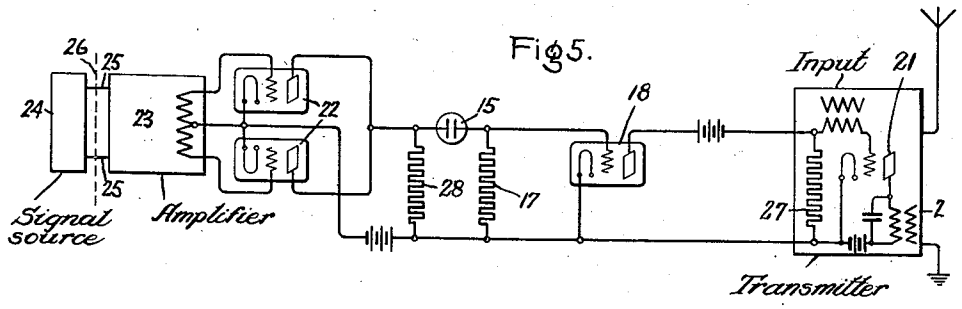


Fig. 5.



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SIGNAL TRANSMITTER

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Application April 20, 1932, Serial No. 606,355

3 Claims. (Cl. 177—352)

My invention relates to signal transmitters and more particularly to keying arrangements therefor. Still more particularly it relates to transmitters of the type shown in my copending application, Serial No. 249,180, filed January 24, 1928, and entitled Carrier current selective systems of which my present application is a continuation in part.

It has for one of its objects to provide a system whereby a high frequency transmitter may be rendered completely operative, or totally inoperative, in response to slight variations in a control electromotive force. In this way a very sharp response of the transmitter, or sharp definition between the "on" and "off" periods thereof, may be had even though the applied control electromotive force may vary relatively gradually or through a small range.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the accompanying drawing in which Figs. 1 and 5 illustrate my invention as applied to different applications of utility, and Figs. 2, 3, and 4 indicate certain characteristics with reference to the operation of the equipment shown in Fig. 1.

Referring to Fig. 1, I have shown therein at 2 a transmitter which is controlled in accordance with my invention. In the application of utility shown in Fig. 1 the transmitter 2 is employed for the purpose of selectively controlling remotely located electroresponsive devices 3 and 3' by means of high frequency currents transmitted over the lines of a power distribution system indicated at 1. These currents may of course be of high frequency or of any other characteristic which renders them readily separable from the currents of the power system. The receiving devices 3 and 3' are each provided with contacts 4 and 4' for controlling signal circuits 5 and 5' respectively. These receiving devices may comprise any suitable means which is operable to close the contacts 4 only when supplied with currents from a plurality of sources. In the form shown in Fig. 1 it comprises a relay having two coils 6 and 7, the former of which is adapted to be supplied with currents in response to the transmitting device 2, and the latter of which is adapted to be supplied with currents from the above mentioned associated induced member in a manner presently to be described. 8 and 8' represent receivers such as are commonly employed in carrier current systems and may comprise rectifying means for the carrier current wave, demodulating means where modulated carrier waves are employed, or which may comprise a simple tuning, or filtering, device whereby the carrier currents may be supplied directly to the coil 6 and 6' of the devices 3 and 3'. A receive of a type which may be employed is shown in Patent 1,522,581 of Lloyd Espenschied.

9, 10 and 10' represent windings such as those of the usual stator winding of an induction motor. These windings are wound upon a closed iron core and are adapted to be supplied with polyphase currents from the distribution system 1. One of these windings, 9, is located at the transmitting station and the others, 10, 10', are located in stations at which signal devices are to be operated. Each of them is associated with a corresponding transmitting or receiving device in a manner presently to be described. Induced members 11, 12, 12' comprise single phase windings each of which is mounted upon a suitable magnetic core which is adapted for rotation about the axis of the windings 9, 10, 10', or, about the axis of rotation of the rotating field which is set up within the windings 9, 10, 10'. These windings are adapted, by means not shown, to be maintained stationary in any one of a plurality of positions, and consequently these windings have induced therein a single phase alternating current potential from the windings 9, 10, 10' having a phase relation with the source 1 which is dependent upon the position in which the induced member is maintained. Energy is supplied from each of these induced windings 11, 12, 12' through suitable transformers 13, 14, 14' and electron discharge devices 15, 16, 16' to the associated signal apparatus 2, 3, 3'. Each of the transformers 13, 14, 14' receives alternating current from the associated winding 11, 12, 12' such that they operate above the point of saturation. For this reason these transformers preferably have cores of metal, such as permalloy or other metal, having high permeability. Electron discharge devices 15, 16, 16' are of the usual glow tube construction and comprise vessels which are filled with suitable gas, such as neon or argon and in which are enclosed electrodes which are dissimilar, either as to shape or as to composition, such that a rectifying action is effected. For the purpose of illustration I have shown within the transmitting device 2 a resistance 17 connected in circuit with the secondary winding of the transformer 13 and the electron discharge device 15 and which is also connected between the grid and filament of the electron discharge device 18 which is employed in the transmitter. This transmitter may comprise an oscillation generator or amplifier or other suitable device, which is normally employed in carrier current transmitters and is adapted by discharge device 18 to be operable only when a certain potential is impressed upon the resistance 17, due to direct current flowing through the electron discharge device 15. That is discharge de-

vice 18 is adapted to key the transmitter in any of the manners now well known in the art. One manner in which this keying may be effected is shown in United States Patent No. 1,888,077 to Gardiner in which the electron discharge device 18 may be considered to correspond to applicant's electron discharge device 18.

As thus arranged the operation of my device is as follows: When the windings 9, 10, 10' are supplied with polyphase currents from the distribution system 1 a rotating field will be set up within these windings with the result that single phase alternating currents having the form shown in Fig. 2 will be impressed upon the induced windings 11, 12, 12'. This alternating current will produce in the secondary windings of the saturated core transformers 13, 14, 14' potential having a wave shape such as that shown in Fig. 3. It is well known that electron discharge devices of the type described will pass current only when the potential applied thereto reaches a predetermined value, at which value these devices break down and a discharge current is caused freely to flow through the device. This breakdown voltage of the devices 15, 16, 16' is represented at *a* in Fig. 3. Since these devices are rectifying devices it will be seen that a direct current will flow therethrough and consequently through the resistance 17 at the transmitter, and the windings 7 and 7' of the receivers only in periodic pulsations, one pulsation occurring during each cycle of the alternating current waves which are impressed upon the induced members 11, 12, 12' and during the time when the potential on the induced windings is at substantially a maximum value. This current will be supplied to the resistance 17 and the windings 7, 7' through a time interval *b* (Figs. 3 and 4) of each cycle of the alternating current wave which is impressed upon the associated induced member of the respective devices 9, 11; 10, 12; 10', 12'. Accordingly the transmitting device 2 will supply currents to the receivers 3, 3' only during this short interval of the wave which is impressed on the winding 11 and the receivers are in condition to respond to this current during a corresponding portion of the wave which is impressed on members 12, 12'.

Any suitable indicating means, such as pointers 19, 20, 20', indicating the position which the induced members 11, 12, 12' occupy with respect to the stator windings 9, 10, 10' respectively may be employed. It will be seen that with the pointers 19 and 20' located in the position shown in the drawing that the winding 7' and the resistance 17 will be simultaneously energized during an interval *b* of each cycle of the alternating current wave, whereas the period of energization of the winding 7 will be displaced in time phase relation with that of the winding 7' and the resistance 17 by about 90 degrees, this relation being controllable by adjusting the position of the induced members 11, 12, 12' with respect to their associated windings 9, 10, 10' respectively. Since each of the windings 6, 6' are energized simultaneously with the resistance 17 by means of carrier currents which are transmitted over the distribution system 1, it will be seen that windings 6' and 7' of the receiving device 3' will be simultaneously energized, thereby closing the contacts 4', which in turn close the signal circuit 5' of any suitable device which is to be operated. The windings 6 and 7 of the receiver 3 will not be energized simultaneously and accordingly this device will not be operated.

If it be desired to operate the device 3 this may be accomplished by moving the pointer 19 to the left through substantially 90 degrees. This will cause the simultaneous energization of the windings 6 and 7 and the consequent closing of the contacts 4 for controlling the signal circuit. As thus arranged the receiving device 3' will not be operated.

It will be apparent from this description that where a number of receiving devices are to be operated selectively from a single transmitter the induced members of each of these devices will be adjusted at a different angle with respect to the position occupied by the induced member of the transmitter at any particular time. Then any receiver may be selectively operated by moving the pointer 19 of the transmitting device to the position corresponding to the position occupied by the pointer 20, 20' of the selected receiver. To prevent unintentional operation of a remote device while the induced member 11 is being moved from one position to another a switch 29 which is connected in series with the electron discharge device 15 may be opened during this operation.

It will thus be seen that the transmitter 2 is controlled through the saturable transformer 13 and the glow discharge device 15 in such a way as to produce a sharp definition between its "off" and "on" periods in response to a control electromotive force which varies in a much more gradual manner as shown by Fig. 2.

In Fig. 5 I have shown a radio transmitter 2 which may be of the same construction as the transmitter 2 of Fig. 1, but which is adapted for the transmission of radio telegraphic or facsimile signals. This transmitter of course includes an electron discharge device 21 and a resistance 27, the voltage of which is controlled through electron discharge devices 18, 15, 22 and amplifier 23 from a source of telegraphic or facsimile signals 24. The source 24 of signals may of course be located at any desired point but frequently it is located at a distance from the transmitter 2 and is connected thereto by means of a transmission line 25. To indicate distance between the source 24 and the amplifier 23 I have indicated a vertical dotted line 26 on the drawing.

Where facsimile signals are being transmitted it may occur that there is very little difference in intensity between the signals received by the amplifier 23 corresponding to light portions of the material in which the signals are transmitted and the signals corresponding to the dark portions thereof. This may be the case, for example, where the signals are being transmitted in accordance with typewritten material in which the letters are, for example, grey on white paper. Further it often occurs that there are undesired noise currents supplied to the amplifier 23 due to extraneous effects upon the line 25. It is necessary therefore that the equipment whereby the transmitter 2 is controlled be capable of close discrimination with respect to voltages received from the line 25 thereby to prevent operation of the transmitter in response to undesired noise currents on the line 25 or signals of magnitude less than those which are to be transmitted to a remote point. To accomplish this effect the discharge devices 22 are arranged to rectify the received signals thereby to produce a unidirectional voltage upon a resistance 28 which is connected in the anode circuit thereof. The voltage on this resistance varies in accordance with the signals received from the line 25. One terminal of this resistance is connected to the cathode of the dis-

charge device 18 and the other terminal is connected to the grid of the discharge device 18 through a glow discharge device 15. A resistance 17 is also connected between the grid and cathode of the discharge device 18. The discharge device 15 is shown as one of bilateral characteristics but it will of course be understood that a device of unilateral characteristics may be used as well. When the voltage on resistance 28 exceeds a certain predetermined value the discharge device 15 breaks down and passes current through resistance 17. This current flows in the resistance 17 in such a direction as to impress a negative potential upon the grid of discharge device 18. The device 18 then becomes of high impedance and interrupts the flow of current through resistance 27 thereby reducing the negative potential on the grid of discharge device 21 to such an extent as to permit the device 21 to become operative thereby to render the transmitter capable of transmitting signals as described in connection with Fig. 1. The device 21 may comprise any discharge device of the transmitter whereby the operation of the transmitter is controlled such, for example, as the oscillator, or amplifier, as previously mentioned in connection with Fig. 1 and as illustrated in the above referred to Gardiner patents. When used as an oscillator or amplifier an alternating current element will, of course, be included in the grid circuit as indicated by the transformer shown on the drawing and bearing the legend "Input". A corresponding output element will also be employed in the anode circuit. The effect of the discharge device 18, it will be seen, is to amplify the voltage appearing on resistance 17 and to change its polarity. It will thus be seen that the transmitter 2 is capable of transmitting currents of the full rated capacity of the transmitter in response to currents received from the line 25 which vary but slightly in magnitude from those currents the transmission of which is to be avoided.

While I have shown particular embodiments of my invention it will be understood that I do not wish to be limited thereto since different modifications may be made, and that I contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a system for keying the output from a transmitter including a source of oscillations in accordance with the variations of a second source of varying electromotive force, the magnitude of the electromotive force of said second source increasing momentarily at times from a value below to a value above a predetermined value and subsequently decreasing to a value below said predetermined value, the value of said electromotive force differing at times from said predetermined value by but slight and changing amounts, the combination of means for causing operation of said transmitter only when the electromotive force of said source exceeds said predetermined value and for preventing operation of said transmitter in response to variations in said electromotive force below said predetermined value, said means being constructed and arranged to control the operation of said transmitter in response to the voltage appearing between the electrodes of an electron discharge device, an impedance connected between said electrodes of said discharge device, and a circuit whereby said discharge device is controlled, said circuit including said impedance, said source of electromotive force and a second electron discharge device, said second electron discharge device being adapted to break down and pass current only when the electromotive force applied between the electrodes thereof exceeds said predetermined value, the current then passed by said discharge device being sufficiently abrupt to render said transmitter completely operative, thereby to produce sharp definition of signals transmitted by said transmitter.

2. In a system for keying the output from a transmitter including a source of oscillations in accordance with the variations of a second source of varying electromotive force, the magnitude of the electromotive force of said second source increasing momentarily at times from a value below to a value above a predetermined value and subsequently decreasing to a value below said predetermined value, the value of said electromotive force differing at times from said predetermined value by but slight and changing amounts, the combination of means to control the output from said source of oscillations in response to voltage between the electrodes of a discharge device, said means including an impedance connected between said electrodes of said discharge device, a second electron discharge device connected in circuit with said impedance and said source of varying electromotive force, the electromotive force of said second source being impressed upon the electrodes of said second electron discharge device, said second electron discharge device being adapted to break down and pass current only when the magnitude of the electromotive force of said second source increases above said predetermined value, the current then passed by said discharge device being sufficiently abrupt to render said transmitter completely operable thereby to produce sharp definition of signals transmitted by the said transmitter.

3. In a system for keying the output from a transmitter including a source of oscillations in accordance with the variations of a second source of varying electromotive force, the magnitude of the electromotive force of said second source increasing momentarily at times from a value below to a value above a predetermined value and subsequently decreasing to a value below said predetermined value, the value of said electromotive force differing at times from said predetermined value by but slight and changing amounts, the combination of means whereby the output from said source of oscillations is controlled by a discharge device, said discharge device having a grid electrode and cathode electrode, one of said electrodes being connected to one terminal of said second source of varying electromotive force, a resistance connected between said grid and cathode electrodes, a second electron discharge device connected between the other terminal of said second source of varying electromotive force and the other of said electrodes, said second electron discharge device having a pair of oppositely disposed electrodes enclosed in an attenuated gaseous medium whereby said device breaks down and passes current only when the voltage of said source exceeds a predetermined value, the current then passed by said discharge device being sufficiently abrupt to render said transmitter completely operative, thereby to produce sharp definition of signals transmitted by said transmitter.

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