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BIASED CARRIER TELEGRAPH SYSTEM

Filed Aug. 14, 1930

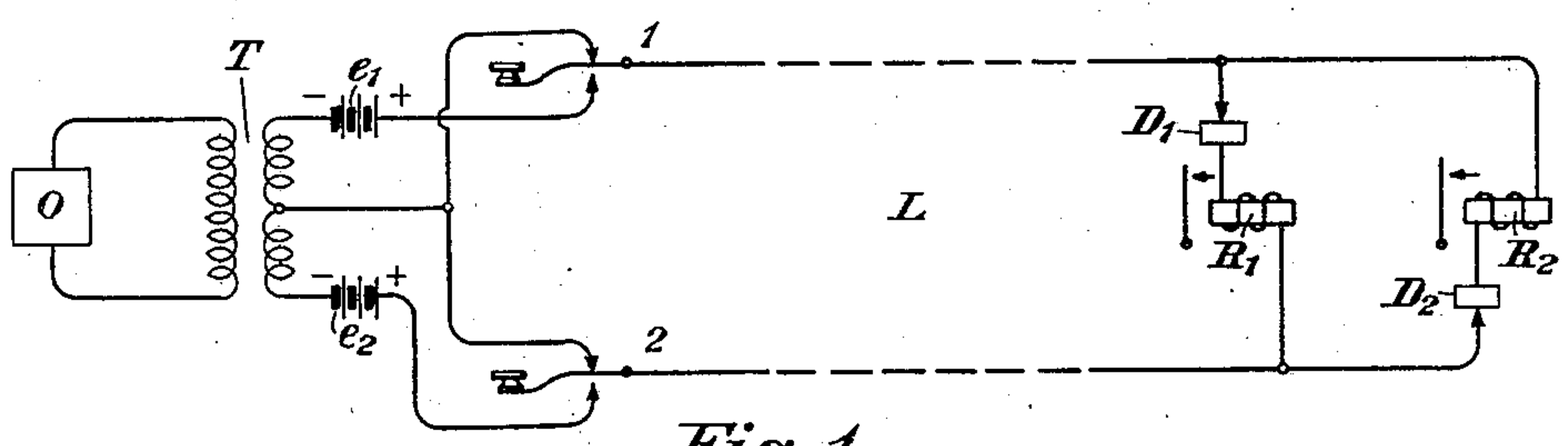

Fig. 1

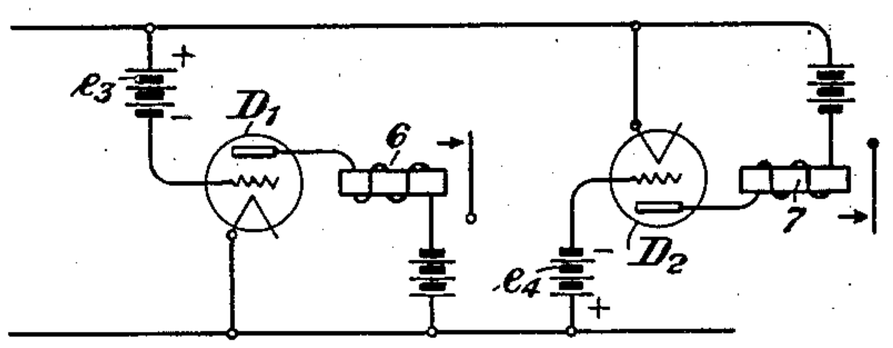

Fig. 2

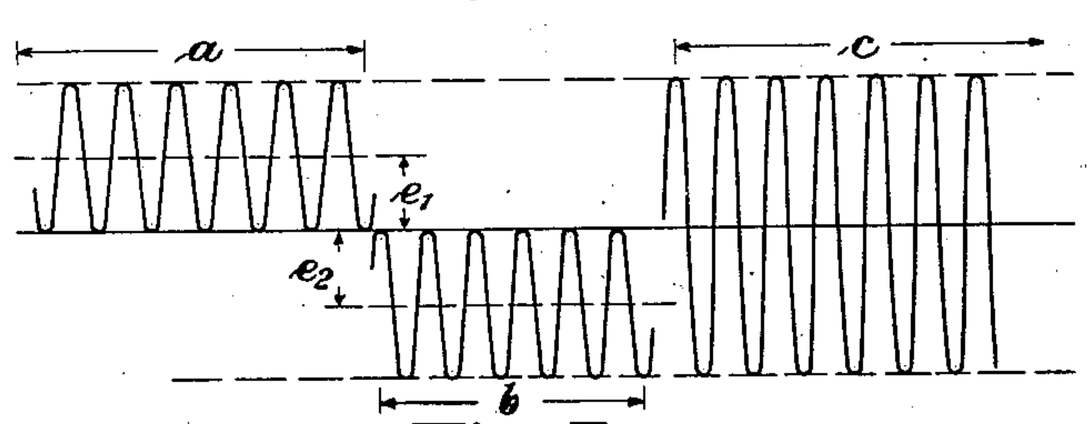

Fig. 3

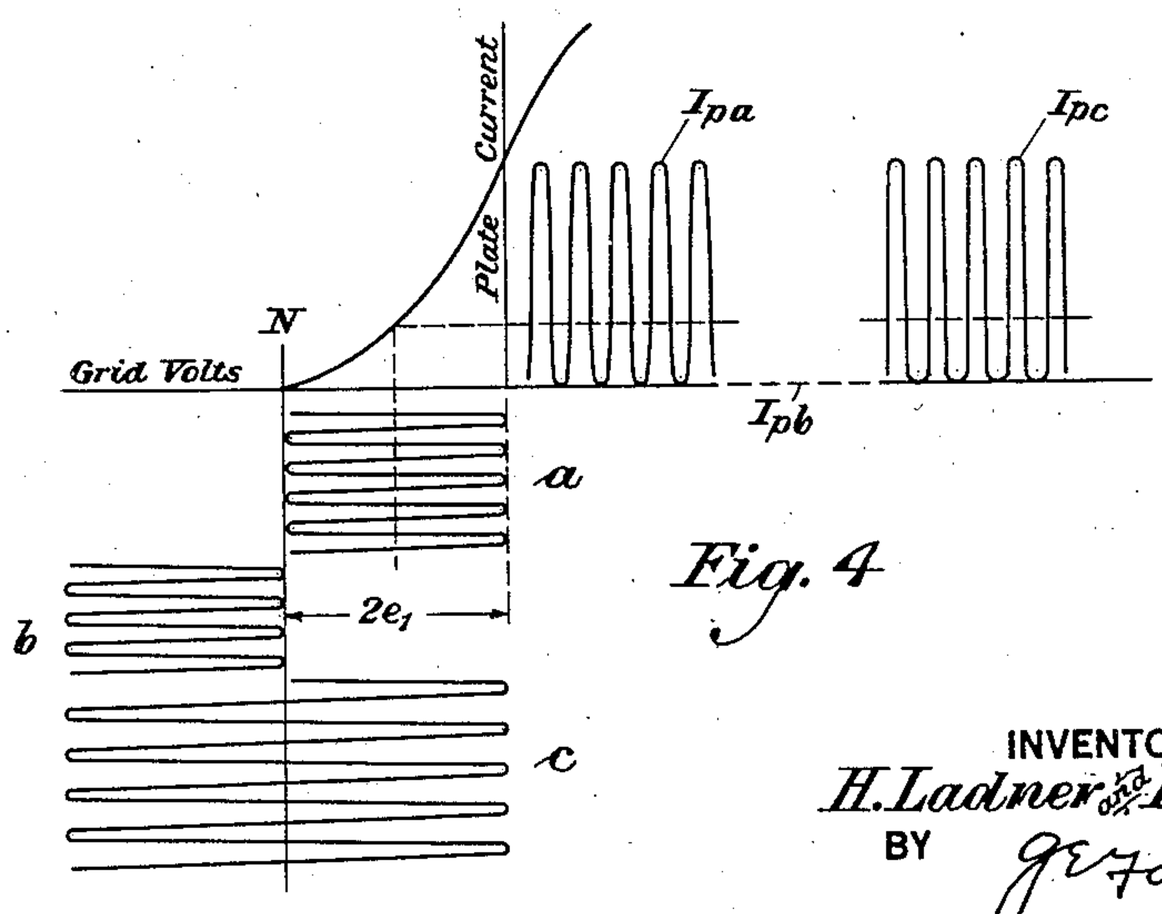

Fig. 4

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UNITED STATES PATENT OFFICE

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BIASED CARRIER TELEGRAPH SYSTEM

Application filed August 14, 1930. Serial No. 475,266.

This invention relates to a biased carrier telegraph system adapted for diplex signaling, and has for its object that of sending two telegraph carrier frequency messages simultaneously with the same carrier frequency and in the same direction over one transmission line.

The invention will be better understood by reference to the following specification and the accompanying drawings, in which Figure 1 shows one circuit connection for carrying out the invention; Fig. 2 gives in more detail a specific receiver adapted for use in Fig. 1; Fig. 3 shows the potential or bias of the carrier wave under different signaling conditions; and Fig. 4 shows the current and voltage relations in a detector of the kind shown in Fig. 2.

Referring more specifically to Fig. 1, there is shown at O a generator of carrier oscillations of any suitable frequency. This oscillator is connected to a line L by means of a transformer T. Associated with one side of the line is a keying device 1 and with the other side of the line a similar keying device 2. The upper contacts of these keys are connected with the midpoint of the secondary of transformer T in such manner that both sides of the line are thus connected to a point of zero or neutral potential. The lower contact of key 1 is connected through a battery e_1 to one end of the secondary of the transformer, and the corresponding contact of key 2 is connected through a battery e_2 to the other end of the transformer secondary. The batteries e_1 and e_2 are poled in the same direction towards the line, which in Fig. 1 is shown as the positive pole. These batteries are each preferably equal or nearly equal in potential to at least one half the maximum carrier potential obtained from the full secondary winding of transformer T. At the receiving end there are connected across the line two receivers R_1 and R_2, these being connected across the line in reverse direction. Each of these receivers is shown as comprising a detecting device D_1 in series with a relay, which relay may itself be a sounder or may be a device for controlling a receiving loop.

When the key 1 is operated, thus coming in contact with its lower contact, it impresses on the line the voltage of the battery e_1 and one-half the A. C. voltage induced in the secondary of the transformer. The detector D_1 is so adjusted by some suitable bias that it becomes operative on the depression of key 1 by virtue of the battery e_1 and the A. C. induced in series with it. The detector D_2, on the other hand, is not rendered operative by such voltage. Upon the depression of key 2 while key 1 is open, there is impressed across the line a similar combination of D. C. voltage from e_2 and A. C. from the transformer secondary, the voltage of e_2 being in such direction as to render the detector D_2 operative but leaving D_1 unresponsive. In the event that both keys are operated simultaneously, the batteries e_1 and e_2 neutralize each other's effect, but the complete voltage of the secondary of the transformer is now impressed across the line and will be of such magnitude as to render both detectors responsive.

This particular operation of the detectors will be made more evident by reference to Fig. 2 in which the detectors are shown as of the vacuum tube type comprising a tube with a filament, a plate and a grid. In the grid circuit of D_1 is placed a battery e_3 with its negative pole connected to the grid and adjusted to any suitable value, such as the cut-off value of the plate supply. Similarly, the detector D_2 has in its grid circuit a battery e_4 with its negative terminal connected to the grid and of such value as to bring this detector also to some definite operating point, such as the cut-off value of the plate current. In the output circuit of the detector D_1 is connected a relay 6, and similarly, in the output circuit of D_2 is connected a relay 7.

The operation of the system will be made more evident by reference to Figs. 3 and 4. Thus, from Fig. 3 it will be evident that when key 1 is depressed there is impressed across the detector D_1 the voltage e_1 and one-half of the A. C. voltage of the transformer, so that the actual instantaneous voltage across the detector D_1 is that corresponding to the portion *a* of Fig. 3. On the depression of

key 2 the instantaneous voltage across the line is represented by the portion *b* of Fig. 3, and upon the operation of both of these keys simultaneously the instantaneous voltage is represented by the portion *c*. Referring to Fig. 4, the usual characteristic of a three-electrode tube is shown and plotted in a vertical direction there is virtually a reproduction of Fig. 3, showing the portions *a*, *b* and *c* as applied to detector D_1. The voltage of battery e_3 is such that the operating point of the tube is brought to the cut-off value N, and the voltage of e_1 may suitably be made one-half of this so that when key 1 is depressed the D. C. voltage of the grid of D_1 is one-half the cut-off value. Superposed on this grid, then, is the voltage corresponding to *a*, which will give rise to a current component in the output of the detector of sufficient value to operate the relay 6, the instantaneous value of this current being represented by the portion I_{pa}.

When the key 2 alone is depressed the instantaneous voltage of the grid of D_1 is shown by the portion *b* of Fig. 4 and since this is at all times more negative than the cut-off value of the tube, no current will flow through the plate circuit of the tube, and this portion would be represented by I_{pb} of Fig. 4. In the event, however, that both keys are depressed the batteries e_1 and e_2 neutralize each other but the A. C. voltage across each of the detectors is doubled and, as shown in Fig. 4, the grid takes on periodically large enough a potential to permit flow of current through the plate circuit, giving an instantaneous plate current represented by I_{pc} which is sufficient to operate the relay 6.

The operation of the detector D_2 is similar in every respect, but being connected in the reverse direction it is apparent that there will be no operation of D_2 on the depression of key 1, but on the depression of key 2 the potential of the grid under the action of the battery e_2 and one-half the A. C. voltage of the transformer will be such as to give rise to a periodic current in the output of the detector D_2 of sufficient value to operate the relay 7. On the simultaneous operation of the two keys the detector D_2 will again be rendered operative, all in a manner precisely as explained in connection with D_1.

From the above description it will be seen that we are enabled to carry on two simultaneous telegraph messages on a single carrier frequency and in the same direction with no interference of the messages, each receiver acting as though it were alone across the line, thus yielding a diplex carrier frequency telegraph system.

While we have explained the invention with certain values of biasing, and more particularly in connection with a vacuum tube detector, it is to be understood that various modifications might be made without departing from the spirit of this invention. For example, it would not be necessary to have the detector tubes biased to exactly the cut-off value but this bias might be somewhat greater or somewhat smaller without affecting the operation of the system. Also, it is to be understood that other than vacuum tube detecting devices might be used, either electrical or mechanical, but possessing characteristics which would yield substantially the same results as described above.

What is claimed is:

1. In a carrier frequency telegraph system, the method of transmitting two messages simultaneously in the same direction which consists in actively biasing the line in one direction for one message and in the opposite direction for the other message.

2. In a signaling system, the method of transmitting two messages simultaneously in the same direction which consists in actively biasing the line in one direction for one message and in the opposite direction for the other message, the two biasings neutralizing when transmitting both messages.

3. In a carrier frequency telegraph system, a transmission line, a source of carrier frequency, a keying device on each side of the line, and circuit connections such that when one key is depressed a D. C. voltage plus one-half of the carrier frequency voltage is impressed on the line and when the other key is depressed a reverse D. C. voltage plus one-half the carrier frequency voltage is impressed on the line and when both keys are depressed the D. C. voltages neutralize and the full carrier frequency voltage is impressed on the line.

4. In a signaling system, a transmission line, a source of carrier frequency, two keying devices, and means for impressing the carrier frequency voltage with an aiding D. C. voltage for one message and the same carrier frequency voltage with an opposite D. C. voltage for the other message.

5. In a carrier frequency telegraph system, a transmission line, a source of carrier frequency, two keying devices and means for impressing across said line a portion of the carrier frequency voltage with a D. C. bias for one message and a portion of the carrier frequency with an opposite D. C. bias for the other message.

6. In a carrier frequency telegraph system, a transmission line, a source of carrier frequency, two keying devices, and means for impressing carrier frequency voltage with a D. C. bias for one message and carrier frequency voltage with an opposite D. C. bias for the other message, the D. C. biases neutralizing and the carrier frequency voltages adding for the two messages together.

7. In a carrier frequency telegraph system, a transmission line, a source of a single carrier frequency, two keying devices, means

for impressing said carrier frequency voltage with an aiding D. C. voltage for one message and said carrier frequency voltage with an opposite D. C. voltage for the other message, and two receiving devices across the line at the remote end, one responsive to the one keying device and the other to the other keying device.

8. In a carrier frequency telegraph system, a transmission line, a source of carrier frequency, two keying devices, means for impressing carrier frequency voltage with a D. C. bias for one message and carrier frequency voltage with an opposite D. C. bias for the other message, and two detector receiving devices across the line at the receiving end connected in reverse direction and each biased to be unresponsive to voltage below a minimum value.

9. In a carrier frequency telegraph system, a transmission line, a source of carrier frequency, two keying devices at the transmitting end, two detector receiving devices at the receiving end connected across the line in reverse direction and each biased to be normally unresponsive, a biasing means associated with each key opposite and substantially equal to that associated with the corresponding receiving device whereby when one key is operated the bias for one detector is neutralized and when the other key is operated the bias for the other detector is neutralized.

In testimony whereof, we have signed our names to this specification this sixth day of August, 1930.

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PAUL VINCENT WELCH.