Dec. 5, 1933. J. L. CLARKE 1,937,640

MEANS FOR PREVENTING BIAS IN TELEGRAPH SYSTEMS

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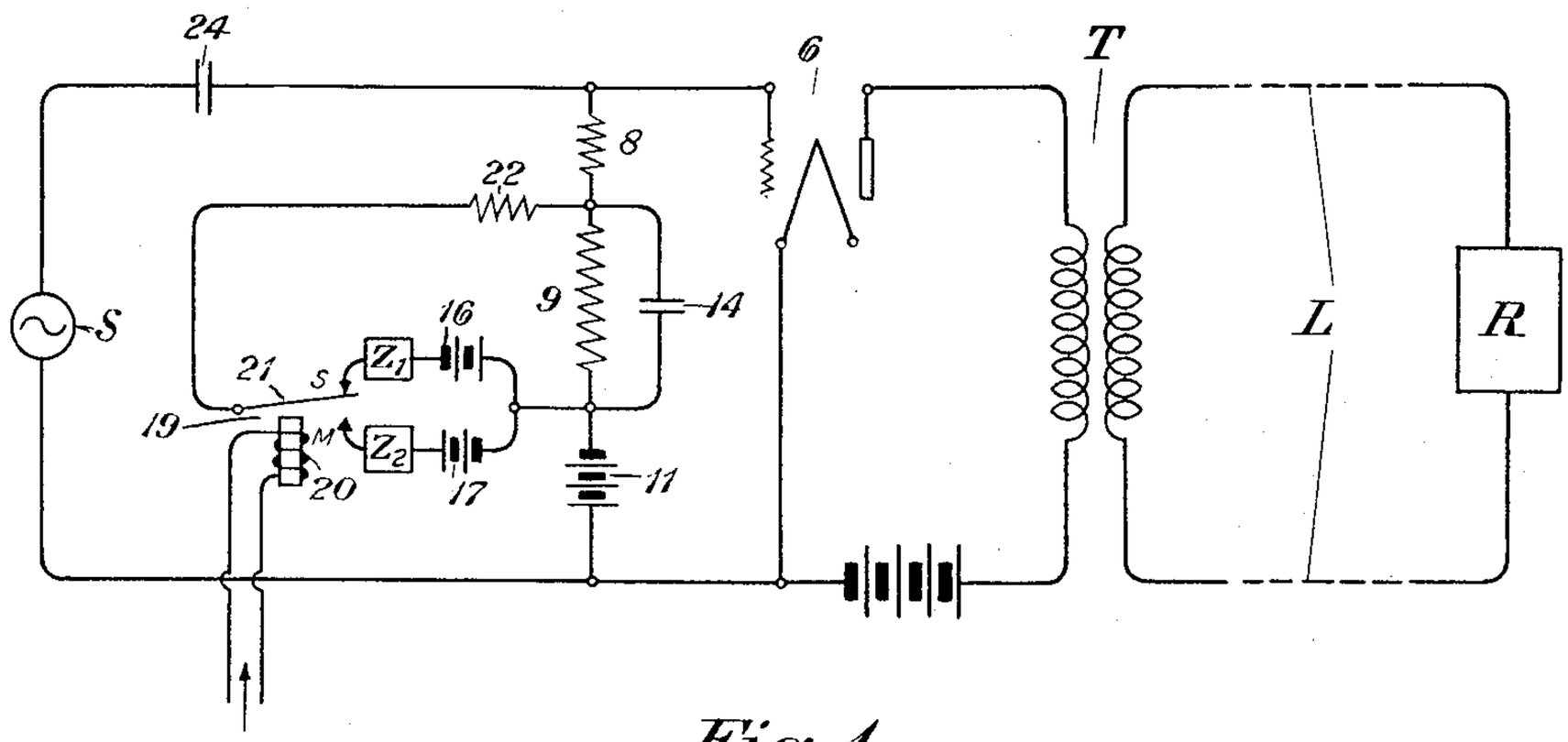

Fig. 1

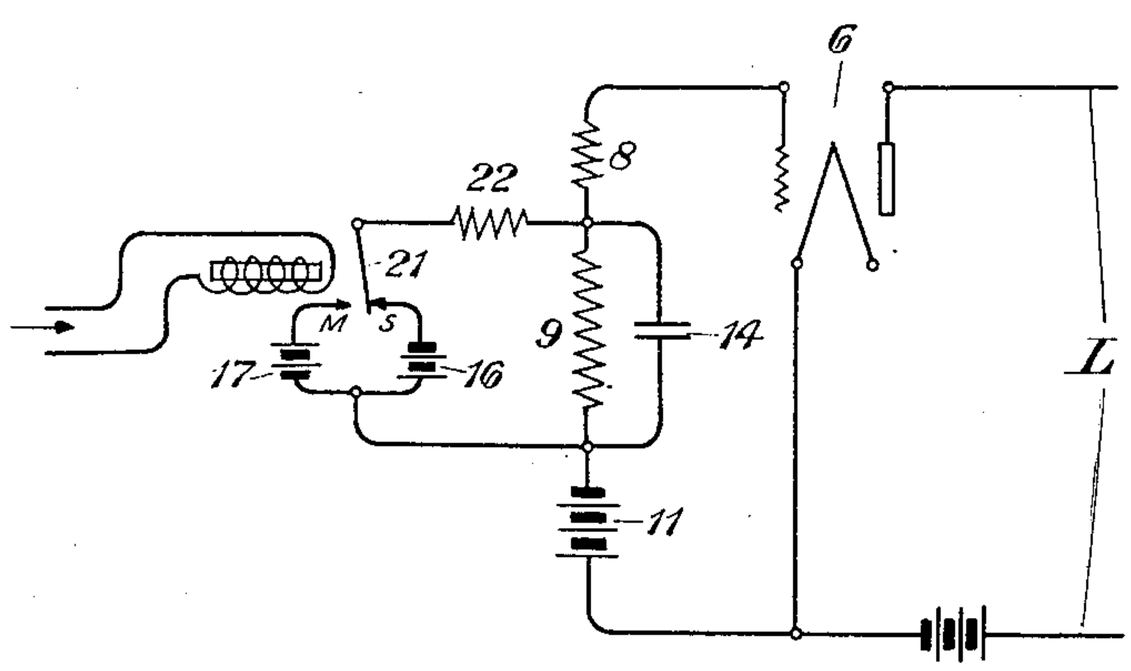

Fig. 2

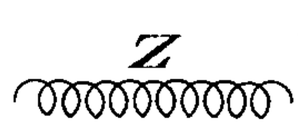

Fig. 3

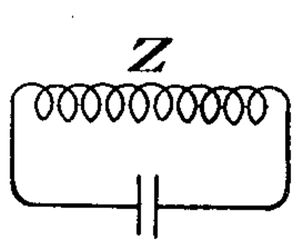

Fig. 4

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MEANS FOR PREVENTING BIAS IN TELEGRAPH SYSTEMS

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6 Claims. (Cl. 178—66)

This invention relates to means for preventing bias in telegraph signaling, and has for its purpose the elimination of such bias as arises in connection with the time of travel of a sending device between its marking and spacing positions.

Most telegraph systems employing current and no-current elements for the transmission of telegraph signals, especially in the case of carrier frequency systems, are subject to the lengthening either of each "spurt" of current, or of the interval between spurts, depending upon the method of keying by an amount equal to the travel time of the sending device. Although this effect may not be serious at ordinary speeds it becomes relatively large at comparatively high speeds. In this invention I propose to eliminate such biasing effects or to reduce them to so low a value as to be negligible even at such high speeds as 400 or 500 words per minute.

The invention will be better understood by reference to the following specification and accompanying drawing, in which Figure 1 shows the circuit arrangement for the transmitting end of a carrier frequency telegraph system, embodying my invention. Fig. 2 is a modification thereof as applied to direct current telegraph signaling. Figs. 3 and 4 show certain types of networks which are represented symbolically in Fig. 1.

Referring more specifically to Fig. 1, there is shown at S a source of carrier frequency current, such as a 5000 cycle source. Ordinarily this would be connected directly to a transmission line L through any suitable sending device which moves alternately from marking to spacing position. In such a connection, when in series, it is apparent that the voltage from the high frequency source is removed from the line as soon as the sending device leaves the marking position, and remains off not only while the sending device is at spacing position, but also during the time of to and fro travel of the sending device. When the sending device is in shunt across the line the reverse occurs; that is the marking time is increased. This biasing of the signals, which becomes serious at high speeds, is the feature which I wish to eliminate. Attempts have been made to reduce the effect by biasing the sending device in one way or another, but I have found these uncertain in action and therefore unsatisfactory.

In my invention I make connection from the high frequency source to the line through a vacuum tube of the three-electrode type as shown at 6, this tube preferably operating on a reasonably flat portion of its characteristic, in other words, acting as a good repeater or amplifier. Across the grid circuit of the tube are connected in series resistances 8 and 9 and biasing battery 11. The resistance 8 is of relatively small magnitude, say 50,000 ohms, but the resistance 9 is considerably larger, such as 500,000 ohms. Across the resistance 9 is connected a condenser 14 which may be of the order of one microfarad. In addition to the biasing battery 11 I provide biasing batteries 16 and 17, oppositely poled, one or the other of which may be connected virtually in series with the biasing battery 11, this being accomplished by means of a connection controlled by the sending device 19 which comprises a relay winding 20 and a member 21 movable from marking to spacing position under control of the winding 20. In the spacing position the battery 16 is connected in series with the battery 11, and in such direction as to increase the negative bias of the tube grid, and under this condition the bias will be sufficiently high to block or substantially block the plate current of the tube. In its marking position, however, the battery 17 is introduced and in opposition to the battery 11. The resultant bias of the grid is thus sufficiently reduced so that carrier frequency voltage from the source S is repeated in the plate circuit of the tube 6 and sent out on the line L.

At the time that the one or the other of the batteries 16 and 17 is connected in circuit, the condenser 14 will be charged quickly to practically the full voltage of the batteries 16 or 17, the rate at which this occurs being controlled chiefly by a relatively small resistance 22 which may be of the order of a few hundred ohms. The resistance 9 is sufficiently large so that the time constant of the condenser circuit does not permit appreciable discharge of the condenser during the time that the moving member 21 is traveling from one position to the other, and as a result the grid of the tube 6 is mainained at substantially constant potential during this travel time.

Various additional features are desirable in order to make this circuit operate in a more satisfactory manner. Thus, a blocking condenser 24 is placed in series with the source S to prevent short-circuiting of the D. C. batteries through the A. C. source. Also, it may be desirable in certain cases, to insert impedances Z_1 and Z_2 in series with the batteries 16 and 17, separately or in common, by placing them near the resist-

ance 22. Such impedances may be for the purpose of reducing the spark which may occur when the element 21 makes contact on the one side or the other. The networks may take on a variety of forms such as shown in Figs. 3 and 4, where in one case it is shown as an inductance, and in another case as an inductance in parallel with a condenser. Obviously, these networks if used, may take on a large variety of other forms in accordance with the function which they are intended to perform. In Fig. 1 the plate circuit of the tube 6 may be connected directly to the line or may be associated therewith by means of a transformer T as shown, and at the remote end there would be connected any suitable type of receiver R.

In Fig. 2 there is shown a modification of the circuit of Fig. 1 adapted for D. C. signaling. In this case the same resistances 8, 9 and 22 are shown, and the biasing batteries 11, 16 and 17. There is also shown the condenser 14. In this case, direct current signals are sent out over the transmission line, and the voltages of the batteries 11, 16 and 17 are so chosen that when the sending device is at spacing position the plate current of the tube is reduced to zero, but when at marking position normal current will flow through the plate circuit and the line. Here again, condenser 14 operates to maintain the potential of the grid of the tube substantially constant during the time of travel of the sending device so that when the member 21 leaves spacing position, having brought the grid potential to blocking value, this potential persists until the member 21 actually makes marking contact, whereupon the potential of the grid is suddenly raised and the charge on the condenser 14 is reversed When the element 21 leaves marking position to go to spacing position, again the condenser 14 maintains the potential of the grid of the tube at marking value until spacing contact is actually made.

Various modifications of my invention will be obvious to those skilled in the art, and such changes are to be considered as coming within the scope of my invention as specified in the claims.

What is claimed is:

1. In a telegraph signaling system a source of potential, a transmitting key and a vacuum tube device, means for biasing the grid circuit of the tube by the transmitting key in accordance with the marking and spacing position of the key, and means associated with the grid circuit to maintain the potential of the grid substantially constant while the key is between contacts.

2. In a telegraph signaling system a transmission line and a source of voltage, a vacuum tube to the output of which is connected the transmission line and to the input of which is connected the source of voltage, a sending device and means controlled thereby to bias the grid circuit permitting the flow of current in the line when the transmitter is in marking or spacing position and stopping the flow when the transmitter is in the reverse position, and means to maintain the grid bias substantially constant during the travel time of the sending device.

3. In a carrier frequency telegraph circuit a transmission line and a source of carrier frequency, a vacuum tube to the output of which is connected the transmission line and to the input of which is connected the source of carrier frequency, a sending device and means controlled thereby to bias the grid circuit permitting the flow of alternating current in the line when the transmitter is in marking position and stopping the flow when the transmitter is in spacing position, and means to maintain the grid bias substantially constant during the travel time of the sending device.

4. In a carrier frequency telegraph circuit a transmission line and a source of carrier frequency, a three-electrode vacuum tube to the output of which is connected the transmission line and to the input of which is connected the source of carrier frequency, a sending device with a vibrating member, sources of direct current voltage controlled thereby to bias the grid circuit of the tube in accordance with the signal to be sent, a condenser across the grid circuit to act as a reservoir for maintaining the potential of the grid substantially constant during the travel time of the sending device.

5. The combination of claim 4 characterized by the fact that a high resistance is connected in parallel to the condenser.

6. In a carrier frequency telegraph circuit a transmission line and a source of carrier frequency, a three-electrode vacuum tube to the output of which is connected the transmission line and to the input of which is connected the source of carrier frequency, a sending device with a vibrating member, oppositely poled sources of direct current voltage, a high resistance connected across the grid circuit and a condenser across the major portion thereof, a circuit connection controlled by the sending device to connect one D. C. source or the other across the condenser to bias the grid and maintain its potential substantially constant during the travel time of the sending device.

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