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REDUCTION OF ATMOSPHERIC DISTURBANCE

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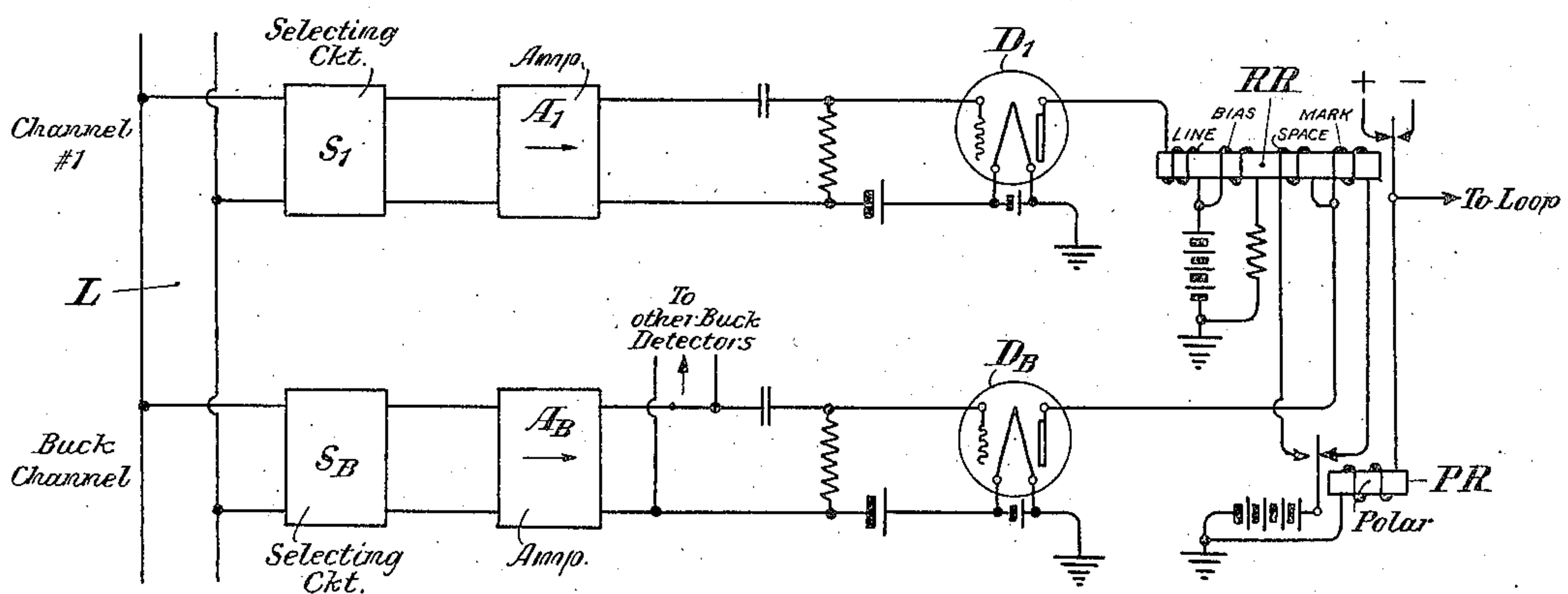


Fig. 1

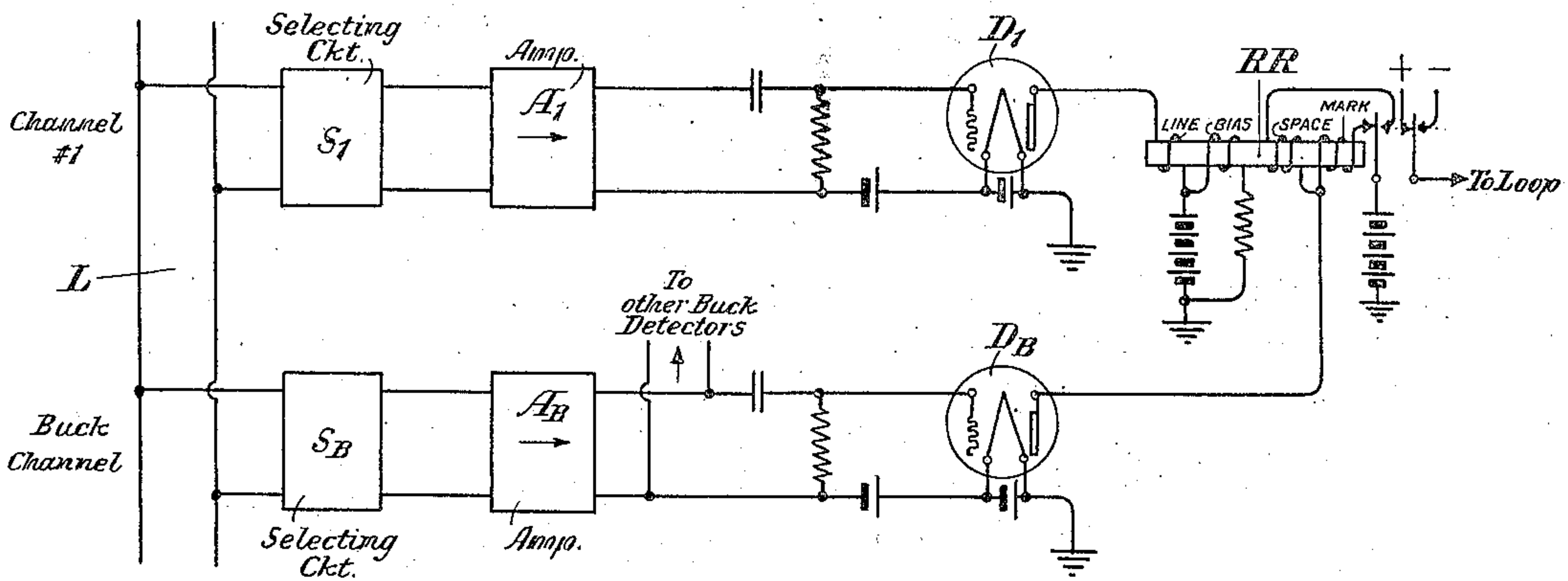


Fig. 2

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REDUCTION OF ATMOSPHERIC DISTURBANCE

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This invention relates to carrier telegraph systems, either radio or on wires and more particularly to arrangements for suppressing false telegraph signals caused by atmospheric disturbances.

In order to suppress false telegraph signals of the type above referred to, it has been proposed to associate with a carrier telegraph system at the terminal station an additional channel, known as a buck channel, which is so arranged as to be receptive to a frequency band which is not used for telegraph signaling but which is adjacent to the bands assigned to the several signaling channels. By means of the buck channel, pulses of current are produced each time an atmospheric disturbance occurs, and these impulses are employed to hold the armature of the receiving relay of the protected telegraph channel or channels against the contact (marking or spacing, as the case may be) upon which it happens to rest at the time the disturbance occurs. In order that the pulse may be so applied as to hold the armature in either position of the relay armature, a reversing arrangement is provided. In the form previously used, this reversing arrangement (which is, in effect, a double-throw reversing switch) involves two armatures and four contacts. As the usual polar relay commonly used in connection with telegraph circuits has but a single armature with but two contacts, in the circuit above referred to it was necessary to use two polar relays to accomplish the necessary reversing.

In accordance with the present invention a circuit arrangement is provided whereby the reversing operation may be performed by a single relay having an armature and two contacts, and without the use of additional vacuum tube detectors in connection with the buck channel. This is accomplished by providing the receiving relay of the protected channel with two buck windings, one for use in connection with disturbances occurring during the marking interval and the other for use in connection with disturbances occurring during the spacing interval. These windings are actuated by current supplied through the plate circuit of a single detector

tube associated with the buck channel, and the reversing armature is so arranged as to complete the plate circuit through one or the other of the two windings alternately. The reversing armature may comprise either an extra armature upon the receiving relay or it may comprise the armature of a single polar relay associated with the loop circuit and controlled by the receiving relay. In the former case the system has the advantage that the reversal is effected simultaneously with the shift of the armature of the receiving relay, since the vacuum tube detector has no mechanical or electrical inertia.

It will be noted that the system involves at least one less polar relay for each protected channel than the prior arrangement, without requiring any additional vacuum tube rectifiers or detectors.

The invention will now be more fully understood from the following description when read in connection with the accompanying drawing, Figures 1 and 2 of which illustrate schematically two different circuit arrangements embodying the principles of the invention.

Referring to Fig. 1, L designates bus bars associated with the receiving terminal of a carrier system (either wire or wireless) upon which the frequencies corresponding to a plurality of signaling channels are impressed at a receiving point. In practice the system will usually be multiplex, but for purposes of illustration the apparatus of but a single receiving channel of a multiplex system is shown. This includes a selecting circuit S_1 which may be a tuned circuit, or a filter, or other known selecting device for admitting to the channel the band of frequencies assigned thereto. An amplifier A_1 is connected beyond the selecting circuit, this amplifier being of any known type such, for example, as a vacuum tube amplifier. To the output of the amplifier a vacuum tube detector D_1 is connected. The plate circuit of the detector includes the line winding of a receiving relay RR. The grid circuit is biased by means of the usual "C" battery so that in the absence of the received carrier no plate current will flow. In signaling, the carrier is

usually transmitted during the marking interval and no current is transmitted during the spacing interval, so that pulses of current will flow in the plate circuit corresponding to the marking signals, while the spacing signals will be represented by no-current intervals in the plate circuit. The receiving relay RR also includes a biasing winding, the current through which is adjusted by means of a suitable resistance to such value that the biasing current will produce a pull upon the armature of the relay in the opposite direction to and about half as strong as the pull produced by the plate current flowing through the line winding during a marking interval.

In order to reduce the effect of the atmospheric disturbance an auxiliary or buck channel is provided which includes a selecting circuit S_B . This selecting circuit may be similar to the selecting circuit S_1 but is selective of a frequency or a narrow band of frequencies which is not used for signaling but is in the neighborhood of the bands actually employed for the transmission of signals. An amplifier A_B , similar to the amplifier A_1 , is connected in the buck channel beyond the selecting circuit. In the output of this amplifier are connected detectors associated with the various receiving channels. In the case of the receiving channel illustrated one such detector, D_B , is provided. The plate of this detector is connected to the junction point of the spacing and marking windings of the receiving relay RR, the other terminals of said windings being connected, respectively, to the left-hand and right-hand contacts of the polar relay PR. The polar relay PR is connected to the loop circuit controlled by the armature of the receiving relay RR, and hence the armature of the polar relay vibrates as the signals change from marking to spacing, and vice versa. As the armature of the polar relay PR vibrates with changes in the signal, the plate circuit of the detector D_B is completed through one or the other of the spacing and marking windings, which are oppositely wound upon the core of the receiving relay RR so that if plate current flows through the spacing winding it tends to oppose the effect of current through the line winding, whereas if plate current flows through the marking winding it tends to assist the effect of current through the line winding. The grid of the detector D_B is normally biased negative by means of the usual "C" battery arrangement, so that in the absence of any alternating potential superposed upon the grid no current will flow in the plate circuit. When, however, an alternating potential is applied to the grid as a result of an atmospheric disturbance, a rectified pulse of plate current flows.

The operation is as follows: When a train of carrier waves is transmitted correspond-

ing to a marking signal and having the frequency assigned to the channel illustrated, a rectified current flows in the plate circuit of the detector D_1 and through the line winding of the receiving relay RR. As this current has a value about twice as great as the normal biasing current through the biasing winding of the relay, the armature is pulled from the spacing contact to its marking contact, and a signal is sent to the loop. At the same time the polar relay PR shifts its armature to its right-hand contact, thereby connecting the plate battery to the plate of the detector D_B through the marking winding. As the selecting circuit S_B does not select the carrier frequency used for signaling, no rectified current flows in the plate circuit of the detector D_B in the absence of an atmospheric disturbance, and hence no effect is produced upon the marking winding.

If, under these conditions, an atmospheric disturbance should occur, its effect upon the signal receiving channel may be either to increase the plate current through the line winding of the receiving relay or to decrease it, depending upon the magnitude of the disturbance. An increase in the plate current of the detector D_1 is without any effect to produce false signals, but if the plate current should be sufficiently decreased a false spacing signal would occur, permitting the armature of the receiving relay to be shifted to its spacing contact under the control of the biasing winding. This is prevented, however, by the action of the buck circuit. The atmospheric disturbance usually assumes the form of an impulse having a wide range of frequencies. A narrow band of these frequencies passes through the selecting circuit S_B of the buck channel and upon being amplified is applied to the grid of the detector D_B . This causes a pulse of rectified plate current corresponding to the atmospheric disturbance to flow through the marking winding. This pulse of current is in such a direction as to tend to hold the armature of the receiving relay upon its marking contact, so that no false signal occurs.

When the carrier current corresponding to the signaling channel illustrated is interrupted in accordance with a space signal, the plate current of the detector D_1 ceases flowing through the line winding of the relay RR and the biasing winding comes into play to shift the armature to its spacing contact, thus sending a space signal to the loop. This causes the polar relay PR to shift its armature to its right-hand contact, thereby connecting the plate of the detector D_B through the spacing winding of the receiving relay RR to the plate battery. Under these conditions, the effect of an atmospheric disturbance is to permit the selecting circuit S_1 to select from the disturbing wave a frequency correspond-

ing to the signaling channel illustrated. This causes a pulse of rectified current to flow in the plate circuit of the detector D_1 and through the line winding of the relay RR , thus tending to produce a false marking signal. This is prevented, however, by the fact that the selecting circuit S_B of the buck channel selects a component of the disturbing wave which is amplified and applied to the grid of the detector D_B . A rectified pulse of current is, therefore, caused to flow in the plate circuit of the detector D_B and through the spacing winding of the receiving relay. The winding is so poled that this pulse of current tends to assist the biasing winding in holding the armature of the receiving relay against its spacing contact. It will be understood, of course, that in the absence of an atmospheric disturbance no current flows in the plate circuit of the detector D_B during a spacing interval, and hence, under such conditions, the spacing winding is without effect.

In the foregoing arrangement it will be observed that the reversing of the holding pulse supplied by the buck channel is controlled by a single armature of a single polar relay included in the loop circuit. This is an advantage over the prior arrangements which require two armatures with two contacts, and hence, two polar relays in the circuit. Furthermore, the elimination of one of the polar relays is obtained without the use of any additional detector tubes in connection with the buck channel.

Fig. 2 illustrates a circuit arrangement operating on principles similar to those of Fig. 1 but differing therefrom in that the switching of the plate circuit of the detector D_B through the spacing and marking windings of the receiving relay RR is controlled by an extra contact on the armature of the receiving relay itself, thus obviating the necessity of a polar relay in the loop circuit. Here, when a marking signal is being received, the left-hand armature of the receiving relay RR will be shifted to its left-hand contact to complete the connection of the plate battery through the marking winding to the plate of the detector D_B , with the same effect in the case of a false signal as described in connection with Fig. 1. When the spacing signal is received, the left-hand armature of the receiving relay is shifted to its right-hand contact to connect the plate battery through the spacing winding to the plate of the detector D_B , so that a rectified pulse of current due to an atmospheric disturbance in the buck channel causes the spacing winding to assist the biasing winding in holding the right-hand or signaling armature of the receiving relay against its spacing contact.

The arrangement of Fig. 2 has the advantage that the holding action produced by the buck channel is instantaneous, due to the

fact that the detecting tube D_B has no mechanical or electrical inertia such as would be introduced by a polar relay.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a carrier telegraph system, a receiving channel including means to select a carrier frequency, means to detect therefrom a telegraph signal and a receiving relay, an auxiliary channel including means to select from an interfering wave a component having a frequency in the neighborhood of that of the receiving channel, a pair of oppositely poled auxiliary windings on said receiving relay, a detector associated with said auxiliary channel and arranged to supply a pulse of current to either of said windings in response to the component selected by said auxiliary channel, and means controlled by said relay for transmitting said pulse to one of said windings during receipt of a marking signal and to the other winding during receipt of a spacing signal.

2. In a carrier telegraph system, a receiving channel including means to select a carrier frequency, means to detect therefrom a telegraph signal and a receiving relay, an auxiliary channel including means to select from an interfering wave a component having a frequency in the neighborhood of that of the receiving channel, a pair of oppositely poled auxiliary windings on said receiving relay, a detector associated with said auxiliary channel and arranged to supply a pulse of current to either of said windings in response to the component selected by said auxiliary channel, and means controlled by said receiving relay to transmit said pulse through one or the other of said windings depending upon whether the relay is responding to a marking or spacing signal.

3. In a carrier telegraph system, a receiving channel including means to select a carrier frequency, means to detect therefrom a telegraph signal and a receiving relay, an auxiliary channel including means to select from an interfering wave a component having a frequency in the neighborhood of that of the receiving channel, a pair of oppositely poled auxiliary windings on said receiving relay, a detector common to said windings associated with said auxiliary channel, said detector having a plate circuit in which a rectified pulse of current flows in response to the component selected by said auxiliary channel, and means controlled by said receiving relay to complete the plate circuit through one of said windings during receipt of a marking signal and through the other winding during receipt of a spacing signal.

4. In a carrier telegraph system, a receiving channel including means to select a carrier frequency, means to detect therefrom a telegraph signal and a receiving relay, an auxiliary channel including means to select
5 from an interfering wave a component having a frequency in the neighborhood of that of the receiving channel, a pair of oppositely poled auxiliary windings on said receiving relay, a detector common to said windings as-
10 sociated with said auxiliary channel, said detector having a plate circuit in which a rectified pulse of current flows in response to the component selected by said auxiliary
15 channel, and a relay in a circuit controlled by said receiving relay for controlling the completion of said plate circuit through one or the other of said windings depending upon whether a marking or spacing signal is re-
20 ceived.

In testimony whereof, I have signed my name to this specification this 24th day of November, 1928.

FRANK A. LEIBE.

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