

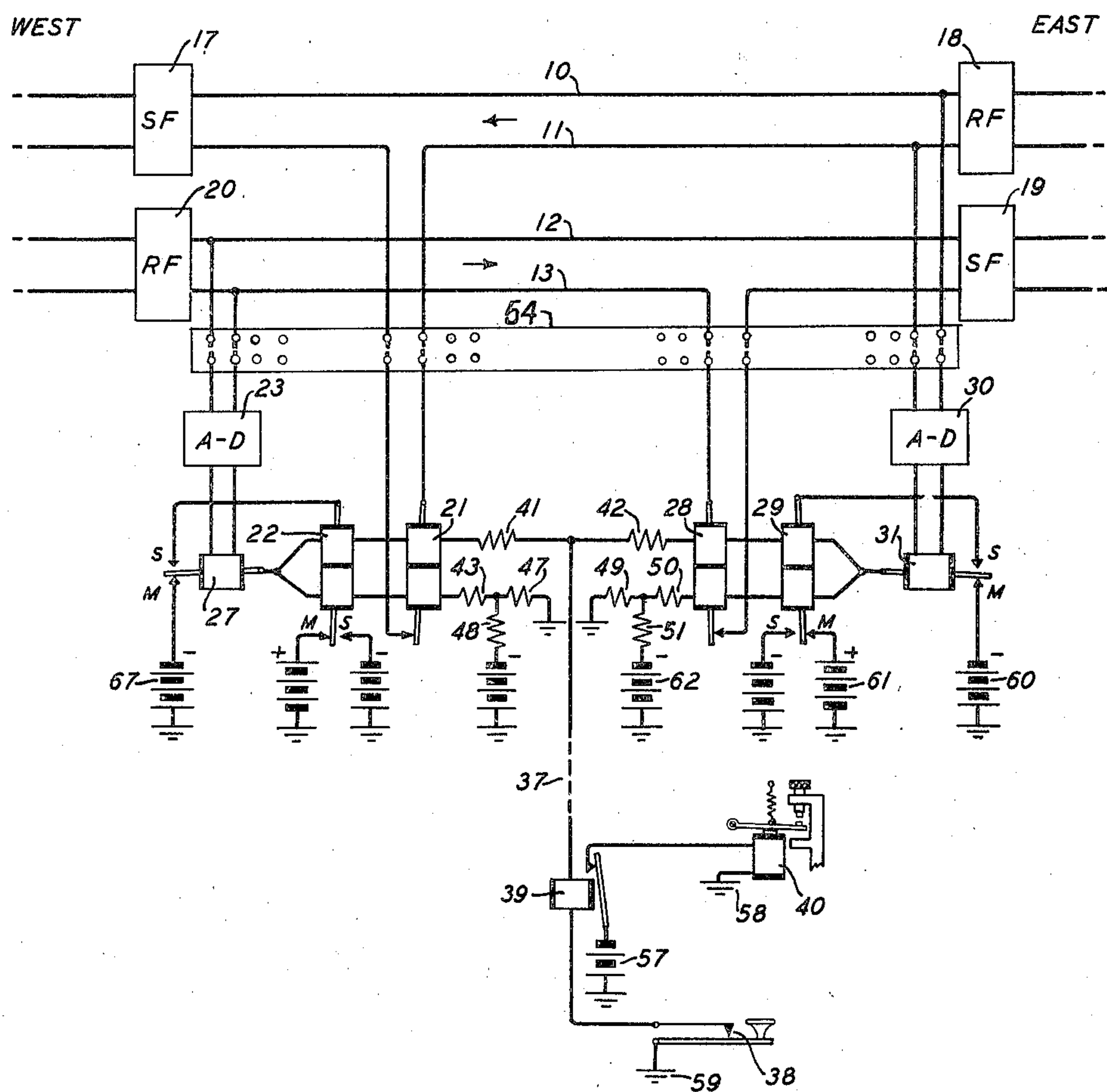
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CARRIER TELEGRAPH SYSTEM

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CARRIER TELEGRAPH SYSTEM

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This invention relates to a telegraph system and particularly to a voice frequency carrier telegraph system.

5 An object of the invention is to facilitate the association of intermediate loop circuits with a telegraph line.

In accordance with a feature of the invention the sending and receiving filters are associated directly with the voice frequency line rather than with the terminal equipment itself. This renders the terminal equipment independent of frequency whereby a particular terminal set may be used on any channel as desired.

10 In accordance with a specific embodiment of the invention the intermediate loop equipment comprises a symmetrical differential circuit each half of which includes a send relay, a break relay, an amplifier-detector and a receive relay. The subscriber's loop equipment, which includes the usual key and sounder, is connected to the electrical midpoint of the symmetrical differential circuit. The contacts of each of the send relays are connected in series with one side of a respective one of the two-wire pairs between the sending and receiving filters which are connected in series with both sides of the respective lines. Each amplifier-detector (and the receive relay controlled thereby) is connected across a respective one of the two-wire pairs between the sending and receiving filters. Resistances and voltage sources of proper values are associated with the intermediate circuit to bring about a proper balance whereby messages received from either direction over the voice frequency line will actuate the subscriber's sounder, whereby operation of the subscriber's key will transmit in both directions over the voice frequency line and whereby messages received at the intermediate point over one pair of voice frequency wires from one terminal will not be transmitted back to the same terminal over the other pair of wires.

35 A full understanding of the arrangement contemplated by the invention and appreciation of the various advantages thereof may be gained from consideration of the following detailed description together with the accompanying drawing the single figure of which shows an intermediate loop circuit associated with a two-way four-wire voice frequency telegraph system.

50 Referring now to the drawing, a four-wire voice frequency telegraph system is represented, wires 10 and 11 comprising the east-west line and wires 12 and 13 comprising the west-east line. Each line has connected in series with it at the intermediate point where the intermediate loop

is to be connected a sending filter and a receiving filter, sending filter 17 and receiving filter 18 being associated with the east-west line and sending filter 19 and receiving filter 20 being associated with the west-east line. All connections between the lines and the intermediate terminal equipment are made between the two filters of the respective line.

The intermediate loop circuit follows a symmetrical differential layout, one half of the circuit including send relay 21, break relay 22, amplifier-detector 23 and receive relay 27 and the other half including send relay 28, break relay 29, amplifier-detector 30 and receive relay 31. The send relays and break relays are of the two winding polarized type one winding of each being connected in series with a respective side of the differential circuit.

At the midpoint of the upper side of the differential circuit, loop conductor 37 is connected, this conductor terminating at the substation in the break contact of sending key 38. The winding of relay 39 is in series with lead 37. Relay 39 controls by its operation an energizing circuit for sounder 40.

Resistances 41 and 42 are included in one side of the symmetrical differential circuit and resistances 43, 47, 48, 49, 50 and 51 are included in the other side of the circuit for balancing purposes; their function will be more apparent from subsequent description of the operation of the circuit.

The connections between line wires 10, 11, 12 and 13 and the local loop circuit have been shown as being completed through cross connections on terminal strip 54 which may be of the type commonly used in telegraph and telephone terminal rooms for such a purpose. Other well-known means such, for example, as a plug and jack arrangement may of course be used; the purpose of the intermediate connector being merely to permit association of the loop circuit with any one of a plurality of line circuits as desired.

To further describe the invention let us assume that a subscriber at the remote east terminal is transmitting to the remote west terminal and let us see how the message is received at the intermediate subscriber's sounder 40. Due to the action of the sending equipment at the remote east terminal, the voice frequency waves impressed on the east-west line are periodically interrupted to produce "mark" and "space" signals on the line. Due to the parallel connection of amplifier-detector 30 across the line these voice frequency waves are also impressed on the ampli-

5 fier-detector which acts in a well understood manner to convert these voice frequency pulsations into corresponding impulses of direct current. These direct current impulses are impressed on the winding of polarized receive relay 31 which is caused thereby to operate in step with the voice frequency impulses transmitted along the line from the east terminal to the west terminal.

10 At the instant of the circuit conditions represented in the drawing sounder 40 is in operated position due to completion of an energizing path therefor traced from battery 57, make contact of relay 39, winding of sounder 40 to ground 58, relay 39 being operated over a path traced from ground 59, break contact of key 38, winding of relay 39, conductor 37 and then over the two parallel paths, one including resistance 42, the upper or line windings of relays 28 and 29 and the armature and M contact of relay 31 and leading to negative battery 60 and the other including resistance 41, the upper or line windings of relays 21 and 22 and the armature and M contact of relay 27 and leading to negative battery 67.

25 The direction of the current through the upper or line windings of relays 21, 22, 28 and 29 is such as to tend to hold the respective armatures in the positions shown in the drawing and, while the direction of the current in the lower or bias windings of the relays is such as to tend to move the respective armatures to a position opposite to that illustrated, the characteristics of the circuits are such that the current flowing in the line windings is greater than that in the bias windings and the armatures remain in the position shown.

30 Now as the armature of relay 31 moves to the S contact, under the influence of an impulse received from amplifier-detector 30, negative battery 60 is replaced by positive battery 61. Relay 39 now falls back to unoperated position as current in the path now established from positive battery 61, M contact and armature of relay 29, S contact and armature of relay 31, line windings of relays 28 and 29, resistance 42, conductor 37, winding of relay 39, break contact of key 38 to ground 59 balances and neutralizes the effect of the current in the path traced from ground 59, break contact of key 38, winding of relay 39, conductor 37, resistance 41, upper or line windings of relays 21 and 22, armature and M contact of relay 27 to negative battery 67. Sounder 40 moves to unoperated position in step with relay 39, its energizing path being interrupted at the make contact of relay 39. It is apparent therefore that sounder 40 will operate in step with the armature of relay 31.

55 The armatures of relays 21 and 22 do not move from the positions illustrated during movement of the armature of relay 31 to the S contact due to the fact that the directions of the currents through the windings thereof remain the same as when the armature of relay 31 was operated to its M contact. The armatures of relays 28 and 29 also remain in the positions illustrated in view of the fact that, while the direction of the currents through the upper or line windings now is reversed and now tends to move the respective armatures to their opposite position, the direction of the currents through the lower or bias windings is also reversed and now tends to hold the respective armatures in the positions illustrated. Now due to the characteristics of the potentiometer arrangement comprising resistances 49, 50 and 51, the current now flowing in the bias windings exceeds that flowing in the line windings and

is effective to hold the armatures in the position illustrated.

It will be apparent from the above that while sounder 40 operates in step with the operations of relay 31, the continuity of lines 11 and 13 is not disrupted as relays 21 and 28 are held in the position illustrated. This is, of course, a desirable feature.

In the instance of messages received over lines 12 and 13 from the west terminal the operation of relay 27, and the operation of sounder 40 in step therewith, is the same as the operation of relay 31 above described and will not therefore be described in detail. It will be apparent, however, that sounder 40 is operated both by east reception and by west reception but that the sending relays 21 and 28 are not affected by either east or west reception.

Assuming now that the local subscriber wishes to transmit a message and depresses his key 38 to transmit a space signal over the lines. Operation of key 38, by removal of ground 59, interrupts the energizing paths previously traced through the line windings of relays 21, 22, 28 and 29, so that the respective armatures are now operated by the current in the lower windings to positions opposite to those illustrated. This means, of course, that line 11 is opened at the break contact of sending relay 21 and that line 13 is opened at the break contact of sending relay 28 whereby an "open" or a space signal is transmitted both to the east terminal and to the west terminal. It will be apparent that relays 21 and 28 operate in step with key 38 whereupon operation of the key is effective to transmit messages both east and west. It will be apparent also that local relay 39 and sounder 40 controlled thereby, will operate in step with key 38.

Break relays 22 and 29 operate in step with key 38 and perform the usual function of break relays, i. e. they act, when the local key is open, to replace the positive battery of the S contact of the receiving relays, (27 and 31) with negative battery so that operation of either receiving relay during the time the local key is open for sending a spacing signal will not affect the local sounder.

The various advantages of associating the sending and receiving filters directly with the voice frequency lines rather than with the terminal equipment as was previously done will be readily apparent. The fact that the terminal equipment is rendered independent of frequency results in a greater flexibility and economy as idle channels do not mean idle terminal equipment as is the case with other arrangements. The terminal equipment, being independent of frequency, may, of course, be assigned to other channels as need arises and it is not necessary to provide a half-a-dozen or so spare terminal equipment sets at each terminal as is now commonly done.

Although the intermediate station equipment illustrated and described is of the low frequency type, other types of equipment such as carrier frequency equipment may, of course, be used at the intermediate point. The embodiment of the invention which has been selected for description should be considered as illustrative of the invention and not as restrictive thereof.

What is claimed is:

1. In a telegraph system, an eastward line transmitting carrier currents in a plurality of frequency ranges, a westward line transmitting carrier currents in a plurality of frequency ranges, a pair of filters in series in each line at a given

location, the two filters of each pair selectively passing the same range of frequencies, a subscriber's loop terminating in two send and two receive relays at said location, each send relay controlling a contact in a respective one of said lines at a point between the pair of filters in the respective line and each receive relay being effectively connected in bridge of a different respective line at a point between the pair of filters connected in the respective line.

2. In a telegraph system, an eastward line transmitting carrier currents in a plurality of frequency ranges, a westward line transmitting carrier currents in a plurality of frequency ranges, a pair of filters in series in each line at a given location, the two filters of each pair selectively passing the same range of frequencies, a subscriber's loop comprising a symmetrical differential circuit layout, each half of said loop circuit including a send relay and a receive relay, a sounder in the subscriber's loop circuit, a relay for controlling the operation of said sounder, a connection between said last-mentioned relay and the electrical midpoint of said symmetrical circuit, each of said send relays controlling a contact in a respective one of said lines at a point between the pair of filters in the respective line and each of said receive relays being effectively connected in bridge of a different respective line at a point between the pair of filters connected in the respective line.

3. In a telegraph system, an eastward line transmitting carrier currents in a plurality of frequency ranges, a westward line transmitting carrier currents in a plurality of frequency ranges,

a pair of filters in series in each line at a given location, the two filters of each pair selectively passing the same range of frequencies, a subscriber's loop comprising a symmetrical differential circuit layout, each half of said loop circuit including a send relay, a receive relay, a break relay, a potentiometer and a voltage source, said send relays and said break relays having two operating windings, a conductor joining the armature of one of said receive relays, the first winding of each of said send relays and each of said break relays and the armature of the other of said receive relays in series, a second conductor joining the armature of one of said receive relays, the second winding of one of said send relays and one of said break relays, one of said potentiometers and one of said voltage sources in series, a third conductor joining the armature of the other of said receive relays, the second winding of the other of said send relays and the other of said break relays, the other of said potentiometers and the other of said voltage sources in series, a sounder in the subscriber's loop, a relay for controlling the operation of said sounder, a fourth conductor joining the midpoint of said first conductor and the operating winding of said last-mentioned relay, each of said send relays controlling a contact in a respective one of said lines at a point between the pair of filters in the respective line and each of said receive relays being effectively connected in bridge of a different respective line at a point between the pair of filters connected in the respective line.

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