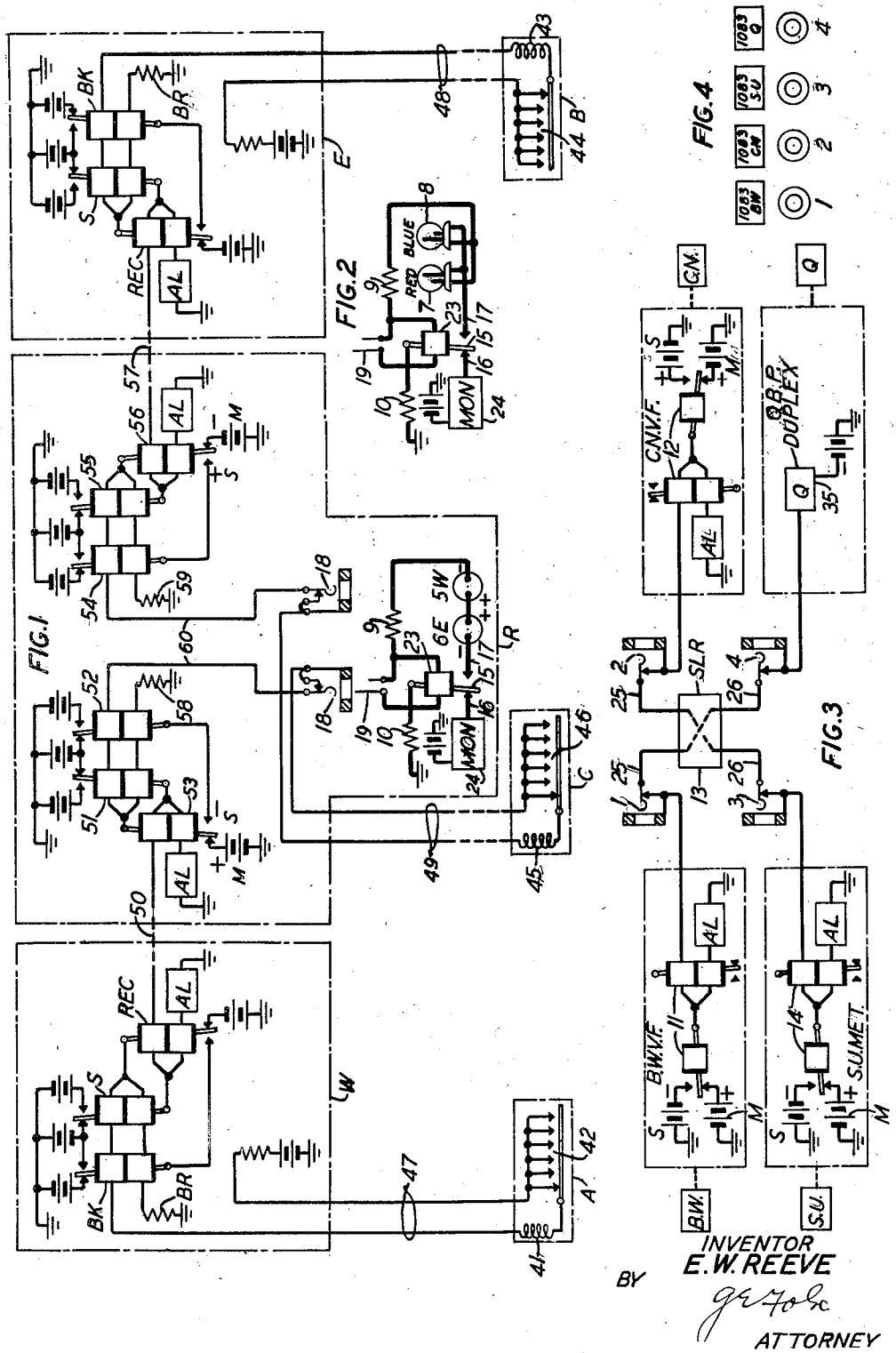
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TELEGRAPH SYSTEM

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TELEGRAPH SYSTEM

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This invention relates to telegraph systems and more particularly to testing telegraph systems.

In a half duplex telegraph system comprising numerous repeaters, branch lines, and stations it is very difficult to locate momentary circuit interruptions and non-signal disturbances which interfere with the operation of the entire system. Such interruptions may be the result of any of a large number of causes such as dirty relay contacts, loose wires, static in carrier systems, operators inserting the plug too far on busy test, etc.

The object of this invention is to detect such circuit interruptions, indicate the direction of signal transmission at the time and show the direction of the source of the non-signal disturbance.

A feature of the invention is a combination of a monitoring device and polarity indicating means connected to the telegraph system to be tested.

One specific embodiment of the invention comprises a receiving relay connected to the telegraph system, preferably at the repeater or central point, a monitoring printer connected to this relay to record the messages and to indicate disturbances and two high resistance direct current voltmeters connected in series opposition between the winding of the relay and its spacing contact to indicate the direction of transmission of the messages over the system and also the direction of the source of non-signal disturbances.

The invention may be more clearly and fully understood by reference to the attached drawing of which:

Figure 1 illustrates a simple embodiment of the invention, as applied to a simple differential half-duplex telegraph system;

Fig. 2 shows a modification of the invention employing gas filled lamps;

Fig. 3 illustrates a typical telegraph system embodying the invention; and,

Fig. 4 indicates the designation of the test jacks of Fig. 3.

Referring to Fig. 1 a subscriber's station A comprising transmitting contacts 42 and the receiving magnet 41 is connected to a terminal station W by loop 47. Station W is connected to repeater station R by loop 50. Station R is also connected to another terminal station E. A second subscriber's station B having a receiving magnet 43 and sending contacts 44 is connected to station E by loop 48. The terminal stations E and W employ the usual sending relays S, receiving relays REC, break relays BK, artificial lines AL and balancing resistances BR used in differential half duplex telegraph systems. The repeater station R employs similar transmitting relays 51 and 55, receiving relays 53 and 56 and break relays 52 and 54 as well as artificial lines AL and balancing resistances 58 and 59. It should be noted that the battery connected to the marking contact M of the receiving relay 56 is of opposite polarity to the battery connected to the marking contact M of the receiving relay 53. The batteries connected to the spacing contacts of these relays are also reversed. These batteries are reversed so that current will flow in line 60 when marking signals are being transmitted. With this arrangement the line relay of a monitoring printer may be inserted in this line for controlling a monitoring printer. Additional subscriber loops such as 49 connected to subscriber's station C may also be inserted in line 60.

Jacks 18 are provided so that the winding of a receiving relay 23 connected to cord and plug 19 may be readily inserted in circuit with line 60 to receive the signals being transmitted thereby. These jacks 18 may either be located at station R or at some distant point in which case they would be connected to line 60 through a loop similar to 49. The armature 15 of relay 23 is connected to ground through a suitable resistance 10. A monitoring printer 24 is connected to the marking contact 16 of relay 23 to record the signals received by this relay. 6E and 5W are direct current voltmeters connected in series opposition between the winding of relay 23 and the spacing contact 17 of this relay. A high resistance 9 is connected in series with this circuit to limit the current through the meters and to prevent interference with the telegraph signals.

Assume the system is normal or idle with no signals being transmitted through it and that plug 19 is inserted in jack 18. Under this condition, the relays are all held on their marking contacts as shown in Fig. 1. The circuit for holding relay 23 on its marking contact may be traced from positive battery on the marking contact M of receiving relay 53 through the windings of relays 51 and 52, line 60, the jack 18 and winding of relay 23, loop 49, and subscriber's station C, loop 49, jack 18, line 60, windings of relays 54 and 55 to negative battery on the marking contact M of receiving relay 56. With relay 23 on its marking contact 16 the monitoring printer 24 is idle and the circuit of meters 5W and 6E is open so that they will not be deflected.

Now assume that subscriber A transmits some signals over loop 47, through station W, over line 50 to station R, over loop 49 to subscriber C, and over line 57 through station E, and loop 48 to sta-

tion B. At the repeater station R, relays 53, 54 and 55 will follow these signals. During a spacing signal the negative battery from the S contact of relay 53 will be connected to a similar negative battery connected to the M contact of relay 56 through winding of relay 23 so that relay 23 is de-energized and therefore releases. Relay 23 in releasing initiates the operation of monitoring printer 24 and completes the circuit of meters 5W and 6E. It should be noted that some current will flow from the battery on the S contact of relay 53 through windings of relays 51, 52 and 23, resistance 9, meters 5W and 6E, spacing contact 17 and armature 15 of relay 23 to ground through resistance 10. Current also flows from negative battery on the marking contact M of relay 56 through windings of relays 54 and 55, resistance 9, meters 5W and 6E, contacts 17 and 15 of relay 23, and resistance 10 to ground. However, as pointed out above these currents are limited to such a value by resistance 9 that they will not interfere with the operation of these relays. The meters are so connected that the west meter 5W will now be deflected while the east meter will not, thus indicating that the signals originate from the west. Had the signals originated from the east, positive battery would have been connected to both winding terminals of relay 23 during a spacing impulse so the east meter 6E would be deflected. Thus the monitoring printer 24 records the transmitted signals and either the 5W or 6E meter is deflected indicating the direction from which the signals originate.

In a similar manner any momentary non-signaling circuit interruption will cause relay 23 to release and deflect one of the voltmeters indicating the direction of the origin of the non-signaling interruptions. However, in this case the monitoring printer will not print any message since none is being transmitted. It will print only random symbols and characters. Should the non-signaling interruptions occur during the transmission of a message, they are apt to mutilate the signals of the message. If they occur, however, during spacing impulses of the signals, the circuit is already open so that they will have no effect on the operation of the circuits at this time. It is only during marking impulses that momentary circuit non-signaling interruptions cause false signals to be received.

If these circuit non-signaling interruptions occur during marking signal impulses and originate from the same direction as the signals, they will cause the monitoring printer to print a "bad copy" of the message. The same meter will be deflected by the interruptions as the signals.

When the circuit is momentarily interrupted in the opposite direction to that from which the signals originate, relay 23 releases and the other meter will be deflected so that under this condition both meters will be deflected and the monitoring printer produce a "bad copy" of the message.

Thus by observing the copy of the message printed by the monitoring printer and noting which of the meters gives an indication, it is easy to detect momentary circuit interruptions and to determine the direction from which these non-signaling interruptions originate.

Fig. 2 illustrates a modification of the invention which employs two asymmetrical gas filled tubes 7 and 8 as polarity indicators instead of the two voltmeters, as illustrated in Fig. 1. One tube may be colored, say, red and the other blue to easily distinguish from which direction the signals and the non-signaling interruptions occur. These lamps are connected so that one of them lights when positive battery is connected to both winding terminals of relay 23 and the other when negative battery is connected to both the winding terminals of this relay. A high resistance 9 is also included in series with these lamps to limit the current through them as well as to prevent interference with the telegraph circuit. Thus, this embodiment functions the same as that illustrated in Fig. 1 except that the lights 7 and 8 flash or light instead of the meters deflecting. This arrangement is particularly adapted to detect or indicate very short interruptions. The flashing of the light also attracts the tester's attention more quickly than the deflection of a meter.

Fig. 3 illustrates a typical circuit of four branches with associated jacks, while Fig. 4 illustrates one method of designating these jacks at the teletypewriter testing board to use the invention to the best advantage. Referring now to Fig. 3, B. W. V. F. represents a voice frequency carrier telegraph repeater connected to a telegraph line to station BW. Details of a typical repeater of this kind are disclosed in patent to V. P. Thorp 1,850,145, March 22, 1932. C. N. V. F. represents a similar repeater connected to a telegraph line to station C. N. 11 and 12 represent terminal receiving relays of these repeaters, respectively, and are shown only diagrammatically in order to simplify the drawing. These two repeaters are connected by means of line 25 in a manner similar to that disclosed in patent to J. M. Fell 1,548,873, August 11, 1925 and R. B. Shanck 1,707,997, April 9, 1929. S. U. MET. represents a metallic telegraph line repeater connected to a telegraph line to station S. U. The operation of such a repeater is discussed in a paper "Metallic polar-duplex telegraph system for long small-gage cables" by J. H. Bell, R. B. Shanck and D. E. Branson published in Electrical Communication, vol. 3, No. 4, April, 1925. This repeater is connected through line 26 through the terminal circuit of a bridge polar duplex repeater Q. B. P. Duplex which is connected to a telegraph line which extends to station Q. A discussion of this type of repeater may be found in patent G. S. Vernam 1,735,940, November 19, 1929. A single line repeater 13 such as disclosed by F. S. Kinkead 1,752,436, April 1, 1930 connects these two lines 25 and 26 so that signals originating at any one of the four stations are repeated to the other three stations. Jacks 1, 2, 3 and 4 are inserted in series with each of these terminal circuits to enable the monitoring and testing circuit to be connected thereto.

Now assume that signals originate from station Q and that circuit non-signaling interruptions originate in the line to station S. U. In checking this condition the tester would insert the monitoring plug 19 in jack 1, the printer would indicate non-signaling circuit interruptions by printing "bad copy" and the lamp or meters would indicate the signal transmission from the east and also the non-signaling interruptions from the east since only the east lamp would light or flash. The tester would then insert the plug in jack 2 where there would be more "bad copy" and an indication of transmission and interruptions both from the west. The insertion of the plug in jack 3 would indicate the transmission from the east and the interruptions from the west. This would locate the source of the non-signaling disturbances as in the line to station S. U. In a similar manner the interruptions

in the other lines with transmission of messages from any of the other stations may easily be located.

If it is desirable, four monitoring units may be employed having a unit connected to each one of the four jacks. In this case it would be necessary to equip only one unit with a monitoring printer. The operation of such an arrangement would be similar to that described for one monitoring unit. The tester would, however, have more lamps or indicators to watch but he would be able to locate the branch in which the trouble originates at once without changing any connections. In addition such an arrangement would indicate interruptions or non-signaling disturbances which occur simultaneously in more than one branch of the circuit.

It is to be understood that the above description of the specific embodiments and applications of the invention is not to limit or restrict the scope of this invention in any way since there may be many other embodiments, modifications and applications without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A telegraph system non-signaling disturbance indicator which comprises a monitoring device, a relay connecting said monitoring device to a telegraph system and indicating devices electrically connected to said relay to indicate the direction of signal transmission, and the direction of the origin of non-signaling disturbances.

2. In a half duplex printing telegraph system, a non-signaling disturbance indicating device comprising a monitoring telegraph printer, a line relay which controls said monitoring printer connected to the telegraph system, potential indicating devices connected to said line relay to indicate the directions of signal transmission over said telegraph system.

3. A telegraph monitoring system comprising a monitoring telegraph printing mechanism, a receiving relay controlling said mechanism and meters electrically connected to said relay to indicate the direction of signal transmission and the direction of the origin of non-signal disturbances, and means for preventing said meters from interfering with the operation of said receiving relay.

4. A telegraph disturbance detector comprising a receiving relay, a recording mechanism and polarity indicating devices connected to said relay to indicate the direction of the origin of the disturbance.

5. A telegraph monitoring device comprising a receiving relay, a recording device connected thereto, and polarity indicators electrically connected to said relay to indicate the polarity of signals and non-signal disturbances, and means for preventing said polar indicators from interfering with the operation of said receiving relay.

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