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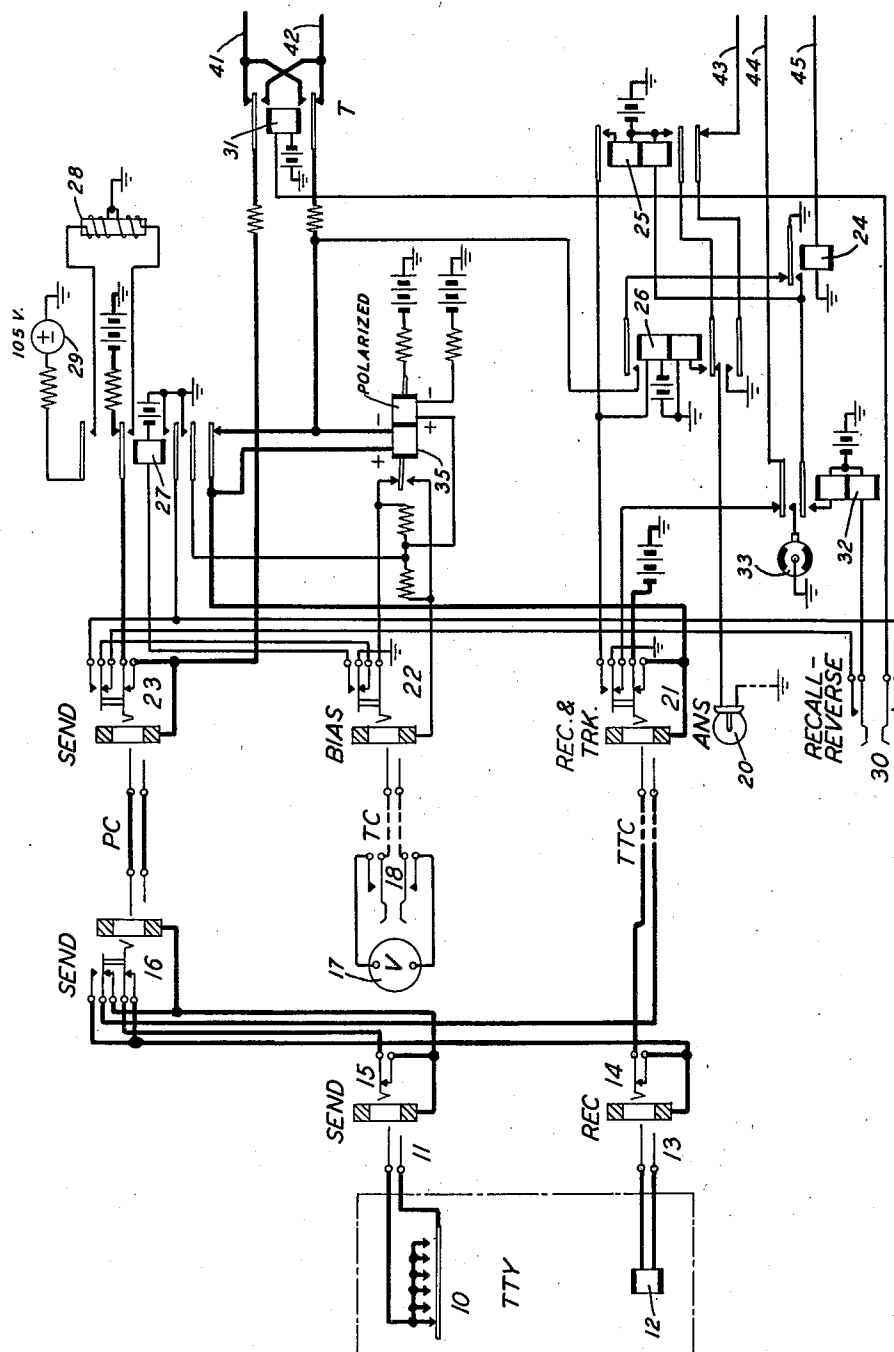
2,106,357

TELEGRAPH SYSTEM

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FIG. 1



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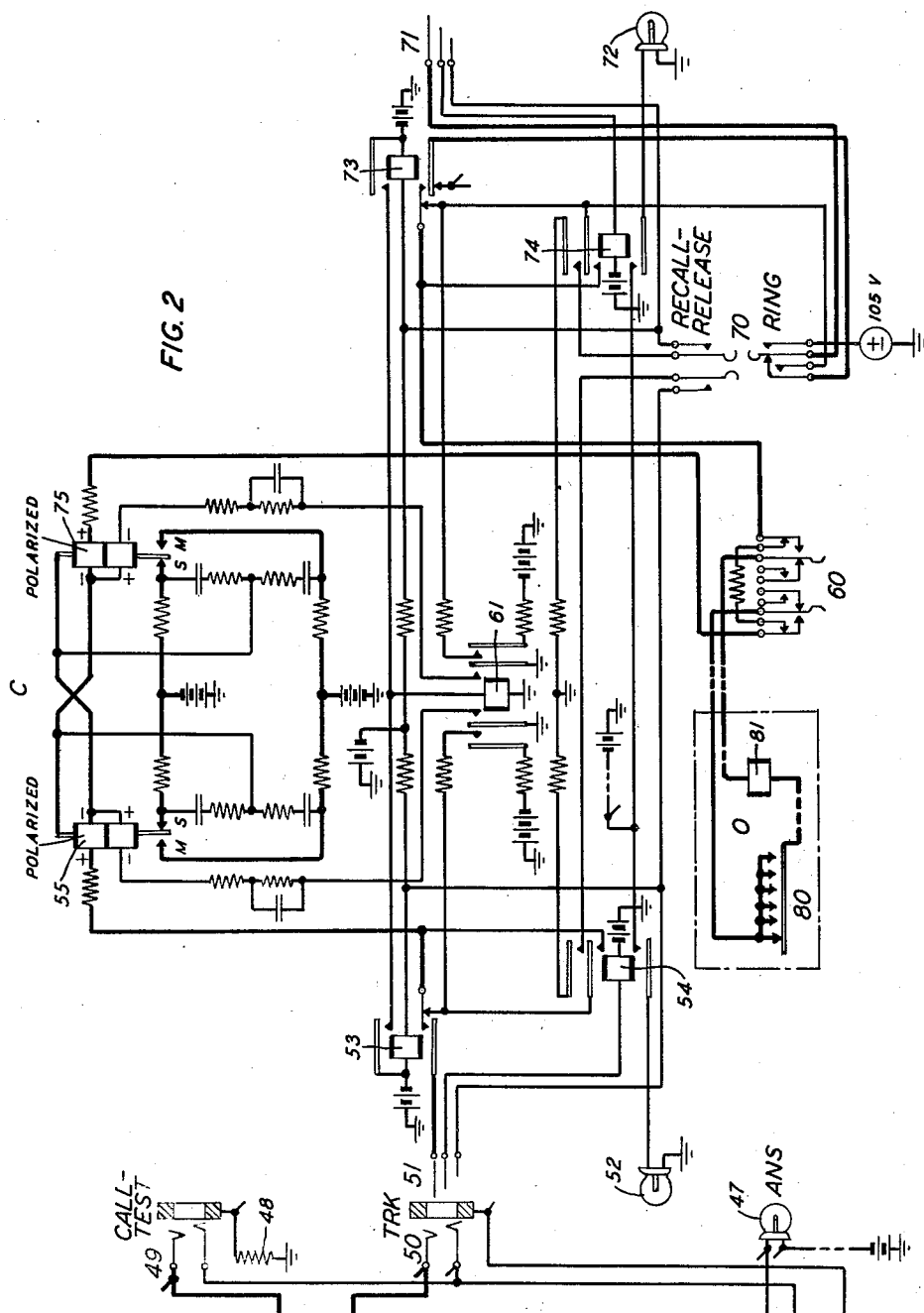
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2 Sheets-Sheet 2



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TELEGRAPH SYSTEM

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10 Claims. (Cl. 178—69)

This invention relates to telegraph systems and particularly to teletypewriter systems and it is the object of the invention to facilitate the testing and maintenance of teletypewriter switchboards.

In telegraph systems comprising a teletypewriter switchboard and a test board, it is known to provide one or more trunks between these boards for communication and to provide testing trunks between these boards. In accordance with this invention a trunk is provided for communicating between a teletypewriter switchboard and a test board and this trunk is arranged for testing the cord circuits at the teletypewriter switchboard.

One feature of the invention is a trunk between a telegraph switchboard and a test board arranged to employ 20-cycle ringing current for testing cord circuits.

These and other features of the invention will be further described by considering a specific embodiment of the invention, one such embodiment being illustrated schematically in the drawings which form a part of this specification. While the switching equipment in the system shown is of the manually operated type, it is, of course, understood that this invention is applicable to systems employing automatic switching equipment.

Referring to the drawings

Fig. 1 shows a test board comprising a two-way trunk circuit T, a test cord TC, a patching cord PC, a teletypewriter cord TTC, a teletypewriter TTY, and teletypewriter jacks REC and send;

Fig. 2 shows a teletypewriter switchboard comprising a cord circuit C, an operator's position circuit O, and the jacks TRK and call-test to which the trunk T of Fig. 1 is connected.

The cord circuit C, which comprises the answering plug 51, calling plug 71, repeating relays 55 and 75, and teletypewriter key 60, is one of a plurality provided at the operator's position O for use in interconnecting subscribers' loops and telegraph lines. In addition to the call-test and TRK jacks 49 and 50 which terminate the trunk T from the test board, answering jacks and multiple jacks are provided for connecting with the subscribers' loops and telegraph lines. The operator's position O comprises sending contacts 80 and a receiving magnet 81. For a complete description of the operation of similar cord circuits in establishing connections between subscribers' loops and telegraph lines, reference may be had to Patent 1,979,273, granted to C. C. Lane et al., November 6, 1934 and to application Serial No.

459,684, filed June 7, 1930 by G. A. Locke et al.

The trunk circuit T comprises sleeve relay 24 and auxiliary relays 25 and 26, an answering lamp 20 associated with the REC and TRK jack 21, a recall-reverse key 30, a reversing relay 31, recall relay 32, a source of 20-cycle ringing current 29, a relay 27 for establishing the circuit connections in the trunk for testing the bias of 20-cycle signals sent to and repeated back from a cord under test, a relay 35 for receiving the bias test signals from the cord, a bias jack 22 for use in connecting the voltmeter of a test cord to the relay 35, and a send jack 23 for use in connecting the signal sending contacts of the teletypewriter or any other sending contacts to the trunk.

To describe the use and operation of the trunk T, assume first that a test man at the test board wishes to communicate with an operator at the switchboard. With the teletypewriter connected by plugs 11 and 13 and jacks 14, 15 and 16 to the teletypewriter cord TTC, the plug of cord TTC is inserted in the REC and TRK jack 21 thereby connecting the sending contacts 10 and receiving magnet 12 in series with the conductor 42 of trunk T. At the upper contact of jack 21, a circuit is closed for energizing the upper winding of relay 26. Relay 26 operates and connects ground through its lowermost front contact and back contact of relay 25 over conductor 43 to the answering lamp 47 at the switchboard. Lamp 47 and the other lamps associated with multiple trunk jacks 50 are lighted. The operation of relay 26 closes a loop circuit through the teletypewriter; this circuit is traced from ground at the back contact of relay 24, through the upper front contact of relay 26, lower back contact of relay 27, sleeve conductors of jack 21 and cord TTC, upper back contact of jack 16, sleeve conductors of jack 15 and plug 11, sending contacts 10, tip conductors of plug 11 and jack 15, lower back contact of jack 16, sleeve conductors of jack 14 and plug 13, receiving magnet 12, tip conductors of plug 13 and jack 14, and through the tip conductors of cord TTC and jack 21 to negative battery. When an operator at the switchboard inserts the answering plug 51 of a cord C in jack 50 to answer the call, a circuit is closed from battery through the winding of relay 53, sleeve conductors of plug 51 and jack 50, over conductor 45, and winding of relay 24 at the test board; and relays 24 and 53 operate. The winding of relay 54 is connected through the ring conductors of plug 51 and jack 50 to conductor 44 of the trunk T but relay 54 does not operate since the middle contact of jack 21 at the test board is

opened when the plug of a cord is inserted in this jack. The operation of relay 24 closes a circuit through the lower winding of relay 25. Relay 25 operates and closes a locking circuit through its upper winding and contact to ground at the upper contact of jack 21. At its lower back contact, relay 25 opens the circuit over conductor 43, thereby extinguishing the answering lamps 47 at the switchboard. At its lower front contact relay 25 closes a circuit through the inner lower front contact of relay 26 for energizing the lower (locking) winding of relay 26. Relay 53 closes a circuit for operating relay 61; and relay 61 connects ground through its inner front contacts to the lower windings of repeating relays 55 and 75. A circuit is thereupon traced from ground at the inner left front contact of relay 61, windings of relay 55 in series, lower front contact of relay 53, tip conductors of plug 51 and jack 50, over trunk conductor 42 to the test board, lower back contacts of relays 31 and 27, sleeve conductors of jack 21 and cord TTC, middle contact of jack 16, sleeve conductors of jack 15 and plug 11, sending contacts 10, tip conductors of plug 11 and jack 15, lower contact of jack 16, sleeve conductors of jack 14 and plug 13, winding of receiving magnet 12, and through the tip conductors of plug 13, jack 14, cord TTC and jack 21 to negative battery. The junction point between the windings of relay 55 may at this time be connected through the spacing contact of relay 75 to negative battery or through the marking contact of relay 75 to positive battery; or the armature of relay 75 may be in mid-position with both contacts open. In any of these three cases the closure of the answering cord loop causes the energization of relay 55 to close its marking contact. The aforementioned operation of relay 61 also connects negative battery through its outer right front contact, inner back contact of relay 73, and through the contacts of teletypewriter key 60 to the line side of the upper winding of relay 75. If the key 60 is operated, the sending contacts 80 and receiving magnet 81 are included in this connection. In either case relay 75 is energized to close its marking contact. The test board operator and answering switchboard operator may now communicate with each other by use of their teletypewriters, the signals being repeated by relays 55 and 75 in usual and well-known manner. If connection is desired with a subscriber's loop or an outgoing telegraph line, the switchboard operator inserts the calling plug 71 in the jack of this loop or line. Relay 73 operates, thereby extending the connection from the upper winding of relay 75 to the tip of the plug 71. The operation of key 70 to its ring position closes a ringing circuit through the tip conductor of plug 71.

If an operator at the switchboard wishes to communicate with a test board operator, the plug 51 or plug 71 is inserted in jack 50; and assuming the plug 51 to be used, relays 53 and 24 operate. Relay 24 closes the circuit for energizing the lower winding of relay 25. The operation of relay 25 closes a circuit for lighting the answering lamp 20. Relay 54 operates, over conductor 44 to ground at the upper contact of jack 21, and closes a circuit for lighting the answering cord supervisory lamp 52. When the test board operator answers the call by inserting the plug of a teletypewriter cord TTC in jack 21, relay 54 releases and relay 26 operates. The release of relay 54 extinguishes lamp 52 and the operation of relay 26 extinguishes lamp 20.

If the test board operator is the first to disconnect, removal of the plug of cord TTC from jack 21 again closes the circuit over conductor 44 for operating relay 54 of the cord C to light the answering cord supervisory lamp 52. When the switchboard operator removes plug 51 from jack 50, relays 53 and 24 release. The release of relay 24 causes the release of relays 25 and 26.

If the switchboard operator is the first to disconnect, removal of the plug 51 from jack 50 causes the release of relays 53 and 24 but relays 25 and 26 are held operated by the ground at the upper contact of jack 21; the release of relay 24 connects ground through its back contact and the upper front contact of relay 26 to the lower back contact of relay 27, thereby maintaining a loop circuit through the teletypewriter at the test board. When the plug of cord TTC is removed from jack 21, relays 25 and 26 release.

Assuming the connection between an operator at the switchboard and an operator at the test board to have been established through cord C and trunk T as hereinbefore described, and a transmission test of cord C being desired, the calling plug 71 is inserted in the call-test jack 49 with plug 51 remaining in jack 50. Relay 73 operates through sleeve resistance 48. At the test board, the send jack 16 is connected by patching cord PC to the send jack 23. The sending contacts 10 of the test board operator's teletypewriter are thereby removed from the signaling circuit over cord TTC and through plug 51 and repeating relay 55; and a sending circuit is traced from negative battery at the upper back contact of relay 27, through the tip conductors of jack 23, cord PC, jacks 16 and 15 and plug 11, through sending contacts 10, sleeve conductors of plug 11, jacks 15 and 16, cord PC and jack 23, upper back contact of relay 31, over conductor 41, tip conductors of jack 49 and plug 71, contact of key 70, lower front contact of relay 73, contacts of key 60 (and through magnet 81 and sending contacts 80, if key 60 is operated) to the line winding of repeating relay 75. Any signals sent by the contacts 10 over the calling cord loop are repeated by relay 75 over the answering cord loop to the receiving magnet 12; in this manner the operation of repeating relay 75 is tested. By operating the recall-reverse key 30, the reversing relay 31 is operated through the lower contact of this key, the upper front contact of jack 23 and the normally closed contact of the bias jack 22. Relay 31 interchanges the connections between conductors 41 and 42 and the jacks 21 and 23 so that signals from contacts 10 are transmitted over conductor 42 in the answering cord loop and are repeated by relay 55 over the calling cord loop to the receiving magnet 12; in this manner the operation of repeating relay 55 is tested.

To make a bias test of the cord repeating relays 55 and 75, the test board operator inserts the plug of a test cord TC in the bias jack 22, and operates the test key 18 thereby connecting the voltmeter 17 to the contacts of relay 35. At the normally open contact of jack 22, a circuit is closed for operating relay 27. With relay 27 operated, the right (biasing) winding of relay 35 is energized and a circuit is closed from the source 29 of 20-cycle ringing current, through the uppermost front contact of relay 27 and upper winding of inductance coil 28 to ground. Polarized signals are thereby induced in the lower winding of inductance coil 28 and transmitted through the inner upper front contact of relay 75

27, lower contact of jack 23, upper back contact of relay 31, over conductor 41 to the calling cord repeating relay 75. These signals are repeated by relay 75 through the answering cord, over conductor 42, through the lower contact of relay 31, left winding of relay 35, to negative battery on the tip conductor of jack 21. The contacts of relay 35 are thereby controlled by the repeated 20-cycle test impulses to alternately reverse the current through the voltmeter 17. The voltmeter directly indicates the per cent bias introduced by relay 75, for instance, a reading of 10 volts indicates 10 per cent bias. By operating the key 30 the impulses are transmitted over conductor 42 to relay 55 and the repeated impulses are received over conductor 41, in which case the voltmeter indicates the bias introduced by repeating relay 55.

To test the recall-release feature of the cord C, the connection is established with answering plug 51 in jack 50 and the plug of the teletypewriter cord TTC in jack 21. The momentary operation of the recall-reverse key 30 closes a circuit through the lower winding of relay 32; and relay 32 locks through its upper winding to ground at the front contact of relay 24. Relay 31 does not operate since there is no plug in either of jacks 22 and 23. At its outer front contact relay 32 connects the interrupter 33 to conductor 44 to alternately operate and release the supervisory relay 54. The supervisory relay 74 is also alternately operated and released if plug 71 is in jack 49. Lamps 52 and 72 are flashed until the switchboard operator momentarily operates the key 70 to its recall-release position. Ground is thereby connected through the uppermost front contact of relay 54 and the left contact of key 70 to the sleeve of jack 50, short-circuiting and thereby releasing relay 24. The release of relay 24 causes the release of relay 32 to end the flashing signal. With plug 71 in jack 50, the operation of key 70 to its recall-release position connects ground through the uppermost contact of relay 74 and the right contact of key 70 to the sleeve of jack 50 to short-circuit and thereby release relay 24.

What is claimed is:

1. In a telegraph system, an operator's position, cords arranged for repeating telegraph signals, a test board, and a trunk interconnecting said position and test board, said trunk being arranged for two-way communication and for testing the cords at said position.

2. In a telegraph system, an operator's position, cords arranged for repeating telegraph signals, a test board, a trunk interconnecting said position and test board, and means at said test board comprising a ringing current generator connected to said trunk for testing the cords at said position.

3. In a telegraph system, subscribers' lines, a switchboard comprising a link for use in completing desired connections, a test board, a trunk interconnecting said switchboard and test board, said trunk being arranged for two-way communication and for testing said link.

4. In a telegraph system comprising a switchboard and a test board, a trunk arranged for two-way communication between said boards, a link at said switchboard for use in completing desired connections, signal repeating means in said link, and means comprising said trunk for testing the signal repeating means of said link.

5. In a telegraph system comprising a switchboard and a test board, a trunk arranged for two-way communication between said boards, a link at said switchboard for use in completing desired connections, signal repeating means in said link, and means comprising an alternating current generator connected to said trunk for testing the signal repeating means of said link.

6. In a telegraph system comprising a switchboard, and a test board, a two-way trunk between said boards, a link at said switchboard for use in completing desired connections, a signal repeating relay in said link, means at said test board for sending signals over said trunk to said link and for receiving the repeated signals over said trunk from said link, and a voltmeter connected to said signal receiving means for indicating the bias introduced by said signal repeating relay.

7. In a telegraph system comprising a switchboard and a test board, a two-way trunk between said boards, a link at said switchboard for use in completing desired connections, supervisory signal means in said link adapted for intermittent operation as a recall signal, means in said trunk for causing the intermittent operation of said supervisory signal means, and recall-signal release means for said link.

8. In a telegraph system according to claim 7, means in said trunk responsive to the operation of said recall-signal release means for rendering ineffective said means for causing the intermittent operation of said supervisory signal means.

9. In a telegraph system comprising a switchboard and a test board, a trunk arranged for two-way communication between said boards, a teletypewriter at said test board comprising sending contacts and a receiving magnet, means comprising jacks for connecting said sending contacts and said magnet in series with one of the conductors of said trunk for half-duplex signaling over the trunk, and means comprising said jacks for connecting the receiving magnet in series with said one of the conductors of the trunk and for connecting the sending contacts in series with another of the conductors of said trunk for full duplex signaling over the trunk.

10. In a telegraph system comprising subscribers' stations, a switchboard and a testboard, a trunk between said boards for use in communicating between said boards, links at said switchboard for use in connecting subscribers' stations, each of said links comprising repeating relays for repeating signals between interconnected stations, and means comprising said trunk for testing the operation of the signal repeating relays of any of said links.

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