

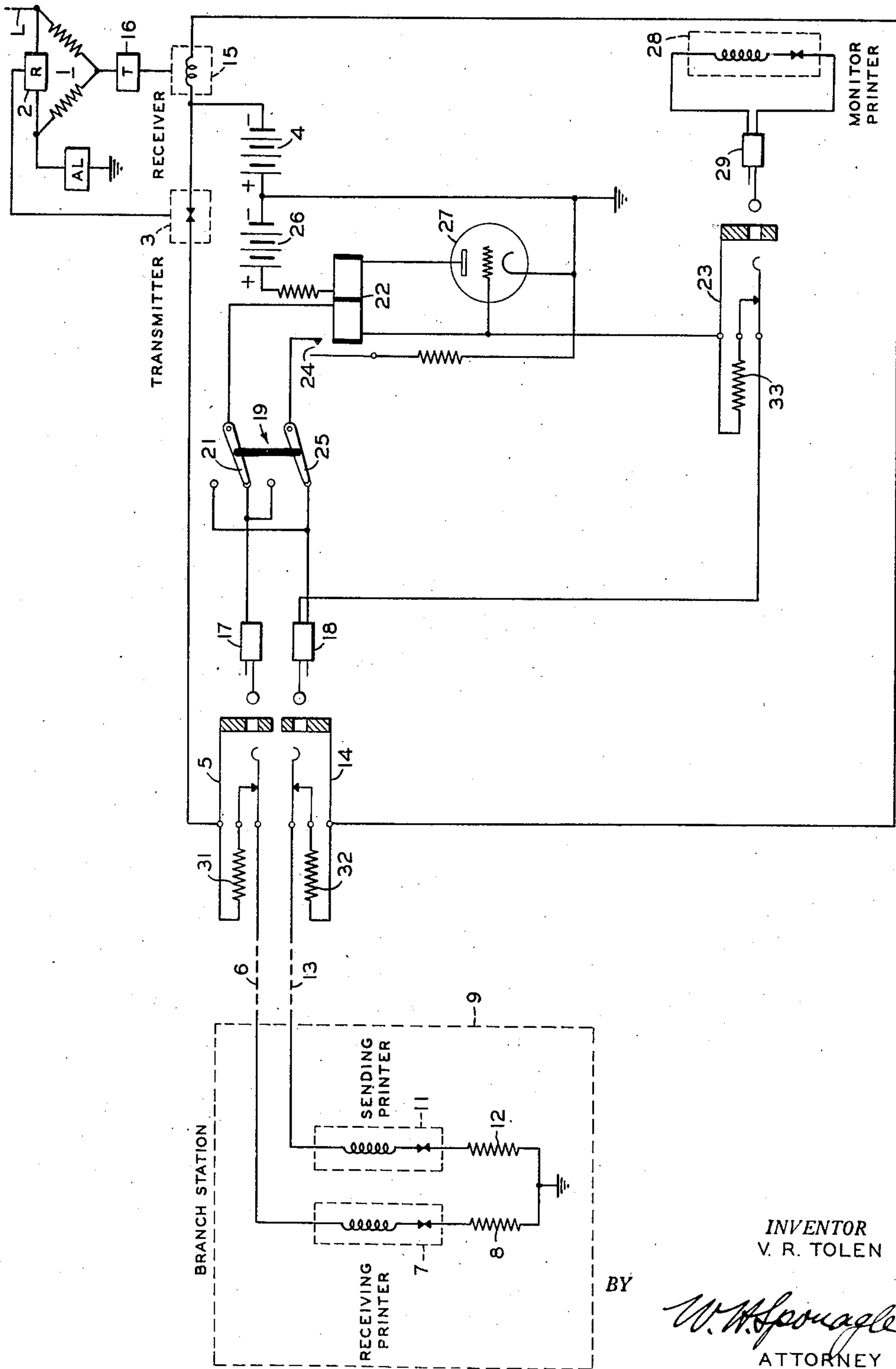
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TELEGRAPH REPEATER

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TELEGRAPH REPEATER

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This invention relates to telegraph systems and has particular reference to telegraph signal repeaters of the half duplex type.

It is customary where a line circuit is operated on a full duplex basis to provide at the terminals of the circuit individual receiving and sending legs. Either or both of these legs may be extended by individual extension lines to a branch station. Independent signaling may be effected simultaneously over the main line circuit and the receiving and sending legs in accordance with well known principles. It may be necessary to combine the legs in some manner because of some failure of one of the extension lines or of the apparatus associated therewith in order to provide temporary receiving and transmitting facilities to a branch station connected to the sending and receiving legs. In such a case both sending and receiving signals may be transmitted over the combined leg but such operations cannot of necessity be simultaneous. The effect upon the main line circuit is that the signaling is on what is known as a half duplex basis.

It is one of the objects of the instant invention to provide an improved, simple, compact and preferably portable apparatus whereby the sending and receiving legs of a system normally operated on a full duplex basis may be combined to enable the system to be operated on a half duplex basis.

Another object of the invention is to provide a novel half duplex telegraph signal repeater.

A further object of the invention is to provide a half duplex telegraph signal repeater in which novel potential responsive means are employed to prevent signals received from a main line circuit from being reflected back into that circuit.

Still another object of the invention is to provide, in a half duplex telegraph signal repeater, signal reflection prevention means which are controlled by the potentials in the combined receiving and sending leg rather than by the signaling currents flowing therein.

These and other objects of the invention are attained in the embodiment chosen for illustration and will become apparent from the following description which is taken in conjunction with the single figure of the accompanying drawing.

The main line circuit L which normally is operated on a full duplex basis is terminated in the conventional duplex bridge 1. Signals received over the main line circuit operate a re-

ceiving device 2 by means of which a transmitting element 3 is controlled. The transmitter 3 is connected in the receiving leg which comprises a series circuit including a grounded negative battery 4, the sleeve, tip and normal contacting elements of a jack 5, extension line 6, the receiving and transmitting elements of a combined transmitter-receiver 7, and resistance 8 to ground. The combination transmitter-receiver 7, which for normal operation is used for receiving, may be located at a branch station 9 which also includes a second combination transmitter-receiver 11. The combination transmitter-receiver 11 is normally used for sending from the branch station and is connected in the sending leg which comprises a series circuit extending from ground at the branch station through resistance 12, the transmitting and receiving elements of the combination transmitter-receiver 11, extension line 13, the tip, sleeve and normal contacting elements of a jack 14, a signal receiver 15 and grounded negative battery 4. The signal receiver 15 controls a transmitting device 16 by means of which signals are transmitted over the main line L.

Such an arrangement is customarily utilized for full duplex operation of a main line telegraph circuit and independent signaling may be effected simultaneously over both the receiving and sending legs extending to the branch office 9. In the event that a circuit failure of one of the extension lines occurs, either because of a fault in the line wire itself or because of the failure of the printing equipment located at the branch station, the branch station is deprived of either sending or receiving facilities depending upon which leg fails. The present invention enables such a branch station to be furnished temporarily with both sending and receiving facilities.

Assume that when a failure of such a character occurs, the normal receiving leg utilizing extension line 6 is incapacitated. Plugs 17 and 18, in which are terminated the leg combining facilities in accordance with the present invention, are inserted respectively in jacks 5 and 14. The blades of a switch 19 are placed in engagement with their lower contacts are shown. Such an arrangement permits the use of the extension line 13 and the combined transmitter-receiver 11 at the branch station 9 to be used both as a sending and as a receiving leg, but of course such uses are not simultaneous.

In this case the combined receiving and sending leg extends from grounded negative battery

4 through the transmitting device 3, the respective sleeve elements of jack 5 and plug 17, the lower contact and blade 21 of switch 19, the left hand or operating winding of a repeating relay 22, the sleeve, tip and normal contacting elements of a monitor jack 23, the respective tip elements of plug 18 and jack 14, extension line 13, the receiving and transmitting elements of the combined transmitter-receiver 11, and resistance 12 to ground. It is seen that the transmitting elements of the combined transmitter-receiver 11 and the transmitting device 3 thus are connected in series with the receiving element of the combined transmitter-receiver 11 and with one winding of the repeating relay 22. The contacts 24 of the repeating relay are connected in a local circuit extending from ground through the blade 25 and lower contact of switch 19, the respective sleeve elements of the plug 18 and the jack 14, the signal receiving device 15, and grounded negative battery 4. Consequently, the receiving device 15 is controlled by the contacts 24 of the repeating relay 22 to actuate the transmitter 16 whereby signals are transmitted over the main line L.

In order to prevent the signals which are received from the main line circuit L from being retransmitted back over the main line circuit, it is necessary to prevent the contacts 24 of the repeating relay 22 from repeating the signals which are applied to its left hand winding by the transmitting device 3. For this purpose the repeating relay is provided with a right hand or locking winding which is connected in series with a battery 26 and the space discharge path of a vacuum tube 27. The control grid of the tube 27 is connected to a point on the combined sending and receiving leg circuit which is located between the transmitting device 3 and the transmitting element of the combination transmitter-receiver 11 at the branch station 9. The impedances on either side of this point are arranged so that with both transmitters in marking or closed positions, the potential of the grid element is sufficiently negative with respect to the grounded cathode to bias the tube beyond the point of cutoff and to thereby render the tube non-conducting.

Assume that transmission is taking place at the branch station and the signals are to be repeated into the main line circuit L. As the combined receiving and sending leg circuit is opened and closed for the transmission of spacing and marking signals respectively, the left hand or operating winding of the repeating relay 22 is deenergized and energized. With each opening of the branch station transmitter, ground is disconnected from the combined receiving and sending leg which interrupts the flow of current in this circuit and places the control grid of the vacuum tube 27 at the full negative potential of the battery 4. The tube is thus biased still further beyond the cutoff point and is maintained non-conducting. Consequently, the right hand or locking winding of the repeating relay 22 is not energized and, in response to the deenergization of the left hand winding, the contacts 24 open to repeat the spacing signal to the receiving device 15 whereby the transmitter 16 may be controlled to repeat the signal over the main line circuit L.

When the transmitting device 3 operates in response to a spacing signal received from the main line L to open its contacts, the left hand or operating winding of the repeating relay 22 is again deenergized. In this case, however, the opening of the contacts of the transmitting device 3 disconnects negative potential from the com-

bined receiving and sending leg, leaving the control grid of the tube 27 at the ground potential derived from the branch station 9. With both the grid and the cathode elements of the tube 27 at ground potential, the tube becomes conducting to energize the right hand or locking winding of the repeating relay 22 and to thereby prevent the opening of the contacts 24. Thus, it is seen that the spacing signal received from the main line circuit L is not reflected back into the main line since the receiving device 15 is maintained in a marking condition under the control of the contacts 24 of the repeating relay 22 to control the transmitter 16 in a manner to apply a steady marking signaling condition to the main line L.

In the event that it is desired to temporarily use the extension line 6 and the combination transmitter-receiver 7 at station 9 in a combined sending and receiving leg, the plug 18 is inserted in jack 5 and plug 17 is inserted in jack 14. The blades 21 and 25 of switch 19 are moved into engagement with their upper contacts. It will be seen then that there is established a series circuit including grounded negative battery 4, the transmitting device 3, the respective sleeve elements of jack 5 and plug 18, upper contact and switch blade 21 of the switch 19, the left hand or operating winding of the relay 22, the monitor jack 23, the respective tip elements of plug 18 and jack 5, the extension line 6, the combination transmitter-receiver 7, and resistance 8 to ground. The contacts 24 of relay 22 control the local circuit extending from ground through the switch blade 25 and its upper contact, the respective sleeve elements of plug 17 and jack 14, the receiving device 15 and grounded negative battery 4.

The operation of the system is the same as that previously described. Signals transmitted by the transmitting element of the combination transmitter-receiver 7 are repeated by relay 22 to actuate the receiving device 15 whereby the transmitter 16 is controlled to further repeat the signals to the main line L. Signals sent by the transmitting device 3 are received by the receiving element of the combination transmitter-receiver 7 and are prevented, by the operations of the vacuum tube 27, from actuating the repeating relay 22 whereby the receiving device 15 is not operated to control the retransmission of such signals to the main line L.

When the system is arranged for normal full duplex operation, a monitor printer 28 comprising transmitting and receiving elements may be connected in either the sending or receiving leg by the insertion of a plug 29 into jack 14 or 5, respectively.

The receiving and sending legs are normally connected through contacts of jacks 5 and 14, respectively, and include the respective resistances 31 and 32. Such resistances are proportioned to balance the resistance of either the monitor printer 28 or the leg combining apparatus depending upon which is plugged into the jacks so that at all times the current flowing in the receiving and sending legs is substantially the same. The monitor jack 23, into which the plug 29 is inserted for monitoring purposes when the apparatus is arranged to combine the receiving and sending legs, is also provided with a similar resistance 33 for substantially the same purpose.

The nature of the invention may be ascertained from the foregoing description of an illustrative embodiment thereof, it being understood

that other modifications incorporating the same inventive idea may be made within the scope of what is claimed without departing from the spirit of the invention.

What is claimed is:

1. In a telegraph system, a line circuit, a repeating device to control signal transmission to said line circuit, means for relaying signals received from said line circuit, a signal transmitter, means for connecting said signal relaying means and said transmitter to similarly influence said repeating device, and potential actuated means associated with said signal relaying means and said transmitter and operable only in response to operation of said signal relaying means to render said repeating device responsive to said transmitter and unresponsive to said signal relaying means whereby signals received from said line circuit are not retransmitted to said line circuit.

2. In a half duplex telegraph signal repeater, a repeating device operable to control signal transmission to a line circuit and having an operating circuit and a locking circuit, two transmitting devices, one controlled by signal reception from said line circuit and both connected to similarly condition said operating circuit, and means actuated by potentials in said operating circuit resulting from operation of said line signal controlled transmitter to operatively condition said locking circuit whereby said repeating device is rendered inoperative.

3. In a half duplex telegraph signal repeater, a first transmitter controlled by received line signals, a local receiving device for cooperation with said first transmitter, a local transmitter, a second receiving device for cooperation with said local transmitter to transmit line signals, means for connecting said transmitters and said receiving devices in a local circuit, means responsive to potentials in a part of said local circuit between said transmitters, and means controlled by said voltage responsive means for preventing the repetition by said second receiving device of signals originating at said first transmitter.

4. In a half duplex telegraph signal repeater, a combined sending and receiving leg comprising the series connection of a first transmitter responsive to signals received from a main line circuit, a local transmitter, a local receiving device responsive to either of said transmitters, a second receiving device to control the transmission of signals over said main line, and means including a potential responsive device connected to said combined sending and receiving leg and

operable by said first transmitter but not by said local transmitter for rendering said second receiving device unresponsive to said first transmitter.

5. In a half duplex telegraph signal repeater, a combined sending and receiving leg comprising a series connection of a grounded source of direct current, a first transmitter responsive to signals received from a main line, a repeating device to control the transmission of signals over said main line, a local receiving device and a local transmitter, said local receiving device being responsive to both of said transmitters, and voltage controlled means connected to said combined sending and receiving leg at a point between said transmitters and operable in response to operations of said first transmitter to prevent said repeating device from relaying signals originating at said first transmitter.

6. In a half duplex telegraph signal repeater, a local circuit comprising two transmitters, a receiver and a repeating relay connected in series and having one terminal thereof connected to a grounded source of direct current and the other terminal to ground, and a vacuum tube having its control element connected to said local circuit at a point between said transmitters and its output circuit connected in series with a locking winding of said repeating device whereby said repeating device responds to one of said transmitters but not the other.

7. In a telegraph system, a substation having a combination transmitter-receiver normally used for sending and another combination transmitter-receiver normally used for receiving, a central station having a transmitter and a receiver, a sending line normally connecting said sending transmitter-receiver with said receiver, a receiving line normally connecting said receiving transmitter-receiver with said transmitter, a relay at said central station having an operating coil, a locking coil and contacts controlled by either of said coils, means for connecting said operating coil in circuit with one of said lines and with said transmitter, means for connecting said receiver to respond to the control of said contacts, and means subject to line potentials and operable in response to operations of said transmitter but not in response to operations of the transmitter of the combination transmitter-receiver associated with the line having in circuit said operating coil to energize said locking coil whereby said relay is prevented from repeating the signals originating at said transmitter.

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