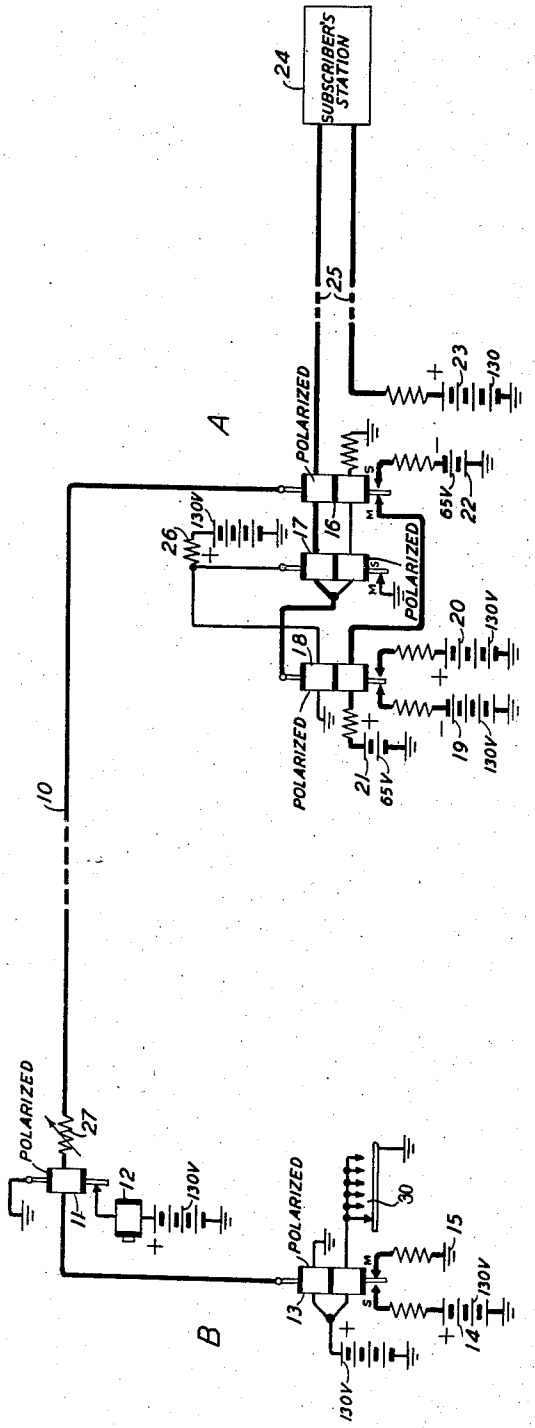
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TELEGRAPH SYSTEM

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TELEGRAPH SYSTEM

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This invention relates to a telegraph system, and more particularly to a system for transmitting telegraph signal pulses over a long telegraph line or channel of a composite toll line to an outlying telegraph station.

An object of this invention is to provide improved telegraph circuits and arrangements which require less adjustment and maintenance at the outlying station.

Another object of this invention is to provide a telegraph system which requires no changes in the adjustments of the apparatus at the outlying station with changes in the leakage resistance of the line due to weather changes.

Still another object of this invention relates to a telegraph system in which the polarized receiving relays are provided at each end of the line. These receiving relays do not require any mechanical or electrical bias under normal or dry weather conditions.

These and other objects and features of the invention can be more readily understood from the following description when read with reference to the attached drawing in which is shown a schematic diagram of the circuit arrangements at the outlying and central stations of a preferred embodiment of this invention.

In the drawing, A represents the apparatus and circuit arrangements at the central station to which a local subscribers' station 24 is connected by line or loop 25. The outlying subscribers' station circuit is shown at B. Stations A and B are connected together by the telegraph line or channel 10. This telegraph channel may be an ordinary so-called direct current or low frequency telegraph line. It may also be a telegraph leg of a composite toll line, and include the usual terminal and intermediate composite sets. Line 10 may also be either an open wire line or a cable circuit, or a portion of it may include open wire lines and other portions cable conductors.

The usual noise suppression filter units may also be included. These noise suppression units have not been shown because they operate in their usual and normal manner which is well understood so that further description of them would only needlessly complicate the description and tend to obscure this invention.

At the outlying station B, the receiving polarized relay 11 is connected directly in series with line 10. The line circuit is then connected to the armature of the sending polarized relay 13 which normally connects the line to ground 15 through its marking contact. Polarized relay 11 operates receiving device 12. Receiving device 12 may be of any suitable type, as for example a telegraph sounder or printing magnet of a teletypewriter.

The transmitting relay 13 is controlled from the contacts 30 of the transmitting device at the outlying station B. Transmitting device 30 may be of any suitable type, as for example a telegraph key, contacts of a tape transmitter or of a teletypewriter keyboard. The current flowing through the upper or biasing winding of the transmitting relay 13 is in such a direction as to tend to move the armature to the spacing contact. The current flowing through the lower winding of sending relay 13 when the transmitting contacts 30 are closed, tends to move the armature of relay 13 to its marking contact. This current flowing through the lower winding of sending relay 13 causes a magnetic effect upon the relay armature which overcomes the magnetic effect of the upper biasing winding. In the preferred embodiment both windings of relay 13 are the same while the current through the lower winding when contacts 30 are closed is twice the current flowing through the upper winding. This causes the relay to move to and remain upon its marking contact so long as transmitting contacts 30 remain closed. However, when contacts 30 are open in accordance with the signal pulses to be transmitted, the current flowing through the lower winding of the sending relay 13 falls to zero at which time the current flowing through the upper or biasing winding causes the armature to move to its spacing position and connect the postive 130-volt battery to the line circuit. Thus, the sending relay 13 connects ground and positive 130 volts to line 10 through the winding of receiving relay 11 in accordance with the signal pulses transmitted from station B.

At station A, line 10 is connected to the armature of polarized relay 16. Positive 65 volts is connected to the marking contact of relay 16 through the lower winding of the polarized receiving relay 18. Negative 65 volts is connected to the spacing contact of relay 16. Receiving relay 18 is provided with an upper winding which is normally short-circuited by break relay 17. Relays 16, 17 and 18 are shown connected to a local subscriber's line circuit.

It is to be understood that they may comprise relays of any suitable line circuit or repeater, including carrier current repeaters, duplex repeaters or single line repeaters. As shown, receiving relay 18 retransmits signals received from line 10 to the subscribers' station 24 over line 25 in a manner well understood in the prior art and need

not be described herein. In addition, polarized relay 16 repeats the signal impulses received from subscribers' station 24 in the usual manner so that this also need not be described in detail. However, the break relay 17 provides a circuit for controlling the locking of upper winding of relay 18. When the attendant at the subscribers' station 24 transmits a break signal during the time signal station 24 transmits a spacing signal it will cause the sending relay 16 and the break relay 17 to move to their spacing positions if the armature of relay 18 is in its marking position. When break relay 17 leaves its marking contact it removes a short circuit from the upper or locking winding of the receiving relay 18, which causes current to flow through the locking winding of relay 18. This current is in such a direction as to maintain this relay on its marking contact. This insures the proper transmission of the spacing signal to the lines 10 by preventing the armature of relay 16 from leaving the spacing contact. Relay 17 also functions in the above manner during long spacing or break signals transmitted from station 24 and insures the proper transmission of these signals to line 10 independently of any impulses which may be transmitted from station B over line 10. This insures the reception of the break signal at station B.

During the time signal pulses are being transmitted from subscribers' station 24, positive and negative potentials of 65 volts are connected to line 10 by the sending relay 16 in accordance with the pulses transmitted. During this time the transmitting contacts 30 at station B normally remain closed so that the line circuit 10 is normally connected to ground 15. Under these conditions, positive and negative potentials connected to line 10 by relay 16 at station A cause positive and negative currents to flow over line 10 and through relay 11 to ground 15 at station B. Since the positive and negative potentials connected to line 10 at station A are substantially equal and opposite, they will cause substantially equal and opposite currents to flow in line 10. These currents operate receiving polarized relay 11 equally in both directions, in the absence of any bias, as shown and described. In addition any leakage current will affect both the positive and negative current received by relay 11 at station B in substantially the same manner so that the adjustment of this relay need not be altered to compensate for changes in the leakage resistance of the line. Thus, the bias of the signals received at station B is substantially independent of any leakage resistance of the line.

The term "bias" as applied to the received signals indicates a lengthening of one signal impulse and the shortening of another signal impulse; for example, marking bias means that the marking signal impulses are lengthened while the spacing signal impulses are correspondingly shortened, whereas spacing bias means that the spacing signal impulses are lengthened and the marking signal impulses are correspondingly shortened. Thus the greater the bias of the signals, the less satisfactory they are for operating telegraph apparatus and relays, while the less bias, the better the quality of the signal impulses.

The common cause of this lengthening and shortening of the various signals is that marking and spacing currents are unequal; for example, for marking bias, the marking current is greater than the spacing whereas for spacing bias, the spacing current is greater than the marking current. These unequal currents cause the receiving relay to respond differently to the two conditions and thus add bias to the signal pulses. However, as pointed out above, the receiving relay 11 at station B receives substantially equal positive and negative currents representing the marking and spacing signaling conditions independently of the line leakage. Consequently, the receiving relay 11 does not introduce any bias in the received signals and does not require any changes in the adjustment of the relay to compensate for changes of the line leakage.

The terms "marking" and "spacing" as used in this specification differentiate two line or signaling conditions transmitted between the telegraph stations. The term "marking" is used to designate the line or signaling condition employed during the time no signal impulses are being transmitted, but the system is energized ready to transmit signal impulses. The term "spacing" designates the other signal or line condition.

When a spacing impulse is transmitted from station B the armature of the sending relay 13 at station B connects a potential of positive 130 volts to line 10. At this time the sending relay 16 at station A is normally maintained on its marking contact so that positive 65 volts is connected to line 10 at station A. 130-volt positive potential connected to line 10 at station B is substantially twice as great as the 65-volt positive potential connected to the line at station A, and consequently causes substantially equal but opposite current to flow over line 10. This current is substantially the same as flows over line 10 during the time the armature of the sending relay 13 at station B is in its marking position and the armature of relay 16 at station A is in its spacing position. This reversed current causes the armature of the receiving relay 11 at station B to move to its spacing position, and thus repeat the transmitted signals to the receiving device 12 to record a home copy. Since during the time signals are being transmitted from station B, the sending relay 16 at station A is maintained on its marking contact, the receiving relay 18 at station A will follow the current reversals transmitted over line 10 and repeat the signal impulses to subscribers' station 24 over line 25.

As pointed out above, with the potential connected to the spacing contact of relay 13 at station B substantially twice the potential connected to the marking contact of relay 16 at station A, the marking and spacing currents flowing in line 10 during the transmission of signal impulses from station B will be substantially equal in magnitude but opposite in polarity. Consequently, no mechanical or electrical bias is required for the receiving relay 18 at station A under this condition.

The foregoing description describes one specific embodiment of this invention, the scope of which is set forth in the following claims.

What is claimed is:

1. In a telegraph system, a line, a polarized relay associated with each of the ends of said line and responsive to reversals of current thereover, a transmitting device associated with each end of said line, each device having a spacing and a marking contact, a first source of current of one polarity and one potential associated with the spacing contact of the first of said devices, a second source of current of opposite polarity and different potential associated with the spacing contact of the second of said devices, a third source of current equal in potential, but opposite in polarity to said first source associated with

the marking contact of said first device through the operating winding of the relay with which said device is associated, and a source of ground potential associated with the marking contact of said second device, the relative potentials of said sources being such that the flow of current in each direction over said line is substantially equal when the marking contact of either device is held closed and the other device is operated to close either its spacing or marking contact.

2. In a telegraph system, a line, a polarized relay associated with each of the ends of said line and responsive to reversals of current thereover, a transmitting device associated with each of said relays, each device having a spacing and a marking contact, sources of current of equal potential and of opposite polarities associated with the spacing and marking contacts of one of said devices, one of said sources being associated with one of said contacts through the operating winding of the relay with which said device is associated, a source of current of different potential associated with the spacing contact of the other of said devices, and a source of ground potential associated with the marking contact of said other of said devices.

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