

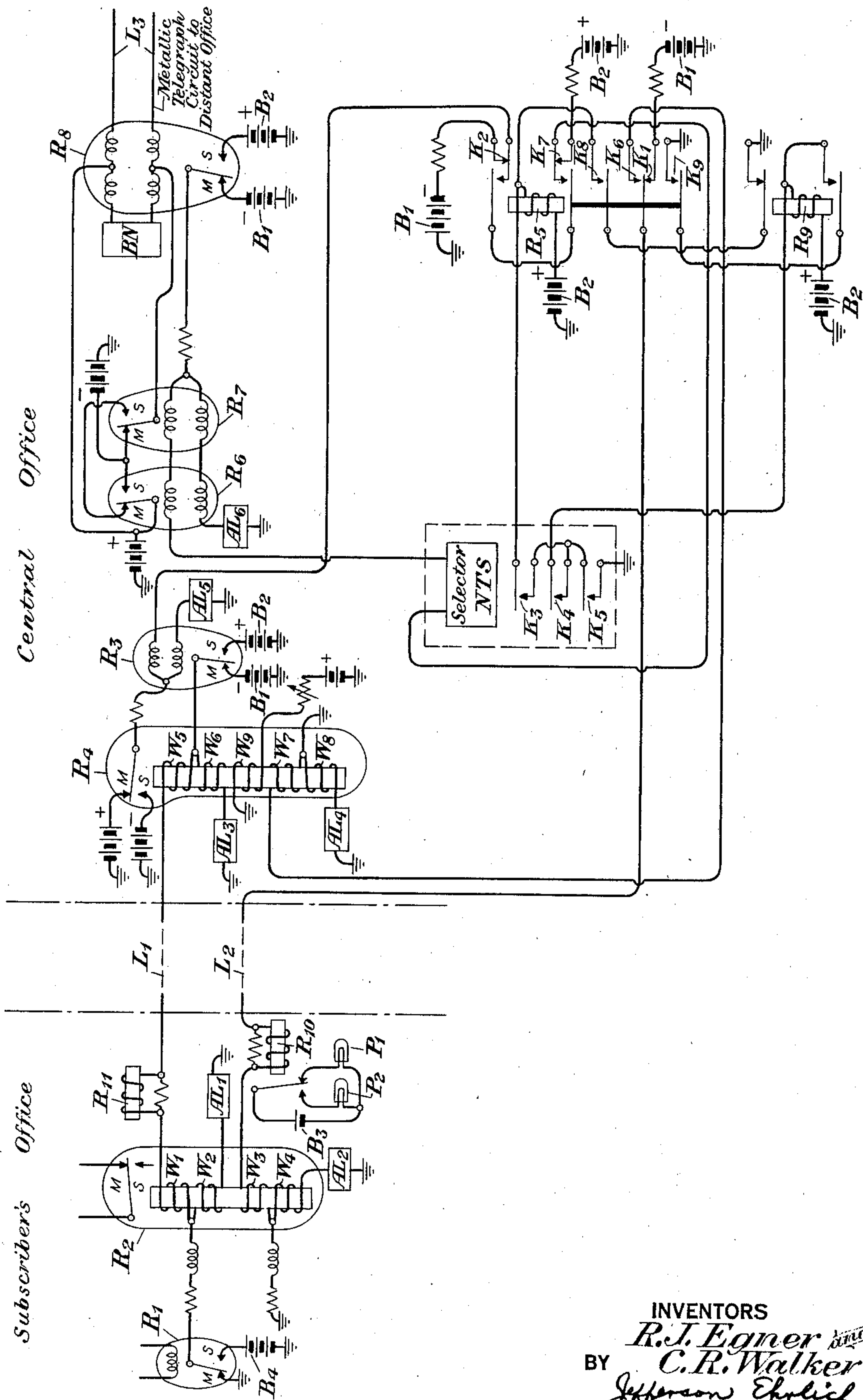
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SIGNALING ARRANGEMENT FOR TELEGRAPH SYSTEMS

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SIGNALING ARRANGEMENT FOR
TELEGRAPH SYSTEMS

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This invention relates to telegraph and teletypewriter systems. More particularly, this invention relates to telegraph and teletypewriter systems in which a subscriber connected to the system may be notified this his circuit has been switched into the system so that he may transmit signals thereover.

In telegraph systems where the subscriber's station is connected to a central office or central switching point by a line circuit which may be of the open-wire type, voltages induced from power sources and other extraneous sources may become so large as to interfere with signaling over the line circuit. In order to overcome such interference, a separate circuit or conductor, known as a neutralizing circuit or conductor, may be added to the system for the purpose of neutralizing such interfering voltages. In cases where it is desired to notify any particular subscriber that he is connected to another distant subscriber through the central office or switching point and to keep the subscriber notified continuously that he is so connected, it has heretofore been necessary to provide still a third circuit or conductor over which such auxiliary signals may be transmitted without in any way interfering with signaling over the line circuit. The addition of this third conductor or circuit is, of course, costly and would add to the maintenance.

According to the present invention it is proposed to obviate the requirement for any such third conductor or circuit by utilizing the neutralizing conductor for auxiliary signaling to the subscriber, thereby indicating to the subscriber than he has or has not been connected to the system and that his signals are or are not being received over the system.

Another object of this invention is to connect a subscriber's station to a central office or other switching point by two conductors, (1) a line conductor over which signals may be transmitted and (2) a neutralizing conductor running parallel thereto to substantially reduce the effect of extraneous voltages, and to employ the neutralizing conductor for auxiliary signaling to the subscriber's station.

These and other objects of this invention will be better understood from the detailed description hereinafter following, when read in connection with the accompanying drawing showing one embodiment of the invention merely for the purpose of illustration.

Referring to the drawing, there is shown a subscriber's office at the extreme left at which there is located a sending relay R_1 and a receiving

relay R_2 . The receiving relay R_2 includes four windings W_1 , W_2 , W_3 and W_4 , which are all approximately of the same number of turns. The winding W_1 is connected between the armature of the sending relay R_1 and the line circuit or conductor L_1 —which may be an open wire line of well-known type—extending between the subscriber's office and a central office or switching point. The winding W_2 is connected between the lower terminal of the winding W_1 and the grounded artificial line AL_1 , the artificial line AL_1 being employed in a well-known manner to balance the main line conductor or circuit L_1 . A neutralizing conductor or circuit L_2 is connected to the winding W_3 of the receiving relay R_2 while the artificial line AL_2 is similarly connected through the winding W_4 of relay R_2 to the lower terminal of its winding W_3 . The artificial line AL_2 is similar to the artificial line AL_1 and is employed to ensure that the neutralizing path has the same impedance as the transmission path.

At the central office the line circuit L_1 is connected to the armature of a relay R_3 through the winding W_5 of a relay R_4 . The artificial line AL_3 is connected to the winding W_6 of relay R_4 for the purpose of balancing the line L_1 at the central office. The relay R_4 also includes windings W_7 and W_8 which are similar to windings W_5 and W_6 , respectively, and a biasing winding W_9 .

In the idle condition of the system the neutralizing wire L_2 is connected to the battery B_1 at the central office by a circuit extending through the contact K_1 of the relay R_5 . This neutralizing wire is associated with a balancing network AL_4 which is similar to network AL_3 at the central office to keep the impedance of the neutralizing path equal to that of the transmission path. In the idle condition of the system, also, the upper winding of the relay R_3 is connected to the battery B_1 through the make-before-break contacts K_2 associated with the upper armature of relay R_5 . But during signaling over the system, the relay R_5 is operated and therefore the upper winding of the relay R_3 is connected to the upper windings of relays R_6 and R_7 over a circuit which includes the upper armature and make contact of relay R_5 , the innermost lower armature and make contact of relay R_5 and the operating circuit of selector NTS. The lower winding of the relay R_3 is connected to an artificial line AL_5 for balancing purposes.

The selector NTS may be, for example, a non-typing teletypewriter or selector of well-known construction. In response to a teletypewriter character such as "Figures" it will close its con-

tact K₅, then in response to a subsequent teletypewriter character such as upper case "B," it will close its contact K₃ momentarily, and later, in response to a third teletypewriter character such as upper case "D," it will likewise close its contact K₄ momentarily.

The lower windings of the relays R₆ and R₇ are also connected to an artificial line AL₆. The apex of the upper and lower windings of relay R₇ is connected to the armature of the relay R₈. The midpoint of the upper winding of relay R₈ is connected to the armature of relay R₆ while the midpoint of the lower winding of relay R₈ is connected to the armature of the relay R₇. The two windings of relay R₈ are connected to a metallic telegraph line or circuit L₃ which may extend to any one of several distant subscribers or offices (not shown), the line L₃ being balanced by a network BN. The selector NTS, when closing its contacts K₅ in response to the receipt from line L₃ of the teletypewriter character "Figures" will remain closed thereafter until the receipt of a "Letters" signal as hereinafter described. The receipt of the teletypewriter character "B" from line L₃ will close the contact K₃ for the purpose of operating the relay R₅, as will be pointed out hereinafter. The closure of the contacts K₄ in response to the teletypewriter character "D" will operate the relay R₉, as will be described hereinafter. The operations of relays R₅ and R₉ will therefore be controlled by contacts K₃ and K₄ of selector NTS but the ground for the operating circuits of these relays will be obtained through the contact K₅ of the selector. The subsequent receipt of the teletypewriter character "Letters" from line L₃ will restore the selector NTS to its normal position, thereby opening the contact K₅. The closing of the contacts K₃ or K₄ will be ineffective unless the appropriate signal has previously been received to close the selector contact K₅.

One of the features of the arrangement of this invention is the inclusion at the subscriber's office of the relay R₁₀ in series with the neutralizing conductor L₂. A lamp and battery may be connected in series with the armature and either the front or back contact of relay R₁₀ so that the lamp will be lighted either when the relay R₁₀ is energized or when it is deenergized as desired. If desired two lamps P₁ and P₂ which may be of different colors may be provided as shown in the drawing, one lamp P₁ being connected to the front contact and the other P₂ connected to the back contact of relay R₁₀. To obtain a balanced condition in the line and neutralizing conductors L₁ and L₂ a similar relay arrangement R₁₁ or an equivalent network, is positioned in series with the line conductor L₁. The latter device, however, need not be a relay but may be any type of network which has the same impedance characteristics as the relay R₁₀.

As will be explained hereinafter the system is so arranged that when the subscriber's office is connected through at the central office to line L₃, relay R₁₀ will be released and a suitable visual indication will be obtained from the lamp P₂. The neutralizing conductor L₂ is connected through contacts K₆ of relay R₅ to the grounded winding W₇ of relay R₄ when relay R₅ is operated. In that case relay R₁₀ is released because battery B₁ is disconnected therefrom at contact K₁ of relay R₅.

Thus when the subscriber receives an appropriate signal through the medium of lamp P₂, it

will indicate that the line L₁ is connected to the line L₃, thereby enabling him to transmit signals to or receive signals from line L₃. When this happens the relay R₅ will be operated so as to open the contact K₁ of relay R₅ and then close the contact K₆ of relay R₅ so as to connect the neutralizing conductor L₂ to winding W₇ of relay R₄. This will cause the release of the relay R₁₀ at the subscriber's office. The lamp P₂, after being illuminated, will remain illuminated and indicate that the subscriber's set and the circuit connected to line L₃ remain properly coupled together so that signals may be transmitted in both directions over the interconnecting circuits.

When a teletypewriter character such as "Figures" is received over the line L₃, it will be relayed through relay R₈ and relays R₇ and R₆ to the selector NTS, which is connected to positive battery B₂ through the make-before-break contacts K₇ of relay R₅. The receipt of this character will close the platen contact K₅ as already explained. The subsequent receipt of another character such as "B" over line L₃ will cause selector NTS to momentarily close its contacts K₃, whereupon the relay R₅ will be operated over a circuit which includes contacts K₅ and K₃ of selector NTS, the winding of relay R₅, battery B₂ and ground. The relay R₅ will be locked in its operated position through the back contact of the upper armature of relay R₉, the locking circuit including battery B₂, the winding of relay R₅, the contacts K₈ of relay R₅, the upper armature and back contact of relay R₉ and ground.

By operating relay R₅ in response to the receipt of a predetermined character over the line L₃, the battery B₁—which was previously connected through the make-before-break contacts K₂ of relay R₅ to the upper winding of relay R₃—will be disconnected and the upper winding of relay R₃ will be connected to the upper winding of relay R₆ over a circuit previously noted. Moreover, the operation of relay R₅ will cause the closure of its contacts K₆ so as to connect the winding W₇ of relay R₄ to the neutralizing conductor L₂. This will be accompanied by the release of the relay R₁₀ at the subscriber's office, the extinction of lamp P₁ and the illumination of lamp P₂. The illumination of lamp P₂ will indicate that the connection between line L₃ and the subscriber's office has been completed. Signals may then be transmitted between the station connected to the line L₃ (not shown) and the subscriber's office over the line circuit L₁ in both directions. The neutralizing conductor L₂ will at the same time function to substantially reduce, if not entirely overcome, the effects of power voltages and other extraneous voltages which may be induced into the exposed conductors L₁ and L₂. The neutralizing conductor L₂ will therefore perform two functions, (1) as a neutralizing conductor to eliminate extraneous voltages and (2) as a medium for indicating to the subscriber through lamp P₂ that his circuit is connected through the central office equipment to another subscriber's station (not shown) for signaling in the usual way.

The closure of the contacts K₃ of the selector NTS is but momentary, as already indicated, in response to the receipt of the teletypewriter character "B." If at some later time the teletypewriter character "D" is received over the circuit L₃, the selector NTS will close its contacts K₄ so as to operate the relay R₉ provided contact K₅ has been previously closed. The operating circuit for relay R₉ includes the battery B₂, the

winding of relay R₉, the contacts K₄ and K₅ of the selector NTS, and ground. The relay R₉ will thereafter be locked in its operated position through the contacts K₉ of relay R₅, the locking circuit including battery B₂, the winding of relay R₉, the lower armature and make contact of relay R₉, the contacts K₉ of relay R₅, and ground. The operation of relay R₉ will also break the locking circuit of relay R₅ by opening the back contact of the upper armature of relay R₉ and the relay R₅ will then release. The release of relay R₅ will in turn bring about the release of relay R₉ because the contacts K₉ of relay R₅ will be opened. Thus upon the receipt of another teletypewriter character such as upper case "D," the relay R₉ will be operated and then both relay R₅ and relay R₉ will shortly thereafter be released.

Upon the release of relay R₅ the line L₃ will then be disconnected from the line L₁ and from the subscriber's office connected thereto. The upper winding of relay R₃ will then be reconnected to the battery B₁ through the make-before-break contact K₂ of relay R₅. The winding W₇ of relay R₄ will also be disconnected from the neutralizing conductor L₂ by the opening of contacts K₆ of relay R₅. The battery B₁ will be reconnected through contact K₁ of relay R₅ to the neutralizing conductor L₂, whereupon the relay R₁₀ will be re-operated to illuminate the lamp P₁ at the subscriber's office.

It will be apparent that any marking and spacing signals received over line L₃ after relay R₅ has been operated will move the armature of relay R₈ between its marking and spacing contacts M and S to alternately connect the oppositely poled batteries B₁ and B₂ to the apex of the windings of relay R₇. These oppositely poled batteries will then be connected through the upper windings of the relays R₆ and R₇, through the operating circuit of the selector NTS (not shown) and over the lower innermost armature and make contact of relay R₅ to the upper winding of relay R₃. The armature of relay R₃ will be moved between its marking and spacing contacts in accordance with the signals received from line L₃ and connect corresponding oppositely poled batteries to the line L₁ through the winding W₅ of relay R₄. These oppositely poled voltages will in turn energize the winding W₁ of relay R₂ so that the armature of relay R₂ will register these marking and spacing signals in a well known manner. During such signaling operations the neutralizing conductor L₂ will function to eliminate extraneous voltages.

In order to send signals from the subscriber's office over the lines L₁ and L₃, the sending relay R₁ will be operated in accordance with marking and spacing signals. The armature of relay R₁ will connect ground to the line L₁ through the winding W₁ of relay R₂ for a marking signal and the positive battery B₄ to the main line L₁ through the same winding of relay R₂ for a spacing signal. These marking and spacing signals will then cause currents to flow through the winding W₅ of relay R₄ in opposite directions so as to move the armature of relay R₄ between its marking and spacing contacts M and S. As the armature of relay R₄ closes its contacts M and S it will alternately connect oppositely poled batteries to the apex of the windings of relay R₃ and thereby transmit oppositely poled currents to the upper windings of relays R₆ and R₇. The interconnecting circuit includes the upper winding of relay R₃, the upper armature and make contact of

relay R₅, the lower innermost armature and make contact of relay R₅, the operating circuit of the selector NTS (not shown) and the upper windings of relays R₆ and R₇ which are connected to the armature of relay R₈ and its marking contact M. The relays R₆ and R₇ will move their armatures between their marking and spacing contacts M and S in accordance with the signals transmitted from the subscriber's office and thereby connect oppositely poled batteries to the midpoints of the windings of the relay R₈. These oppositely poled batteries will cause oppositely directed currents to flow over the line L₃ to the distant subscriber's station or central office (not shown).

During signaling from the subscriber's office to the circuit connected to the line L₃ the neutralizing wire L₂ will again perform its neutralizing functions to eliminate the effects of transient and extraneous voltages and the lamp P₂ will indicate to the subscriber that his circuit is connected to the line L₃ and that the subscriber's circuit is not transmitting signals "into the air." This is an important feature of this arrangement not only because it indicates that the subscriber's office and the line L₃ are interconnected but also because the indication is continuous and is interrupted only when the interconnecting circuit is broken.

While this invention has been shown and described in certain particular arrangements merely for the purpose of illustration, it will be understood that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In a telegraph system, the combination of a subscriber's station, a central office, a telegraph line over which telegraph signals may be transmitted, a neutralizing line which together with the telegraph line are interposed between the subscriber's station and the central office, the neutralizing line picking up extraneous voltages similar to those picked up by the telegraph line, means coupled to said lines whereby said extraneous voltages may be effectively nullified, a relay at the subscriber's office, the winding of said relay being connected to the neutralizing line, an indicating device controlled by said relay, and means at the central office for applying voltages to said neutralizing line to energize said relay.

2. In a telegraph system, the combination of two separated stations, a telegraph line, a neutralizing line which together with said telegraph line span the two stations, means connected to said lines for the neutralization of extraneous voltages, means for indicating whether or not signaling may take place between said stations over said telegraph line, said means including a relay the winding of which is connected in series with said neutralizing line, an indicating device controlled by said relay, and means for applying voltage to said neutralizing line to operate said relay without interfering with signaling over said telegraph line.

3. In a telegraph system, the combination of first and second stations, a line over which telegraph signals may be transmitted, a neutralizing wire, said neutralizing wire and said line running parallel to each other between said two stations, means connected to said line and said wire for the neutralization of extraneous voltages, a re-

lay at the first station having its winding connected in series with said neutralizing wire, a device at said first station having an impedance substantially equal to that of said relay winding and connected in series with said line, an indicating device controlled by said relay, and means at said second station for applying voltage to said neutralizing wire to operate said relay.

4. In a telegraph system, a first subscriber's station, a central office, a second subscriber's station connected to said central office, a telegraph line over which telegraph signals may be transmitted, an auxiliary line running parallel to said telegraph line, said telegraph line and said auxiliary line interconnecting the first subscriber's station and said central office, means connected to said lines for the neutralization of extraneous voltages, a relay at said first subscriber's station having its winding in series with said auxiliary line, an indicating device controlled by said relay, and means responsive to a predetermined signal from said second subscriber's station to indicate at the first subscriber's station whether or not the two subscribers' stations may send telegraph signals to each other over the telegraph line, said means including apparatus at the central office responsive to said predetermined signal to apply voltage to said auxiliary line to operate said relay.

5. In a telegraph system, the combination of first and second stations, a telegraph line over which telegraph signals may be transmitted, a neutralizing line which together with said telegraph line interconnect said first and second stations and parallel each other, means connected to said lines to nullify the effect of extraneous voltages, a source of voltage connected to said neutralizing line, means responsive to a first predetermined signal at said second station to re-

move the voltage of said source from said neutralizing line to indicate to the operator at said first station that telegraph signals may be transmitted over said telegraph line, and means responsive to a second predetermined signal at said second station to apply said voltage to said neutralizing line to indicate to the operator at said first station that telegraph signals may not be transmitted over said telegraph line.

6. In a telegraph system, the combination of a first subscriber's station, a central office, a second subscriber's station connected to said central office, a line for telegraph signals, a neutralizing conductor which together with said line run substantially parallel to each other between the first subscriber's station and said central office, means connected to said line and said conductor for neutralizing extraneous voltages, an indicating device at said first subscriber's station controlled by voltage received over said neutralizing conductor from said central office, a source of voltage for connection to said neutralizing line, means responsive to a predetermined signal received at said central office from said second subscriber's station to effectively connect said first and second subscribers' stations through said central office so that telegraph signals may be transmitted between said stations over said line, said means also including means to remove the voltage of said source from said neutralizing conductor, and means responsive to a different predetermined signal received at the central office from said second subscriber's station to effectively disconnect said stations from each other and simultaneously apply said voltage to the neutralizing conductor to thereby operate said indicating device.

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