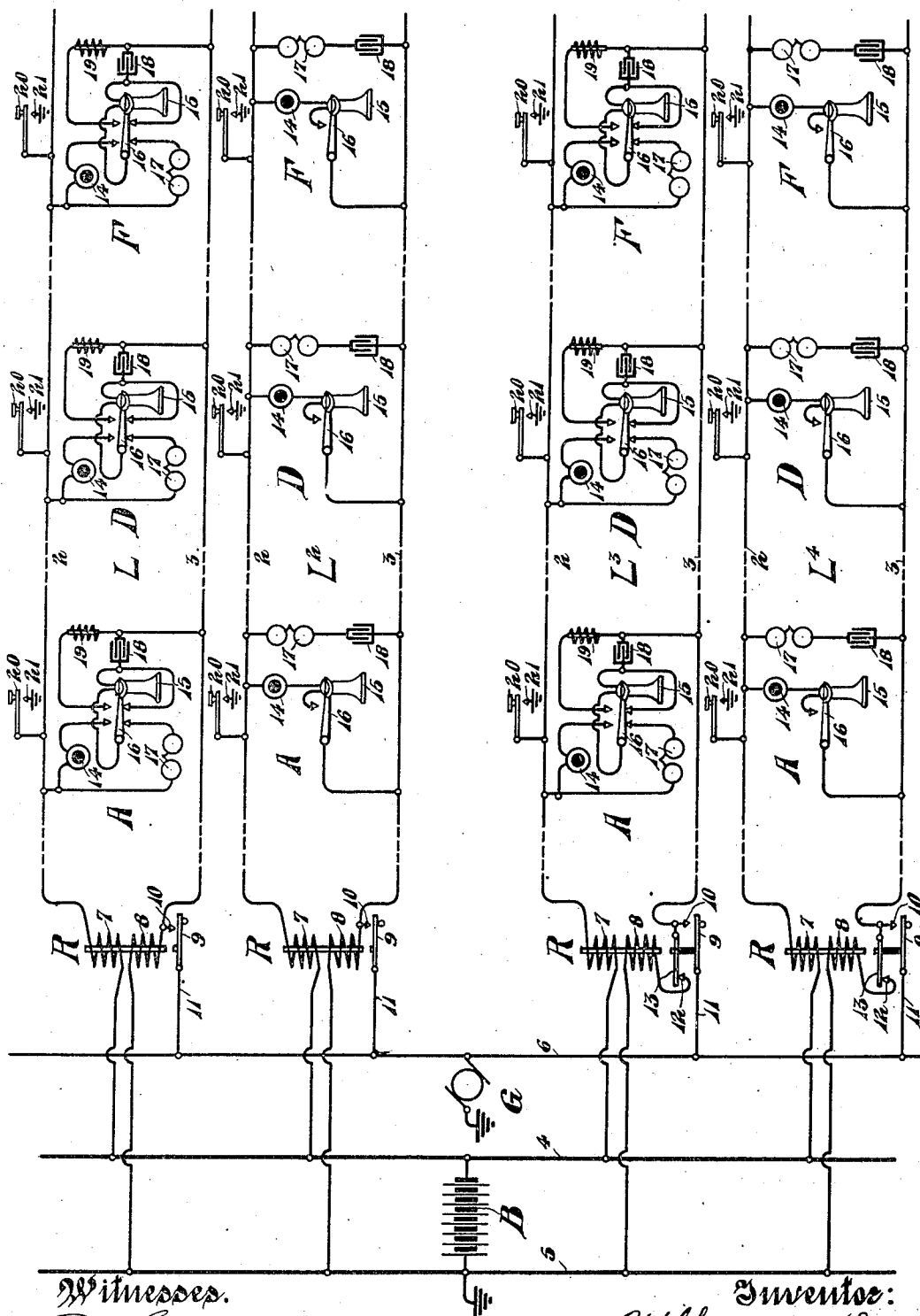


No. 825,894.

PATENTED JULY 17, 1906.

W. W. DEAN.  
TELEPHONE SYSTEM.

APPLICATION FILED FEB. 8, 1904.



Witnesses.  
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# UNITED STATES PATENT OFFICE.

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## TELEPHONE SYSTEM.

No. 825,894.

Specification of Letters Patent.

Patented July 17, 1906.

Application filed February 8, 1904. Serial No. 192,478.

*To all whom it may concern:*

Be it known that I, WILLIAM W. DEAN, a citizen of the United States of America, and a resident of Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems partaking of the nature of both the so-called "intercommunicating" systems and "party-line" systems.

This invention is of particular advantage where a single line of considerable length is desired and where such line must accommodate a number of stations scattered along it at points perhaps several miles apart. Such a telephone-line is of particular advantage in connection with railroads where it is desired to place stations at isolated and unfrequented points—as, for instance, at sidings and at small towns—and at the same time to have the apparatus at each of these stations of the simplest possible character, so that they are not liable to get out of order and are capable of withstanding the rough usage of trainmen and others unaccustomed to the frequent use of the telephone. It is particularly desirous with such lines to place the source or sources of energy required for the proper operation of the calling and talking instruments at some point along the line where some one is in attendance at all times and preferably where skilled attendants are available. This may occur, of course, at some large city or at some point where the railroad is maintaining an electric or other plant. By thus locating the sources of energy at such a point and placing at each of the stations on the line only the necessary mechanical apparatus for the various operations of talking and signaling a system is secured which is of particular advantage for the uses stated.

In carrying out my invention I preferably locate a source of steady current and a source of ringing-current at one point and from said sources a pair of line-wires constituting a metallic line are extended throughout the region in which it is desired to locate the subscribers' stations. At each of the stations there is provided an ordinary talking set as well as the signaling-bell, together with a suitable calling button or switch which when

depressed causes ringing-current from the said ringing-generator to traverse the various signaling-bells located upon the line, whereby with a suitable code of signals any subscriber is enabled to call the other subscribers upon the line. When the parties are in communication, the source of current at the central point furnishes the current for conversation to all the parties upon the line. Thus each station on the line is provided with only the simplest apparatus, which is not liable to get out of order and which will withstand rough usage and is capable of manipulation by unskilled persons. If the stations on the telephone-line are located at isolated points, the trainmen and any others intended to have access thereto may be provided with a key to unlock the box in which the set is placed. As many lines as are desired may of course be supplied from said central source by varying the capacity thereof according to the number of lines supplied.

My invention is illustrated in the accompanying drawing, in which the figure is a diagram of several of such party-lines, each provided with means for intercommunication.

In this diagram, L, L<sup>2</sup>, L<sup>3</sup>, and L<sup>4</sup> indicate the lines, which are shown extending in two limbs 2 and 3 throughout their respective districts from the point at which the source of steady current B and the source of ringing-current G are located. These lines are connected with the battery-leads 4 and 5, connected, respectively, with the live and grounded poles of the battery B. The ringing-generator G is provided with a common lead 6 to supply each of the lines with ringing-current, as hereinafter specified. At the central point in addition to the generators B and G there is also provided for each line a relay R, the windings 7 and 8 of which are included in the respective line conductors 2 and 3 and are differentially wound with respect to currents over the metallic line, said windings 7 and 8 being preferably placed end on upon the core of the relay or otherwise separated so that though differentially wound sufficient impedance is presented to the rapidly-varying voice-currents in the metallic line to prevent them from being short-circuited through the battery B. This relay is provided with a pair of normally open contacts 9 and 10, the

latter being connected with the line conductor 3, while the former is connected through the medium of a branch conductor 11 with the ringing-generator lead 6. In the case of lines  $L^3$  and  $L^4$  I have shown the said relays provided with an additional set of contacts 12 and 13, which are normally closed and included in the line conductor 3.

I have shown only three stations A, D, and F on each line; but it will be understood that any desired number within reasonable limits may be added thereto. In the case of lines  $L^2$  and  $L^4$  I have shown a simple arrangement of substation apparatus, transmitters 14 and receivers 15 being included in bridges of the line conductors 2 and 3, which bridges are normally open at the switch-hook 16. A signaling-bell 17 of ordinary type and a suitable condenser 18 are located in a second bridge at each station. The substation arrangement which I prefer to use, however, is shown in connection with the various stations upon the lines L and  $L^3$ , this arrangement including the call-bell 17 and condenser 18 in a bridge of the line conductors that is normally closed by the switch-hook 16, but which is opened when the receiver 15 is lifted from the hook, the said receiver, the transmitter 14, condenser 18, and a suitable retardation-coil 19 being then suitably connected in the circuit for conversation. This subscriber's arrangement is shown more fully in my Patent No. 747,331, dated December 15, 1903. At each substation I place a push-button 20, electrically joined to the conductor 2 and which when depressed is adapted to make connection with a ground branch 21.

The operation of my invention is as follows: Any subscriber desiring to converse with any other subscriber upon the same line depresses his call-button 20, which completes a circuit from the live pole of the battery B over the common lead 4, the line conductor 2 of the calling-party's line, through winding 7 of relay R of that line, and thence over line conductor 2 to the substation at which the button is depressed, and through the call-button 20 and ground branch 21 to ground, thus completing a path for current from the battery B, since the opposite terminal of said battery is also grounded. The current in this path, through the winding 7 of the relay R, energizes said relay, which attracts its armature 9 and closes together its normally open contacts 9 and 10. The closing together of these contacts permits current from the ringing-generator G to flow out over the common lead 6, the branch conductor 11 of the calling-line, contacts 9 and 10 of relay R, over line conductor 3 of the telephone-line upon which the calling party is located, thence through all the signaling-bell bridges at the various substations upon the line in multiple, and thence by way of line conductor 2 and ringing-button 20 at the calling-station to ground.

The ringing-current being either alternating or pulsating in character passes readily through the condensers 18 in the bell-bridges and serves to operate the several bells 17, located upon that line. With a suitable code of signals, therefore, any subscriber or any one at any substation is enabled to call any of the other substations. When the party called responds to the signal and both parties take up their receivers, they are in communication over the line upon which they are located and the battery B is furnishing current for the operation of their transmitters. The current from the battery B during conversation flows through the windings 7 and 8 of the relay R; but owing to the differential arrangement of these windings said relay remains inactive to the steady currents, so that the contacts 9 and 10 remain open. At the same time, since the windings 7 and 8 are not superimposed or twin-wound or otherwise closely associated, the rapidly-varying voice-currents are not neutralized, and sufficient impedance results in said windings to confine the voice-currents to the external portion of the telephone-line in use and preventing them from being short-circuited through the batteries. The windings 7 and 8 of the relays R are preferably of five hundred ohms resistance, and the battery B has a voltage of about fifty. The generator G is preferably a continuously-operated power-generator. The electrical dimensions of the other parts may be those usually employed or such as are suitable or desired.

In the case of lines  $L^3$  and  $L^4$  it will be observed that when the relays R are operated by the depression of a call-button at any of the stations, the line conductor 3 is opened at the contacts 12 and 13 of said relay, whereby all tendency of the ringing-current to be confined locally at the power-station is prevented; but it is apparent that in the arrangement of lines L and  $L^2$  the retardation of the coils 8, as well as their high ohmic resistance, renders the same fully operative.

The apparatus at the substations is of simple character and not liable to get out of order by either rough or infrequent usage or in being operated by unskilled persons, and there are no scattered sources of current to be inspected and maintained upon the line. It is possible with this arrangement to locate stations at isolated sidings and other points along a railway-line without undue expense on account of maintenance and which is capable of withstanding the shocks, jars, and any general rough handling to which they would be subjected by the men of the train crews.

Although I have mentioned specifically the most advantageous use of my invention, it is of course applicable to other places and other relations.

Various changes and modifications may be

made in the details of the invention without departing from the scope or principle of the invention.

5 Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a telephone system, the combination with a telephone-line, of a plurality of substations on said line, a source of current permanently connected therewith by a continuous conductor free from series contacts or possible variable resistances, a differential relay having its coils interposed between said source and the limbs of the telephone-line, a single source of ringing-current for the line, a normally open contact of said relay adapted by its actuation to connect said source of ringing-current with one limb of said line, a normally open ground connection at each substation of said line adapted to be closed to send current through one side only of said relay, whereby the relay is actuated to place ringing-current upon the line to signal the desired station, substantially as described.

2. In a telephone system, the combination with a telephone-line having a plurality of substations thereon, each bridged in a normally open circuit between the limbs of said line, a single source of current permanently connected with the line and adapted to furnish current for the operation of the substation-transmitters, a differential relay having its coils interposed between said source and the limbs of said line, a single source of ringing-current for the line, a normally open contact of said differential relay adapted when closed to connect said source of ringing-current with one limb of said telephone-line, a third conductor normally disconnected from

said telephone-line at the substations but permanently connected with one side of said direct-current source, a key at each of said substations for connecting one limb of the telephone-line with said third conductor whereby current is caused to flow through one coil only of said differential relay to actuate it, causing ringing-current to be placed upon the other limb of the line, substantially as described.

3. In a telephone system, the combination with a metallic telephone-line, of a plurality of substations normally bridged in open circuit between the limbs of said line, an annunciator at each of said substations, a common battery for said plurality of substations permanently connected to the limbs of said telephone-line through conductors free from series contacts or possible variable resistances, a differential relay having its coils interposed between said line and said source of current, a source of ringing-current for said line, a normally open contact for said differential relay adapted by its actuation to connect said source of ringing-current with one limb of the telephone-line, and means associated with each of said substations for actuating said differential relay, thereby connecting the ringing-current with the telephone-line to signal any of the desired substations thereon, substantially as described.

Signed by me at Chicago, county of Cook, State of Illinois, this 31st day of December, 1903.

WILLIAM W. DEAN.

Witnesses:

E. A. GARLOCK,  
ROBERT LEWIS AMES.