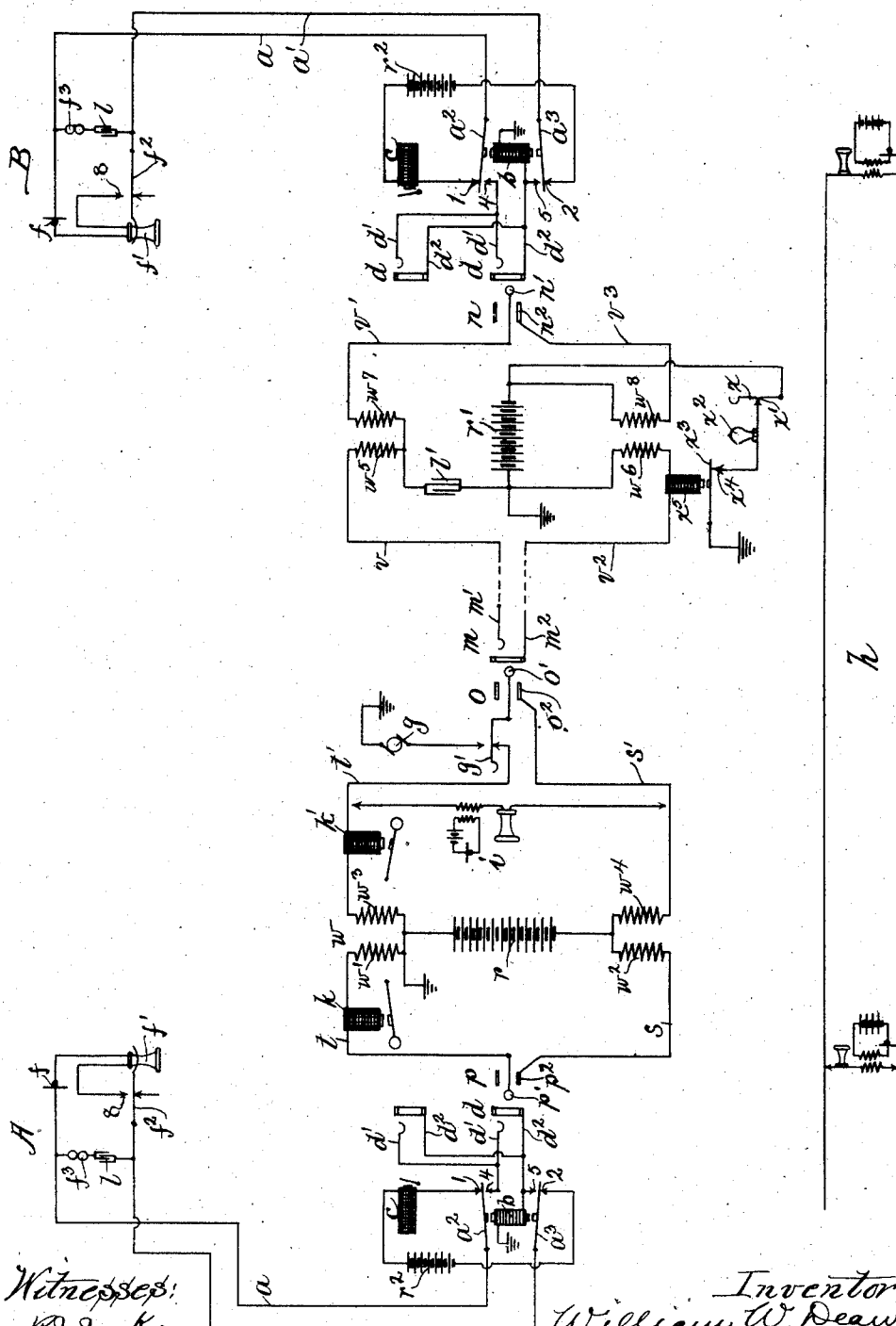


No. 854,337.

PATENTED MAY 21, 1907.

W. W. DEAN.
TRUNK LINE TELEPHONE SYSTEM.
APPLICATION FILED JUNE 10, 1901.



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UNITED STATES PATENT OFFICE.

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TRUNK-LINE TELEPHONE SYSTEM.

No. 854,337.

Specification of Letters Patent.

Patented May 21, 1907.

Application filed June 10, 1901. Serial No. 63,925.

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Trunk-Line Telephone Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to a telephone system, and more particularly to means for uniting two subscribers through the agency of a trunk line.

In telephone systems having a plurality of central stations it is necessary to employ trunk lines for uniting two subscribers whose telephone lines terminate at different central stations. These trunk lines as commonly constructed terminate at one end in a switch socket and at the other end in a plug or movable terminal and the switch socket of the called subscriber is adapted to be connected with the switch socket of the trunk line through the agency of the usual plug connectors, the plug or movable terminal of the trunk line being then inserted in the switch socket of the called subscriber to complete the connection. In trunk line systems of this general class it has been the usual practice heretofore to provide the signaling apparatus for sending signals to the called subscriber and for receiving signals therefrom at the station at which terminates the telephone line of the called subscriber. The operator at the station of the calling subscriber, whom I designate as the "initial" operator connects her cord set with the line of the calling subscriber, receives the number of the called subscriber and then connects the other terminal of her cord set with the trunk line, and the operator at the station of the called subscriber, whom I shall designate as the "trunk line" operator completes the connection with the called subscriber and sends calling current to the substation of the called subscriber to advise him of the connection. Likewise, at the completion of the conversation, the called subscriber signals to the trunk line operator by actuating an annunciator or responsive device provided in connection with the trunk line.

It is the object of the present invention to

provide means whereby the initial operator may signal direct to the called subscriber, and moreover, to provide means whereby the called subscriber may signal back for disconnection direct to the initial operator. The provision of signal sending apparatus and signal receiving apparatus in connection with the trunk line is thus obviated and the signal receiving and sending apparatus of the usual cord connectors may be employed as well when connection is made through the trunk line as when connection is made directly between two telephone lines. The trunk line is thus greatly simplified and the provision of signal sending and receiving apparatus in connection therewith is obviated. Moreover, the speed of making connections between two subscribers is increased since the trunk line operator in making a connection has only to receive the number of the called subscriber, and connect the trunk line therewith. Likewise, in disconnecting the lines, the trunk line operator has only to remove the trunk line plug upon receiving a proper signal from the initial operator and is unconcerned with the signals from the called subscriber. Trunk lines have also been employed in connection with relays for closing a signaling circuit from the cord connector of the initial operator to the line of the called subscriber. In accordance with my invention, I accomplish this result without the employment of relays or other auxiliary devices and am enabled to signal through the trunk line direct.

I have illustrated my invention in the accompanying drawing in which the figure is a diagram showing two telephone lines and the central station apparatus for uniting the same for conversation in accordance with my invention.

The telephone line, A, extends in two limbs, a , a' , to the central station, where the same are connected respectively with the springs, a^2 , a^3 , the former normally resting against contact, 1, and the latter against contact, 2, between which contacts are connected the relay, c , and the battery, r^2 . The winding of relay, b , is connected between contacts 5 and ground. The springs, a^2 and a^3 are adapted to respectively engage with contacts 4 and 5 when the relay is energized. The contacts 4 and 5 are connected respec-

tively with the contacts, d' , d^2 , of the connection terminals, d , d . At the substation A, a microphone, f , and receiver, f' , are provided, the same being connected with contact, s , adapted to be engaged by the switch hook, f^2 , when the receiver is removed from the hook. The bell, f^3 , and condenser, l , are included in a bridge between the two limbs, a , a' . The line of subscriber B shown upon the right is similar to that of subscriber A and is provided with the same parts and apparatus, like parts being indicated by the same reference letters.

The answering plug, p , is provided with a tip, p' , and a sleeve, p^2 , while the calling plug, o , is provided with a tip, o' , and a sleeve, o^2 . The tips of the plugs are joined through the strands t , t' , and the sleeves are joined through the strands s , s' . The battery, r , is connected in a bridge between the tip strands, t , t' and the sleeve strands, s , s' . The windings, w and w^3 of a repeating coil w , are connected between the battery, r , and the respective strands, t , t' , and the windings w^2 and w^4 are connected between the battery and the respective strands, s , s' . One pole of the battery, r , is grounded.

The operator's telephone set, i , is adapted to be bridged between the strands, t' and s' , by any suitable listening-in key and a grounded calling generator, g , is adapted to be connected with the tip, o' , by means of the ringing key, g' . Clearing out indicators, k , k' of any approved type are connected in circuit with the strands t and t' , respectively.

The trunk line is provided with a switch socket, m , having terminals, m' , m^2 , and a plug, n , having a tip, n' and a sleeve, n^2 . The tip contacts, m' , n' are united through the strands, v and v' , and windings w^5 , w^7 , of a repeating coil, while the sleeve contacts, m^2 , n^2 , are united through the strands, v^2 , v^3 , and the windings, w^6 , w^8 of a repeating coil. The battery, r' , is connected in series between the two windings w^6 and w^8 . One pole of the battery, r' is grounded and this pole is also connected with the united ends of the windings w^5 , w^7 through a condenser, l' . The opposite pole of battery, r' is connected through the contacts, x , x' , of a plug seat switch and thence through a lamp, x^2 , and the contacts, x^3 , x^4 , of a relay x^5 , the coil of which relay is included in the strand, v^2 . The usual signal circuit, h , extends between the two central stations whereby the operators may communicate with each other in the usual manner.

We will assume that subscriber A wishes to talk with subscriber B. He lifts his telephone receiver from its hook and thereby closes the circuit of battery, r^2 , through the indicator, c , to actuate the same. The operator seeing the signal, inserts answering plug, p , in the socket belonging to subscriber A, thus completing the circuit of battery, r ,

over the limbs of the telephone line. She then depresses her listening-in key and receives the number of the called subscriber. Learning that the called subscriber is at another station, thus necessitating the employment of a trunk line, she communicates with the operator at the other station through the agency of the talking circuit, h , and receives instruction as to which trunk line to employ for the connection. She then inserts the calling plug, o , in the switch socket of the chosen trunk line and the operator at the remote station who will be referred to as the "trunk line" operator inserts the trunk line plug, n , in the switch socket belonging to the called subscriber B. As soon as the connection has been completed through the trunk line the initial operator actuates the ringing key, g' , to connect the calling generator, g , in circuit, and current is thus sent through tip, o' , contact, m' , strand, v , windings w^5 , w^7 , and strand v' , the trunk line contacts, n' , and d' , limb a , through the bell of subscriber B, thence by limb, a' , contacts, d^2 , and n^2 , strand v^3 , winding, w^8 , battery, r' , to ground, and back to the generator. The bell of the called subscriber is thus actuated to attract his attention. The calling current does not pass through condenser l' , to an appreciable extent because of the low frequency of the calling current, but telephonic currents will readily pass through said condenser, the same being adjusted in capacity for the telephonic but not for the calling currents. When the called subscriber responds and lifts his receiver from the hook, the circuit of battery, r' will be closed through the microphone at substation B. The circuit of battery, r' , may be traced to ground through winding, w^3 , strand, t' , contacts, o' , m' , strands, v , v' , and windings w^5 , w^7 , limbs, a , and a' , of substation B, strand, v^3 , and winding w^8 , back to the battery, r' . The microphone of subscriber A will be energized by the current from battery, r . Battery r , will also send current to ground and thence from ground through winding w^6 , relay, x^5 , strands, v^2 and s' , and winding, w^4 , back to the battery. The talking currents from either substation will be propagated to the other substation through the windings of the several repeating coils.

It will be noted that during conversation the circuit of battery, r' , is closed through the clearing out indicator, k' , and this circuit which has been previously traced is controlled by the switch hook at the station of the called subscriber. When the called subscriber, therefore, has completed the conversation, he places his receiver upon its hook, thus opening the circuit of battery, r' , through clearing out indicator, k' , to actuate the same and convey to the initial operator the signal for disconnection. The initial operator thereupon removes the plugs, p

and o , from the sockets. It will be noted that during conversation, the battery, r , sends current through the windings of the relay, x^5 , the circuit having been heretofore traced, and the relay, x^5 , is thus energized during conversation. The contacts, x^3 and x^4 of the relay are thus separated, and the circuit of battery, r' , through the lamp, x^2 , is thus opened. When the initial operator, therefore, removes the plug, o , from the socket of the trunk line, the circuit of battery r , through the winding of relay, x^5 , is opened, and the relay is thereby deenergized, thus permitting contacts, x^3 and x^4 , to close together and closing the circuit of battery, r' , through contacts, x , x' , lamp, x^2 , contacts, x^4 , x^3 , to ground and then back to the battery. The lamp, x^2 is thus lighted to convey to the trunk line operator the signal for disconnection. The trunk line operator thereupon removes plug, n , from the socket of the called subscriber, and replaces said plug in its seat, thereby separating the contacts, x , x' , of the plug seat switch, and thus extinguishing the lamp, x^2 . The central station apparatus are now in condition for another call. It will be noted that in accordance with this system, the signaling generator and the clearing out indicator instead of being connected with the strands of the trunk line are connected with the strands of the cord connectors of the initial operator, and that the signaling current sent to the sub station of the called subscriber passes through one strand of the trunk line, while the signaling circuit by means of which the called subscriber signals to the initial operator also includes this strand of the trunk line.

The feature wherein the charging battery is connected, as illustrated, so as to send current in series over the two limbs of the talking circuit and through the windings of the repeating coils, is claimed in an application filed by me March 22nd, 1901 No. 52,275, Series of 1900, and I do not claim herein such features in their individual capacity.

Having described my invention what I claim as new and desire to secure by Letters Patent is:—

1. The combination with a pair of telephone lines, of an operator's connector and a trunk line for uniting the same for conversation, a charging source of electricity associated with said trunk line, a signal sending device adapted to be connected between said connector and a third conductor, a permanent bridge, containing a condenser, between one side of the trunk line and said third conductor, a signal receiving device at the substation of the called subscriber, and means for sending current from said signal sending device over a circuit including said signal receiving device and one limb of said trunk line with suitable return through said third conductor, substantially as described.

2. The combination with a trunk line, of a repeating coil having its windings united at the ends and included in series in one strand of said trunk line, of a bridge including a condenser and extending between the united ends of said windings and the opposite strand of said trunk line, and a signal sending device adapted to send current through said first named strand and windings, said condenser being adjusted in capacity to prevent the signal current from being shunted there-through while permitting the talking currents to traverse said bridge, substantially as described.

3. The combination with a pair of telephone lines, of an operator's connector and a trunk line for uniting the same for conversation, a repeating coil associated with said trunk line, having a pair of windings united at the ends and included in series in one strand of said trunk line, a bridge containing a condenser and joining the united ends of said windings with the opposite strand of the trunk line, a signal sending device associated with said connector, a signal receiving device at the substation of the called subscriber, means for sending current from said signal sending device over a circuit including one strand of said trunk line, said windings and said signal receiving device, said condenser being adjusted in capacity to permit the passage of talking currents while preventing the passage of the signal currents, substantially as described.

4. The combination with a pair of telephone lines, of an operator's connector and a trunk line for uniting the same for conversation, a charging source of electricity associated with said trunk line, a signal receiving device associated with said operator's connector; and a circuit including said source of electricity, said signal receiving device and a switch at the substation of the called subscriber; whereby the called subscriber may signal back to the initial operator, substantially as described.

5. The combination with a pair of telephone lines, of an operator's connector and a trunk line for uniting the same for conversation, a charging source of electricity associated with said trunk line, a signal receiving device associated with said operator's connector; and a circuit including said source of electricity, said signal receiving device, one strand of the trunk line, and a switch at the substation of the called subscriber; substantially as described.

6. The combination with a pair of telephone lines, of an operator's connector and a trunk line for uniting the same for conversation, a signal receiving device adapted to be connected between the said connector and a third conductor, and a circuit including a suitable source of electricity, said signal receiving device, one strand of said trunk line,

and a switch at the substation of the called subscriber with suitable return through said third conductor, substantially as described.

7. The combination with a pair of telephone lines, of an operator's connector and a trunk line for uniting the same for conversation, a charging source of electricity and a repeating coil associated with said trunk line, said source of electricity being in series with certain of the windings of said repeating coil, a signal receiving device associated with said connector, a switch at the substation of the called subscriber, and a circuit including said source of electricity, said signal receiving device, the said windings of said repeating coil and said switch; substantially as described.

8. In a telephone system, the combination with two telephone lines, of a trunk circuit and a cord circuit adapted to connect said lines together for conversation, a separate source of current associated with each, of a signal associated with the trunk circuit under the control of the originating operator and actuated by current from the cord circuit source, and a signal-controlling device associated with the cord circuit under the control of the called subscriber after connections have been established throughout and actuated by current from the trunk source, substantially as described.

9. In a telephone system, the combination with a pair of telephone lines, of a cord circuit and a trunk circuit adapted by their connection with the lines and with each other to unite said lines for conversation, of a source of current associated with the cord circuit, and a second source of current associated with the trunk circuit, a signal associated with the cord circuit adapted to be actuated by current over the called telephone line from said second source during conversation, substantially as described.

10. The combination with a pair of telephone lines, of a cord circuit and a trunk circuit adapted to connect said lines together for conversation, a source of current associated with said cord circuit, and a second source of current associated with the trunk circuit, a signal-controlling device associated

with the trunk circuit adapted to be actuated by current from the cord circuit source when a connection is established between the said cord and trunk circuits, and a signal-controlling device associated with the cord circuit and adapted to be actuated by current from said trunk circuit source over the called telephone line when the called subscriber has answered his call, substantially as described.

11. The combination with a pair of telephone lines, of a cord circuit, and a trunk circuit adapted to connect said lines for conversation, of a source of current associated with said cord circuit, and a second source associated with said trunk circuit, a signal-controlling device associated with said cord circuit having its coil serially included in one of the strands thereof, and adapted to be actuated by current from said second source when a connection has been established throughout and the called subscriber answers his call, substantially as described.

12. The combination with a pair of telephone lines, of a cord circuit and a trunk circuit adapted to connect said lines for conversation, of a source of current associated with the cord circuit, and a second source of current associated with the trunk circuit, a signal-controlling device having its coil serially included in one of the talking strands of the trunk circuit and adapted to be actuated by current from said first source when a connection is established between the cord and the trunk circuits, and a signal-controlling device having its coil serially included in one of the talking strands of the cord circuit, and adapted to be actuated by current from said second source when connections have been established throughout and the called subscriber responds to his call, substantially as described.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

WILLIAM W. DEAN.

Witnesses:

MELANCTHON R. NYMAN,
KEMPSTER B. MILLER.