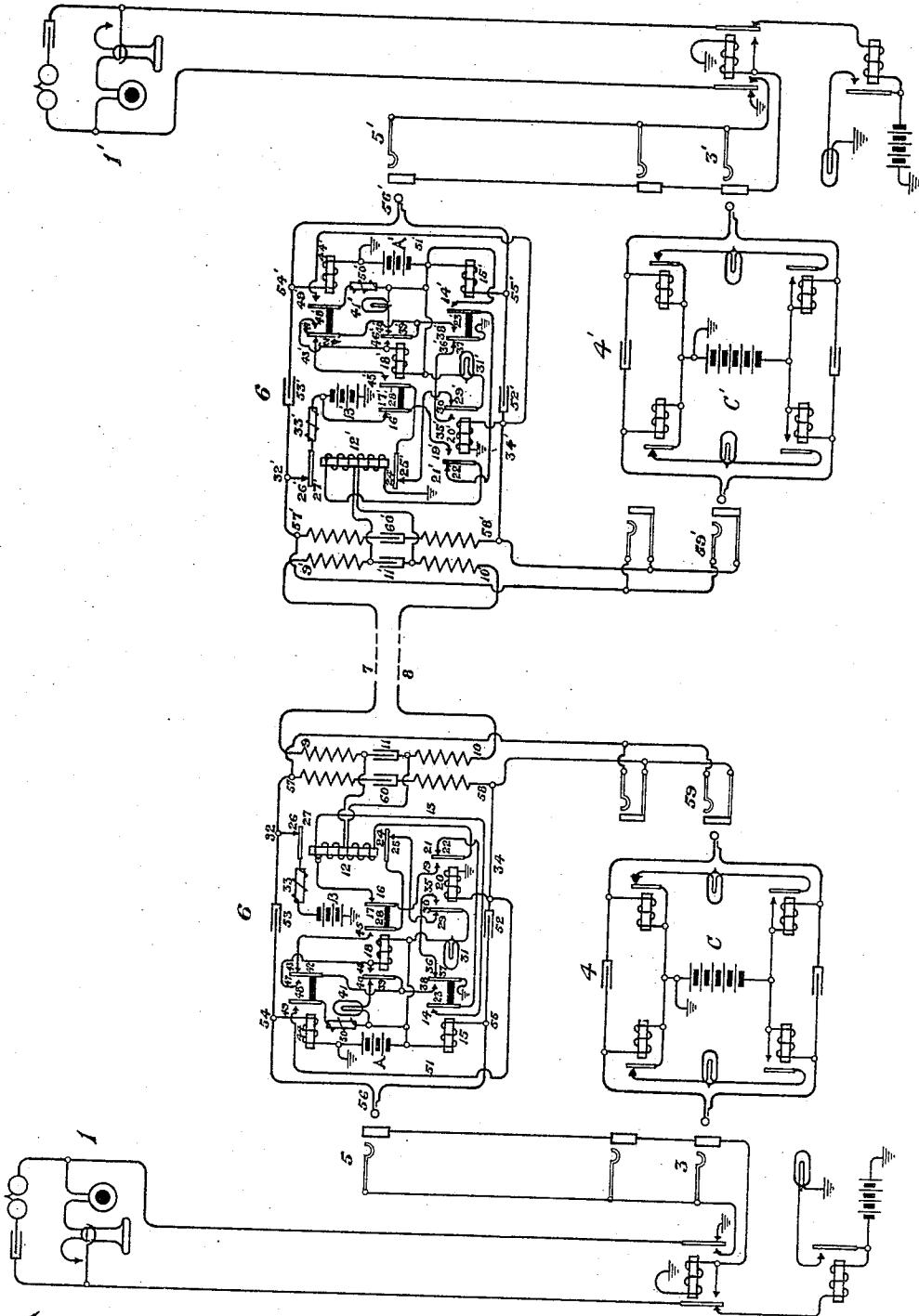


C. A. SIMPSON.
 TELEPHONE TRUNKING SYSTEM.
 APPLICATION FILED MAR. 18, 1907.

936,374.

Patented Oct. 12, 1909.



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TELEPHONE TRUNKING SYSTEM.

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To all whom it may concern:

Be it known that I, CHARLES A. SIMPSON, a citizen of the United States, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone Trunking Systems, of which the following is a specification.

My invention relates to telephone trunking systems adapted to connect for conversation telephone lines terminating in different switchboards or different exchanges.

My invention has for its object the provision of a trunking circuit adapted to be used for both incoming and outgoing connections at each exchange.

It has been customary in the past to provide trunking circuits of this character, commonly known as two-way trunks, with a disconnect signal at each end of the trunk by means of which the trunk operator at the end of the trunk then used as the incoming end is informed when the subscribers using the trunk have terminated their conversation, and the trunk becomes idle. In the use of the systems heretofore disclosed it is necessary for the subscriber's operator to make tests upon the testing terminals of a number of two-way trunks leading between the exchanges before finding a trunk which is idle, thus delaying the connection considerably. By my invention in addition to the disconnecting signal, I provide a visual busy signal for each trunk cord, the signal at one end being displayed whenever the trunk is being used by the trunk operator at the other end. By this means I am able to use a two-way trunk in the same manner that a one-way trunk is used, and the answering operator desiring a trunk is not compelled to test for an idle trunk as before, but the trunk is designated to her in the same manner as is customary where one-way trunks only are used.

My invention is illustrated in the accompanying drawing which represents a telephone trunking system with all of the apparatus shown in its normal or unactuated condition.

In the drawing I have provided the usual common battery subscribers' stations 1 and 1', station No. 1, connecting in a well known way with one of the exchanges, and station No. 1' connecting similarly with the other of the exchanges. The answering terminal of subscriber No. 1 is represented at 3, in

such a position that the cord circuit 4, which is of the well known four-relay type may be connected therewith in answering the calls from substation 1. This subscriber's line is also provided with multiple contacts 5, one of which is located before the trunk operator, within reach of the cord connected to her trunk circuit 6. The exchanges shown on the right and left of my drawing are similarly equipped as far as the operation of the circuits is concerned, and like parts in the two exchanges are designated by like characters, the parts shown in the right hand exchange being signated by the suffix "r" to each of the designation characters of the left hand exchange.

The trunk line wires 7 and 8 extend between the two exchanges, and terminate in the left exchange in the windings 9 and 10 of the trunk repeating coil. The inner terminals of these windings are connected by the condenser 11. The inner terminal of the winding 9 is also connected through the upper coil of relay 12, through conductor 13 to the open contact 14 of relay 15. The outer terminal of the upper winding of relay 12 is also connected through closed contacts 16 and 17 of relay 18 to the normally open contact 19 of relay 20. The inner terminal of winding 10 of the repeating coil is connected through the lower winding of relay 12 through contacts 21 and 22 of relay 20 to the open contact 23 of relay 15. Relay 12 controls the normally closed contacts 24 and 25 and normally closed contacts 26 and 27, contact 24 being connected with the normally open contact 28 of relay 18, contact 25 connecting through closed contacts 29 and 30 of relay 20 through the signal 31 to the live pole of battery A.

Contact 26 of relay 12 is connected with the talking conductor 32, and contact 27 connects through impedance coil 33 with the live pole of battery B. Relay 20 has its coil connected between ground and the talking strand 34 of the cord circuit. This relay has, in addition to the former contacts mentioned, the contact 35 which connects with the normally closed contacts 36 and 37 of relay 15. Contact 37 of relay 15 is adapted when actuated to connect with contact 38 of said relay, this contact connecting through contacts 39 and 40 of relay 18 with the lamp 41, and thence to the live pole of battery A. This contact 38 of relay 15 is also connected

through contacts 42 and 43 of relay 44 with the normally open contact 45 of relay 18. The coil of relay 18 is connected between the live pole of battery and its own contact 46, contact 46 being also connected with the normally open contact 47 of relay 44. Relay 44 has in addition to these contacts the normally open contacts 48 and 49, contact 48 being connected through the impedance coil 50 with the live pole of battery A, while contact 49 connects through conductor 51 with the talking strand 34 of the cord circuit.

The cord circuit itself is divided into two parts by condensers 52 and 53, the condensers being connected on one side with strands 32 and 34, and on the other side with the strands 54 and 55, which lead respectively to the tip and sleeve of the calling plug 56. The coil of relay 44 is connected between the talking strand 54 and the ground pole of battery A, while the coil of relay 15 is connected between the sleeve talking strand 55 and the live pole of battery A. The talking conductors 32 and 34 are connected with the windings 57 and 58 of the trunk repeating coil, these strands 32 and 34 being also connected respectively with the tip and sleeve contacts of the trunk multiple jacks 59. The inner terminals of the windings 57 and 58 are connected for conversational purposes by the condenser 60.

The trunk cord in the right hand exchange differs slightly from the trunk cord just described, the lower winding of relay 12' being connected with the ground terminal of battery B, and the upper terminal being connected to the contact 21' of relay 20', and the contact 16' of relay 18' being connected with the live pole of battery B'.

Having thus described my invention with respect to the circuits themselves I will now proceed to trace the operation as it would follow when the call would arise at station 1, and be connected through the two exchanges with the station 1'.

Subscriber No. 1 removes his receiver from his hook and displays his line signal in the usual manner. The answering operator seeing this signal, connects the answering plug of cord circuit 4 with the line terminal 3 and inquires the desired number. Finding the line of the desired subscriber to terminate in another exchange the operator by means of the usual order wire repeats this number to the trunk operator having charge of the trunk circuit 6'. This operator, observing that her busy signal lamp 31' is not displayed, responds, by designating to the subscriber's operator in charge of cord circuit 4 to connect with the trunk terminal 59. At the same time the trunk operator proceeds to connect her calling plug 56' with the multiple jack 5' of the desired subscriber's line. As soon as the subscriber's

operator connects her plug with the jack 59 current flows from the live pole of battery C through the sleeve cut-off relay, over the sleeve side of the multiple jack through conductor 34 and the coil of relay to ground, thus actuating the sleeve supervisory relay in the subscriber's cord circuit to display the supervisory signal, and also actuating relay 20 in the trunk circuit. The actuation of relay 20 closes contacts 30 and 35, thus completing the circuit of signal 31 from the live pole of battery A through contacts 30 and 35 of relay 20 and contacts 36 and 37 of relay 15 to ground. Signal 31 is thereby displayed to indicate to the trunk operator having control of the cord circuit 6 that the trunk with which this cord circuit is connected is now in use. This operator will not therefore designate this trunk to any subscriber's operator of the right hand exchange during the time the signal 31 is displayed.

When the trunk circuit 6' is connected with the desired subscriber's line, current will flow from the live pole of battery A' through the coil of relay 15' over the sleeve of the cord and jacks 5' and through the coil of the cut-off relay of line 1'. Current in this path, in addition to actuating the cut-off relay in the usual manner, actuates the relay 15', closing the contacts 14' and 23' and also the contacts 37' and 38'. The closing of contacts 14' and 23' connects the live pole of battery A' through contacts 22' and 21', the upper coil of relay 12', the trunk line conductor 7, the upper coil of relay 12, contacts 16 and 17 of relay 18, the now closed contacts 19 and 21 of relay 20, the lower coil of relay 12, the line trunk conductor 8, the lower coil of relay 12' to ground. Current in this path actuates both relays 12' and 12. The closing of contacts 37' and 38' of relay 15' closes the circuit of the signal 41' from the live pole of battery A through such signal, the normally closed contacts 39' and 40' of relay 18' and the contacts 37' and 38' to ground. This displays the signal 41'.

When the called subscriber answers his call the relay 44' is actuated in the usual manner by current from the ground pole of battery A' over the telephone line. The actuation of this relay closes contacts 42' and 47', thus closing the circuit of relay 18' and causing it to actuate. The actuation of relay 18' closes a locking circuit for itself through its own contacts 39' and 46' and effaces signal 41' by severing the circuit of said signal at contacts 39' and 40'. The actuation of relay 44' closes contacts 48' and 49' connecting battery through impedance coil 50', the conductor 51' through the coil of relay 20' to ground. This actuates the relay 20' and severs the circuit of relay 12' at contacts 21' and 22' of relay 20', the contacts of relay 18' being now in their actuated condition.

Relay 12 being in the circuit of relay 12' is now deenergized, and its contacts again assume their normal positions. The closing of contacts 26 and 27 connects battery from the live pole of battery B through the impedance coil 33, conductor 32 to the tip of the multiple terminal 59, and thence to ground through the tip supervisory relay of the cord circuit 4. This effaces the cord supervisory signal and indicates to the subscriber's operator that the called party has responded. The signals are now all effaced except signal 31, which remains displayed during the entire connection to indicate to the trunk operator in charge of circuit 6 that the trunk circuit is in use.

At the termination of the conversation the called subscriber hangs up his receiver and again opens the circuit of relay 44'. The deenergization of this relay severs the circuit of relay 20' and allows that relay to assume its normal condition and thereby again close the circuit of relays 12' and 12. The energization of relay 12 severs contacts 26 and 27 and removes the connection of the live pole of battery B from the tip of the jack 59, and thereby deenergizes the tip supervisory relay of the cord circuit 4, and allows the supervisory signal to be again displayed. Upon the display of this signal the operator removes her plug from the jack 59, and thereby severs the connection of battery C from the sleeve terminal of the jack 59. This severs the circuit of relay 20 and allows that relay to resume its normal position. Upon the release of relay 20, the circuit of relays 12 and 12' is again severed at contacts 19 and 21 of relay 20, thus allowing relay 12' to resume its normal position. Relay 18' now being locked in its actuated position the circuit of lamp 31' is closed from the live pole of battery through the lamp 31', contacts 29' and 30' of relay 20', contacts 24' and 25' of relay 12', contacts 28' and 45' of relay 18', contacts 42' and 43' of relay 44' and contacts 38' and 37' of relay 15' to ground. The display of this signal indicates to the operator in charge of the trunk circuit 6' that the subscriber 2 has terminated his conversation, whereupon the plug is severed from the jack 5' and the apparatus assumes its normal condition, the circuit of relay 18' being unlocked by the deenergization of relay 15'. The operation of this circuit is substantially the same when the call arises in the subscriber's station 1', in this case the signal 31' remaining displayed during the entire conversation to indicate to the operator having charge of the trunk circuit 6' that the trunk with which that circuit is connected is busy.

All of the usual auxiliary apparatus, such as ringing and listening keys, operators' sets, order wire connections, and busy testing devices have been omitted from the draw-

ing and description for the sake of simplifying the circuits but it is to be understood that any usual or well known apparatus may accompany this invention which will aid in its commercial application.

It may be readily seen that other means may be employed for keeping the trunk operators in touch with the condition of the trunk circuit, a part of which is under their control, and for this reason I do not wish to be unduly limited to the specific arrangement here shown and described. Neither do I wish to be unduly limited to the specific circuit arrangement, many other arrangements being possible without departing from the spirit or scope of my invention.

What I claim is:

1. The combination with a trunk circuit extending between different switchboard sections and adapted for reciprocal operation, of a plurality of terminals for said trunk at each end a visual signal located at each end of the trunk for indicating the idle or busy condition of the terminals at its own end of the trunk, substantially as described.

2. The combination with a trunk circuit, of a flexible terminal at each end thereof appearing before trunk operators, and multiple jacks at each end thereof appearing before subscribers' operators, of visible means to indicate to the trunk operator at each end when the trunk is in use by the subscriber's operator at said end, substantially as described.

3. The combination with a trunk circuit adapted for reciprocal operation, of multiple connecting jacks for said trunk appearing before the subscribers' operators at each end of the trunk, a flexible terminal for each end of said trunk appearing before other operators, and means whereby the latter operators may know at all times whether or not the trunk is in use, substantially as described.

4. The combination with a trunk line terminating at each end in a connecting jack, and a flexible cord, the flexible cord and connecting jack appearing upon different switchboard sections in the exchange, of a signal upon the switchboard at which the flexible cord is located for indicating when a connection is made with the jack at the other switchboard section at the same end of the trunk, substantially as described.

5. In a telephone system, the combination with a trunk for connecting telephone lines of different switchboards for conversation, said trunk terminating in a plug and a jack at each end, a signal associated with the plug at each end, and means for displaying one of said signals whenever a connection is established with the jack at its end of the trunk, substantially as described.

6. The combination with a trunk circuit, of a cord circuit at each end thereof adapted

to be connected with the trunk, and a telephone line at each end of the trunk with which the trunk is adapted to be connected, means actuated when a cord is connected with said trunk at one end for indicating to the trunk operator at said end that the trunk is in use, substantially as described.

7. The combination with a trunk circuit extending between different switchboard sections and having a switch socket and a flexible cord terminating in a connecting plug at each end of the trunk to adapt the same for reciprocal operation in inter-connecting telephone line circuits for conversation, of operator's connective circuits at each end of the trunk to establish connections with said sockets, a signal associated with each of said flexible cords and adapted to indicate the idle or busy condition of the trunk, substantially as described.

8. The combination with a trunk circuit extending between different switchboards, of a cord terminal at each end of said trunk located at the trunking section, a plurality of multiple terminals at each end of said trunk located upon the different subscribers' sections, a visual signal associated with each end of the trunk and located at the trunking section, said signal being adapted to indicate to the trunk operator when the trunk is in use by one of the subscriber's operators at the same end of the trunk, substantially as described.

9. The combination with a trunk circuit extending between different switchboard sections and provided with multiple terminals at each end of the trunk, a cord and plug associated with each end of the trunk for connecting the same with the lines of the different switchboards, a subscriber's cord circuit at each end of the trunk adapted to be connected with said multiple terminals, and a signal associated with each of the flexible cords, one of said signals being adapted to be displayed when a connection is established between the subscriber's cord circuit and a multiple terminal at its own end of the trunk, and the other of said signals being adapted to be displayed when a connection is established between the subscriber's cord circuit and one of the multiple terminals at the other end of the trunk, said signals being adapted to indicate the idle or busy condition of the trunk, substantially as described.

10. The combination with a trunk circuit adapted for reciprocal operation, of multiple connecting jacks for said trunk appearing before the subscribers' operators at each end of the trunk, a flexible terminal for each end of said trunk appearing before the trunk operators, and a signal to indicate to the trunk operator of one exchange when the trunk is in use by the trunk operator of the other exchange, substantially as described.

11. The combination with a trunk circuit adapted for reciprocal operation, of multiple connecting jacks for said trunk appearing before the subscribers' operators at each end of the trunk, a flexible terminal for each end of said trunk appearing before the trunk operators, a signal located before each of the trunk operators, the said signal at one end being used as a busy signal when a connection is established with one of the jacks at said end, and said signal being used as a disconnect signal by the trunk operator using the trunk, substantially as described.

12. In a telephone trunking system, the combination with a trunk line terminating at each end in a winding of a repeating coil, a relay at each end of the trunk, each having a coil permanently connected with a limb of said trunk line, a source of current at one end of the trunk, means to include said source in the circuit of said relays and both limbs of the trunk line in series, and auxiliary telephone circuits controlled by the actuation of said relays, substantially as described.

13. In a telephone trunking system adapted for reciprocal operation, the combination with a trunk line, of a cord circuit at each end of the trunk adapted to be connected with the trunk, and a telephone line at each end of the trunk with which said trunk may be connected, a supervisory relay associated with the cord circuit, a relay associated with the trunk circuit, the said relays at the same end of the trunk line being actuated in series when the cord is connected with the trunk, a signal associated with the trunk circuit displayed by the actuation of said trunk relay, a second supervisory relay associated with the cord circuit, means associated with the trunk circuit for completing the circuit of said second supervisory relay when a called party answers his call, and a supervisory signal associated with the cord circuit and controlled by said cord supervisory relays, substantially as described.

14. The combination with a trunk line extending between different exchanges and adapted for reciprocal operation, each of said trunks terminating before a trunk operator in a cord and plug, a signal at each end of the trunk adapted to be displayed when the trunk is connected with a called party's line and effaced when the called party answers his call, a second signal at each end of the trunk, said signal at one end of the trunk being displayed when the trunk is connected with a subscriber's line at the other end, the corresponding signal at said latter end being effaced during conversation but being adapted to be displayed when the conversation is terminated, substantially as described.

15. The combination with a telephone

trunk line adapted for reciprocal operation, flexible terminals permanently associated therewith at each end, multiple jacks also associated therewith at each end, the signal
5 at each end of the trunk associated with the flexible terminals, said signal being displayed when the flexible terminal is connected with a called subscriber's line and effaced when the called subscriber answers
10 his call, means to prevent the display of said signal when the called subscriber hangs up his receiver, a second signal associated with each of said flexible terminals, the latter signal at the end of the trunk being
15 then used as the outgoing end being dis-

played during the entire connection, said signal at the end of the trunk when used as the incoming end being effaced during the entire connection and being displayed when the connection is severed with the trunk at the outgoing end, substantially as described. 20

Signed by me at Chicago, county of Cook, and State of Illinois, in the presence of two witnesses.

CHARLES A. SIMPSON.

Witnesses:

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