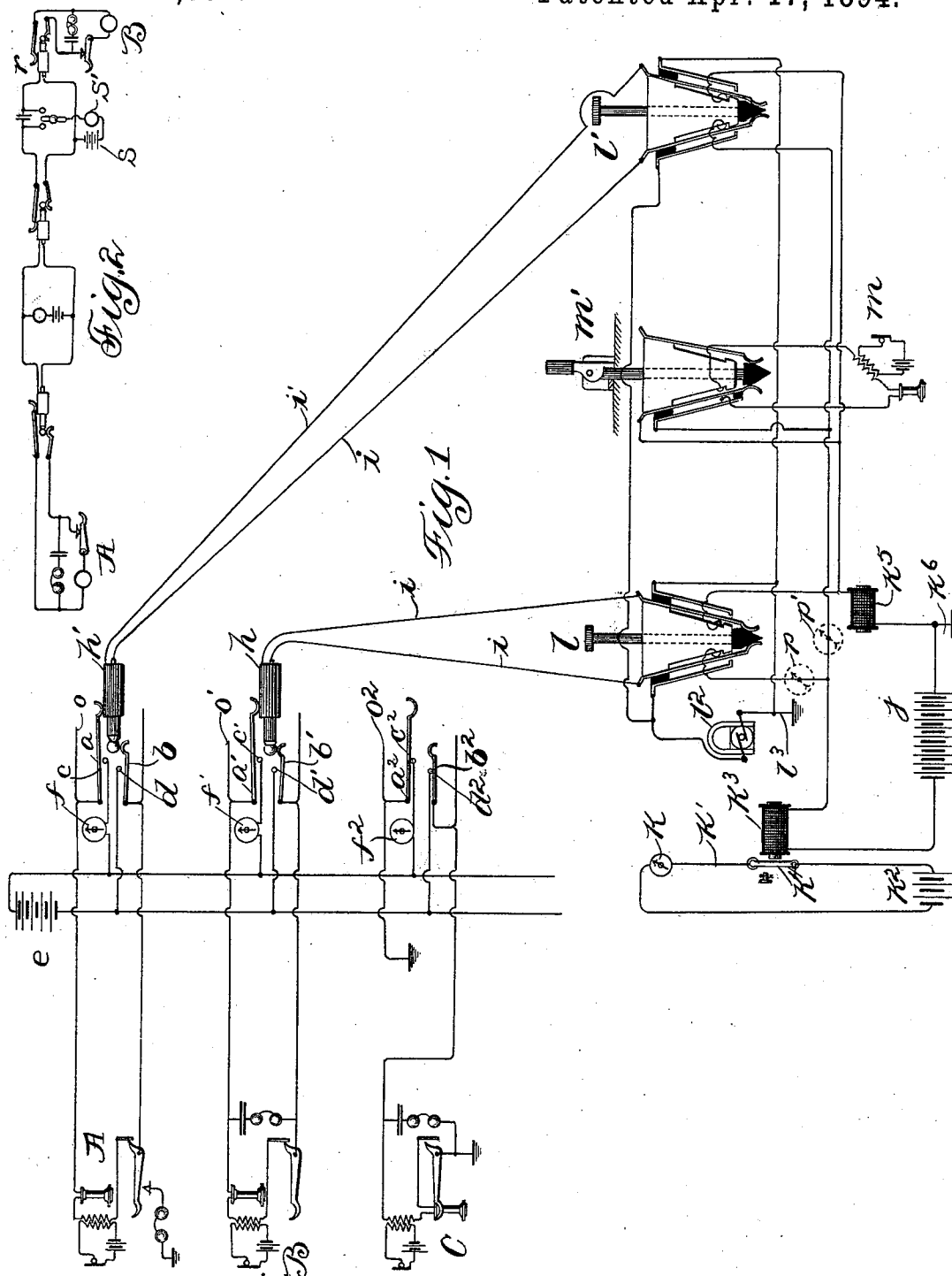


(No Model.)

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TELEPHONE SYSTEM.

No. 518,332.

Patented Apr. 17, 1894.



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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 518,332, dated April 17, 1894.

Application filed November 14, 1893. Serial No. 490,950. (No model.)

To all whom it may concern:

Be it known that we, JOHN I. SABIN and WILLIAM HAMPTON, citizens of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented a certain new and useful Improvement in Telephone Systems, (Case No. 5), of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our invention relates to telephone systems, and its object is to provide means whereby the subscriber may automatically signal the operator for connection and disconnection, by removing the telephone receiver from its hook in the first instance, and by replacing it thereon in the second instance, and further to provide means whereby one of two connected subscribers may transmit to the operator a selective signal indicating a desire for connection with another subscriber.

A further object of our invention is to obviate the necessity of the operator's bridging her telephone into circuit to determine whether or not the conversation is completed.

In an application, Serial No. 470,229, filed by us April 13, 1893, we have described a telephone system in which the subscriber closes a battery circuit through an individual indicator at the central office by the act of removing his telephone from the hook, the battery current being prevented from passing through the bell circuit by placing in the bridge containing the bell, a condenser, thereby rendering said bridge circuit opaque to the passage of the direct battery current.

Our invention, herein, in this particular, consists in placing the bell in a connection to ground from one limb of a metallic telephone line, the telephone set being included in a normally open branch between the two limbs of the line, whereby the subscriber by removing his telephone from the hook may close a circuit through his individual indicator at the central station, and whereby the operator may, by means of a grounded generator send a calling current to the subscriber over one limb of the metallic circuit, with return through ground.

Our invention further consists in the union in one exchange, of telephone lines embody-

ing the above mentioned features, with telephone lines as set forth in the application heretofore referred to.

Our invention further consists in a trunk line system as hereinafter described.

Our invention further consists in such features as will be hereinafter set forth.

We will describe our invention in connection with the accompanying drawings, in which—

Figure 1 represents three subscribers' lines extending to a central station, two of the subscribers being connected thereat for conversation. Fig. 2 represents our system as applied to divided boards, the several boards being connected together by a trunk line.

Like letters refer to like parts throughout both the figures.

We will first describe our invention as illustrated in Fig. 1, which shows the subscribers' lines extending to a switch board at the central station, which may either be a single board or one section of a multiple switch board, following out the several operations necessary for connecting two subscribers for conversation. We have illustrated but a single board, it being understood that in a multiple system the telephone lines will likewise extend to spring jacks upon the other boards.

Each subscriber is connected with a spring jack at the switch board at the central station. The spring jacks o, o', o'' , comprise each a pair of springs, $a, b, a' b', \&c.$, adapted to make contact respectively with the sleeve and the tip of a plug adapted to be inserted therein. The springs normally rest against contact anvils $c, d, c' d', \&c.$, which are connected to the opposite sides of a source of electricity, such as a battery e , a galvanometer f , or other device responsive to the passage of an electric current being provided in one of the connections and mounted upon the board so that it may be observed by the operator. The several circuits thus formed through the individual indicators $f f'$ and the battery e are normally open at the subscriber's station to the passage of the continuous battery current, while means are provided at the subscriber's station whereby he may close the circuit, thus completing the battery circuit through his particular individual indicator to signal the operator for

connection. We preferably secure the normal opening of the circuit at the subscriber's station by so arranging the telephone hook that when the telephone is hung thereon the circuit is maintained open, but is closed when the telephone is removed therefrom.

At stations B and C the subscriber's bell is shown included in a bridge across the telephone set, the bridge including a condenser that prevents the passage therethrough of the continuous battery current, while permitting the unobstructed passage of alternating or pulsatory currents from the operator's generator. This method of connecting in circuit the subscriber's bell, in connection with the calling apparatus employed, forms the subject matter of the application hereinbefore referred to, and in its individual capacity forms no part of the present application.

At station A, the subscriber's bell is shown in a ground connection which is closed so long as the telephone is upon its hook, whereby the operator may send calling signals either from a grounded battery or a grounded generator over one limb of the metallic circuit, the calling currents being thus provided with a ground return.

The central station apparatus comprises a number of pairs of plugs,—but one pair h, h' , being shown in the drawings—each plug being provided with a tip adapted to make contact with the shorter of the line springs, and with a sleeve adapted to make contact with the longer of the line springs. The tips and the strands of the plugs are respectively connected together by tip and sleeve strands i, i' . In a bridge between the two strands is included a battery j .

The clearing out indicator k is shown included in the local circuit k' supplied by a battery k^2 . A magnet k^3 serves when excited to attract its armature k^4 , thereby closing the local circuit. A balancing coil k^5 is included in the circuit upon the side of the ground connection k^6 opposite that in which the magnet k^3 is included, thus furnishing a balance of the line for electrostatic discharges.

Ringing keys l and l' are provided, adapted when depressed to sever the connection between the plugs and to connect one of the plugs with the calling generator l^2 . Thus when key l is depressed the plug h is disconnected from plug h' and is connected in circuit with the generator, while when key l' is depressed plug h' is so connected. A ground connection l^3 is provided from one side of the generator to furnish a return for the calling current when a non-metallic calling circuit is employed.

The operator's telephone set m is included in a bridge between the tip and sleeve strands, a bridging-in key m' being provided adapted to connect or disconnect the telephone set.

We will now describe the various operations necessitated by the connection of two subscribers for conversation. Suppose sub-

scriber A desires to talk with subscriber B; he removes his telephone from the hook thus completing the circuit of battery e through individual indicator f , thereby informing the operator that subscriber A desires a connection. The operator inserts plug h' into spring jack o , the springs a, b , being thereby moved away from the contact anvils c, d , to open the circuit through the individual indicator f . The operator next throws down the handle of her bridging-in key m' , thereby throwing her telephone set in circuit with subscriber A. Having received from subscriber A instructions to make connection with subscriber B, she inserts plug h into spring jack o' . If subscriber B is engaged in conversation with some other subscriber through a connection at another board there will be a difference of potential between springs a' and b' , and the closing of the circuit through the operator's telephone by the insertion of the plug will cause a click in her telephone, indicating to her that the line is busy. If the line be not busy, she depresses ringing key l , thereby sending current from the alternating current generator l^2 over the line and ringing the bell of subscriber B, the alternating current passing freely through the bridge containing the condenser and bell. Subscriber B, having removed his telephone from its hook is in communication with subscriber A. The operator learning that the subscribers are in conversation cuts out her telephone set. It will be observed that when each subscriber has an individual clearing out indicator, as indicated in dotted lines, the operator may cut out her telephone as soon as the plug has been inserted in the spring jack of the called subscriber, the fact that the called subscriber has responded and is in conversation being indicated by the visual signal of his individual clearing out indicator, nor is she at the necessity of bridging her telephone into circuit from time to time to learn if the subscribers are through conversation and have forgotten to ring off, for so soon as the subscriber hangs up his telephone at the completion of the conversation, the clearing out indicator visually conveys this fact to the operator. When divided boards are used the same information may be conveyed to the operator with the use of but one clearing out indicator as will be more fully explained hereinafter. Should the operator desire to send a calling current to subscriber A it would return to the generator by the ground connection l^3 .

So long as the subscribers are connected for conversation, current flows through the helix of magnet k^3 , thus maintaining closed the local circuit k' . So long, therefore, as the lines are thus connected, the clearing out indicator gives a visual signal that the lines are in use. When, however, both subscribers have hung up their telephones, current ceases to flow through the helix of magnet k^3 and the clearing out indicator ceasing to give the

visual signal the operator knows that the subscribers are through conversing and removes the plugs.

Instead of providing a local circuit for the clearing out indicator, the same may be placed in the position occupied by the magnet l^s , or two clearing-out indicators may be used as indicated in dotted lines at p and p' . In the latter case, indicator p will cease to give its visual signal when B hangs up his telephone, while indicator p' will not cease to give its visual signal until A has hung up his telephone.

It often happens that a subscriber after having completed conversation with one subscriber desires connection with another subscriber; when two clearing out indicators are employed, the operator noting that one of the subscribers has indicated his desire for disconnection while the other has not, will bridge her telephone set into the line and inquire of the subscriber who has not indicated his desire for disconnection, whether he desires connection with another subscriber. With our system we are able to accomplish a greatly desired object, which is that of enabling the subscriber to transmit to the central office clearly a calling signal that the operator will distinguish from a clearing out signal. With clearing out annunciators as heretofore used it has been impossible for the operator to determine, without listening in whether a signal received upon the clearing out annunciator when two subscribers are connected together means simply a wish to be disconnected, or a wish on the part of one or both the subscribers for new connections, or a completion of the old connection. The necessity for the operator to listen in is an obstruction to rapidity of service and the inability of the operator to distinguish between a calling and a disconnecting signal prevents the operator giving the prompt attention to the former which the latter does not require. In our system the distinction between a calling and clearing out signal may be secured by moving the telephone hook up and down repeatedly for the former, while merely hanging the telephone on the hooks signifies the latter.

The trunk line feature of our invention will be now described. In Fig. 2 two subscribers A and B are shown connected together through a trunk line. A condenser r is placed in one side of the trunk line, and contact points are provided upon each side thereof so that the battery s and indicator s' may be closed upon either side of the condenser. When the switch arm is to the right the battery is in circuit with subscriber B, so that so soon as he hangs up his telephone, indicator s' displays the visual signal for disconnection. The operator may then throw the switch arm to the left and if the trunk line is open, the battery circuit remaining open, the indicator will inform her of the fact. The switch may remain to the left while the trunk line is not

in use, so that so soon as the operator at the first board inserts a plug in the spring jack connected with the trunk line, the indicator will be actuated to signal the operator that a connection through the trunk line is desired. While the subscribers, A and B, are in conversation the switch lever is to the right so that the indicator in the cord connectors is controlled by the switch at the station of subscriber A, the visual signal of disconnection being displayed as soon as the battery circuit is opened at A's station, the condenser in the trunk line preventing the switch at B's station from affecting the said indicator. When this system of divided boards is used the operator after she has received the number of the called subscriber need not bridge her telephone into circuit again since the visual signal of the indicator notifies the operator when the conversation has been completed, or whether or not she is to bridge her telephone into circuit to receive an order for a new connection with some other subscriber.

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The combination with a metallic circuit telephone line, of a connection to ground from one limb thereof, a bell, or other signal device included in said ground connection, a grounded generator at the central station adapted to be connected to the grounded limb of said metallic circuit, a calling indicator and a battery included in a bridge between the limbs of said metallic circuit at the central station, and means for cutting said bridge from circuit by the act of connecting with the line, substantially as described.

2. The combination with a metallic circuit telephone line, normally open at the subscriber's station, of a normally closed ground connection from one limb of said metallic circuit containing a bell, or other signal device, a telephone hook adapted, when the telephone is removed therefrom to close said telephone line circuit and open the grounded connection a grounded generator at the central station adapted to be connected with the grounded limb of said metallic circuit, a calling indicator and a battery included in a bridge between the limbs of said metallic circuit at the central station, and means for cutting said bridge from circuit by the act of connecting with the line substantially as described.

3. The combination with a telephone line extending to spring jacks at the central station, of a source of electricity and an individual indicator bridged between the limbs of said line, means for closing the circuit at the subscriber's station, and a plug adapted to be inserted into the spring jack at the central station to open the bridge containing said source of electricity and said individual indicator, substantially as described.

4. The combination with a metallic circuit telephone line extending to spring jacks at the

central station, of a source of electricity and an individual indicator bridged between the limbs of said line, means for closing the circuit at the subscriber's station, and a plug adapted to be inserted into the spring jack at the central station to open the bridge containing said source of electricity and said individual indicator, a ground connection from one of the limbs of said line containing a subscriber's bell, or other signal device, and a grounded generator at the central station adapted to be connected to said grounded limb through said plug, substantially as described.

5. The combination with two metallic circuit telephone lines connected together at the central station through a pair of cord conductors, of a grounded generator included in a normally open bridge between the strands of said cord conductors, a bridge across the telephone set at one of the subscribers' stations, containing a signal device and a condenser, and a connection to ground at the other subscriber's station from one limb of his metallic circuit, said connection containing a signal device, substantially as described.

6. The combination with a subscriber's metallic circuit containing his telephone set and extending to the central station, of a subscriber's grounded circuit containing his telephone set and extending to the central station, a connection containing a signal device extending from one limb of said metallic circuit to ground, a connection containing a signal device and a condenser extending from the metallic limb of said grounded line to ground, and a pair of plug conductors connecting said lines at the central station, a grounded generator included in a normally open bridge between the strands of said cord conductor, substantially as described.

7. The combination with a subscriber's metallic circuit containing his telephone set and extending to the central station of a subscriber's grounded circuit containing his telephone set and extending to the central station, a bridge at the subscriber's station between the limbs of said metallic circuit, containing a signal device and a condenser, a connection to ground from the metallic limb of said grounded circuit containing a signal device and a condenser and a pair of plug conductors connecting said lines at the central station, a battery and a calling indicator in a bridge between the two sides of each of said lines at the central station, and means for cutting said bridges from circuit by the act of connecting with the lines substantially as described.

8. In a telephone-system, the combination of a subscriber's circuit composed of two line-wires normally separated at the subscriber's station, a local circuit at the switching-station in which is included a calling-indicator and a battery, and four-point spring jack

connections at the switch-board by which the two wires of the subscriber's line are connected to the said local circuit; a shunt or short circuit adapted to close the two sides of the subscriber's line, and a switch-lever having two anvils or contacts, to one of which said shunt is connected, and to the other of which is connected a bell-signal and a "ground;" and a grounded generator at the central station adapted to be connected with the line the lever of said switch being the subscriber's telephone-hook; whereby the circuit of the indicator-battery is closed through the indicators by the act of removing the telephone from its hook, and one side of the subscriber's line is grounded through the bell-signal when the telephone is hanging on its hook, as hereinbefore described.

9. In a trunk line, the combination with a condenser in one limb thereof, of a battery and an indicator in a bridge between the two limbs of said trunk line, and means for connecting said bridge upon either side of said condenser, substantially as described.

10. In a trunk line, the combination with a condenser in one limb thereof, of a battery and an indicator in a bridge between the two limbs of said trunk line, and a switch for changing the location of said bridge from one side of said condenser to the other side thereof, substantially as described.

11. The combination with a trunk line provided upon its ends with contact terminals whereby connection may be made therewith, of a battery in a bridge of said line, an indicator in circuit therewith, and a condenser in one of the limbs of said line; whereby the circuit of the battery through said indicator can be controlled from one end only of said line, substantially as described.

12. The combination with a trunk line provided upon its ends with contact terminals, whereby connection may be made therewith, of a battery in a bridge between the two sides of said line when connection is made through said trunk line, an indicator in circuit with said battery, and a condenser in one side of the line; whereby the circuit of the battery through said indicator can be controlled from one end only of said line, substantially as described.

13. The combination with the limbs of a trunk line connected at one end with the terminals of a spring jack switch, and at the other end with the terminals of a cord plug, of a condenser in one limb of said trunk line, and a bridge containing a battery and an indicator adapted to be connected to the limb containing the condenser between said condenser and the cord plug, substantially as described.

14. The combination with the two limbs of a trunk line, of an indicator in circuit therewith adapted to be actuated by the insertion of a plug in the switch end of said trunk line,

said indicator adapted to serve as the clearing out indicator of a called subscriber when the plug of said trunk line is inserted in the switch of said subscriber, substantially as described.

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15. The combination with the two limbs of a trunk line, of an indicator in circuit therewith adapted to be actuated by the insertion of a plug in the switch end of said trunk line,
10 and means for switching said indicator in po-

sition to serve as the clearing out indicator of a called subscriber, substantially as described.

In witness whereof we hereunto subscribe our names this 1st day of November, A. D. 1893.

JOHN I. SABIN.

WILLIAM HAMPTON.

Witnesses:

JNO. LAWRENCE,

JNO. A. MALLORY.