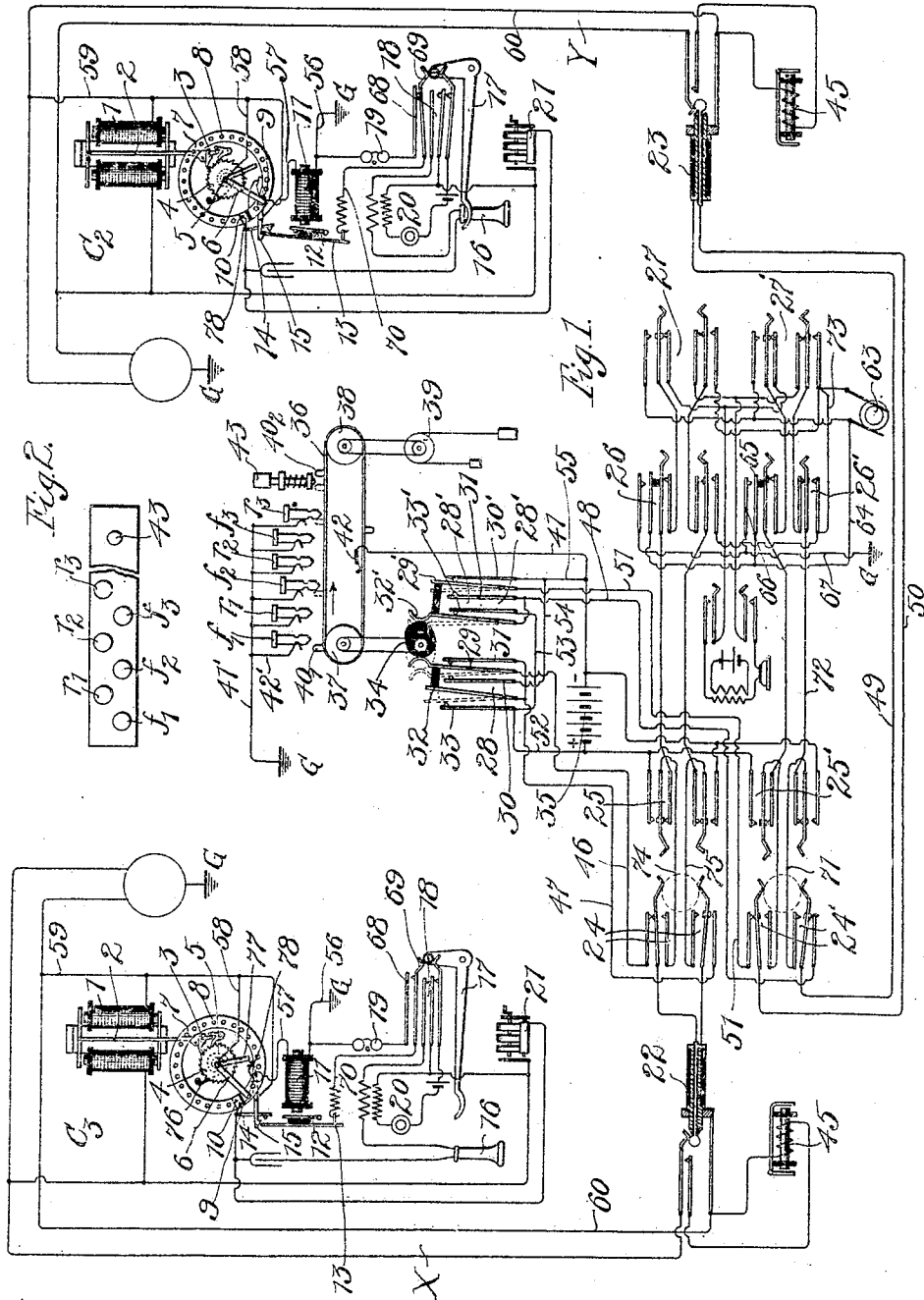


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G. BABCOCK.
MULTIPARTY LINE EXCHANGE SYSTEM.

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MULTIPARTY-LINE EXCHANGE SYSTEM.

No. 824,701.

Specification of Letters Patent.

Patented July 3, 1906.

Application filed November 30, 1903. Serial No. 183,114.

To all whom it may concern:

Be it known that I, GARRISON BABCOCK, 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 Multiparty-Line Exchange Systems, 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.

My invention relates to multiparty-telephone exchange systems, and has for its object improved central-exchange apparatus and connections whereby the central operator may more readily establish circuit conditions necessary for such systems.

My invention is particularly adaptable to a system such as described in my Patent No. 763,351, dated June 28, 1904, in which it is necessary for the operator to successively send setting-up current, locking-current, signaling-current, and restoring-current into the line to properly adjust or rearrange subscribers' substation apparatus, whereby to selectively signal and connect subscribers together for conversation and to restore the system to its normal condition after conclusion of the conversation. In such systems heretofore it has been necessary for the operator to connect the cord apparatus with one plug of the cord-circuit to set up the necessary circuits at the substations connected with the calling-line and then to connect the central apparatus with the other plug of the cord-circuit to set up the necessary circuit conditions at the substations connected with the called line. This operation occasioned great loss of time, and the features of my present invention are embodied in an improved operator's cord-circuit which enables the central apparatus to be associated with both plugs of the cord-circuit at the same time, whereby the necessary circuit conditions on both the calling and called lines may be simultaneously established, thus reducing the time consumed to a minimum.

I also provide improved means for automatically connecting the desired substations into telephonic communication with the line and automatically excluding all other substations from the line. For this purpose I employ a contact which is caused to travel

under a plurality of contact-buttons arranged in staggered arrangement, as shown in Figure 2, one line of buttons being associated with the front plug and the other line being associated with the rear plug, each button corresponding to one of the substations connected with the line with which the corresponding plug is associated. If connection is desired between two substations and the rear and front plugs being associated respectively with the calling and called lines, the button corresponding in number to the calling subscriber is depressed and the button corresponding in number to the called subscriber is also depressed and brought into the path of the traveling contact.

Switching mechanism for associating pulsating current with the lines is adapted to be actuated in harmony with the traveling contact, and this pulsating current serves to step forward switch-arms at the substations, and when the switch-arms are in a certain position the traveling contact at the central exchange will be in contact with the corresponding depressed buttons and a circuit will be established through additional substation apparatus, whereby the desired subscribers are telephonically connected with the line and all other subscribers are locked out.

In Fig. 1 I have diagrammatically shown a multiparty-line telephone system and my improved cord-circuit associated therewith, Fig. 2 showing the arrangement of the buttons associated with a cord-circuit.

At each substation there is a polarized electromagnet 1, whose armature is provided with an arm 2, terminating in pawl mechanism 3. A ratchet-wheel 4, mounted upon a shaft 5, is engaged by said pawl mechanism to step forward a switch-arm 6, secured to the shaft. The end of said arm 6 travels over a ring 7, provided with a plurality of equally-spaced holes 8, into any one of which may be placed a contact-pin 9, adapted to be engaged by the arm 6 upon its rotation about the ring 7. The contact 10 is disposed above the ring, but insulated therefrom, and the arm 6 is normally in engagement with said contact. A relay 11 is connected in circuit between the contact-pin 9 and the earth and controls an armature 12, to which is secured a switch-arm 13, adapted when

the armature is attracted to close contact with the contact-spring 14, and a detent lever 15 serves to maintain contact between the switch-arms 13 and spring 14. A receiver 16 normally rests on the switch-hook 17, which engages the switch-springs 18 to normally include the signal-bells 19 in circuit. A local transmitter-circuit 20 is also associated with the switch-springs 18, and by means of a calling-generator 21 the subscriber may signal the central exchange.

At the central exchange I have shown a cord-circuit provided with a rear plug 22 and a front plug 23, the rear plug engaging the spring-jack connected with the line to which is connected the calling subscriber C^1 and the front plug being inserted in the spring-jack connected with the line to which is connected the called subscriber C^2 . The selective keys 24 and 24', release-keys 25 and 25', selective ringing-keys 26 and 26', and metallic ringing-keys 27 and 27' are respectively associated with the rear plug and the front plug of the cord-circuit. Circuit-changing switch mechanism 28 is associated with the rear plug, and circuit-changing mechanism 28' is associated with the front plug. The circuit-changing mechanism 28 consists of an actuating-spring 29, adapted to alternately engage springs 30 and 31, and a spring 32 is connected with but insulated from the switch 29 and alternately makes and breaks contact with a switch-spring 33. The circuit-changing mechanism 28' consists of a spring 29', adapted alternately to engage springs 30' and 31', and an actuating-spring 32' is rigidly secured to but insulated from the spring 29' and alternately makes and breaks contact with the spring 33'. A cam 34 of insulating material revolves between the actuating-springs 29 and 32', whereby the circuit-changing mechanisms are actuated to alternately short-circuit the lines connected therewith and to connect with said lines a source of current 35, whereby current impulses are sent through the substation electromagnets 1 to step forward the switch-arms 6.

After the switch-arms 6 at the desired substations have traveled to engage the associated contact-pin 9 it is desirable that a current be sent from the substation through the relay 11 to telephonically connect the desired subscribers with the line. At the central exchange I associate a plurality of actuating-buttons with each plug, these buttons being preferably disposed in staggered arrangement, as shown in Figs. 2, the front row of buttons $f^1 f^2 f^3$, &c., being associated with the front plug, while buttons $r^1 r^2 r^3$, &c., in the rear row are associated with the rear plug, there being sufficient buttons in each row to provide for any number of substations on a line, each substation being represented by a button. Below these buttons I dispose an endless conductor, which may be in the shape

of a band 36, adapted to travel over carrier-wheels 37 and 38. The wheel 38 may be driven by weight mechanism 39, as shown, or may be actuated by spring or other means, while the carrier-wheel 37 is in driving relation with the cam 34. Equally-spaced contact-ridges 40 project from the band 36 and serve to engage and to restore the keys which have been depressed. The band 36 is continually connected with the negative side of the battery 35 through a conductor 41 and a wiper-contact 42, while the buttons f^1 , &c., and r^1 , &c., are continually in connection with the earth through a conductor 41' and contact-springs 42'.

The operation of the system is as follows: Suppose the calling subscriber to be C^1 , connected with line X, and the called subscriber to be C^2 , connected with line Y. Normally the switch-arms 6 are in engagement with their contacts 10, and the receivers are on the hook. The subscriber by actuation of the calling-generator 21 may actuate the indicator-signal 45 at the central exchange, in reply to which signal the operator inserts one of the plugs into the jack connecting the line X, the plug in the illustration being the rear plug. After central ascertains the desired substation, which in this case is supposed to be C^2 , she inserts the other plug in the spring-jack connecting with the telephone-line Y. She now actuates the selective keys 24 and 24' and depresses actuating-buttons f^2 , corresponding with substation C^2 , and actuating-button r^2 , corresponding with substation C^1 . One of the contact-ridges 40' is disposed at the left of the actuating-buttons just in front of the button f^1 . The starting-key 43 has been pulled upwardly, as shown, to release the contact-ridge 40' to allow the weight mechanism to revolve the band 36, at the same time revolving cam 34, the cam in the figure being shown as just depressing the actuating-spring 32', and when said actuating-spring and the associated spring 29' are fully depressed to the right and the actuating-spring 29 and the associated spring 32 are entirely retracted toward the right the contact-ridge 40' will be directly below the actuating-button f^2 , and the circuit-changing mechanism 28 serves to short-circuit the line X through the following circuit: actuating-spring 29, conductor 46, through the selective key 24 to the tip of the rear plug, thence through the substations on the line, back to the sleeve of the rear plug, to the selective key 24, to conductor 47, and to spring 31, any static charge on the line being thus removed. The circuit-changing mechanism 28', however, sends a positive impulse through the substations on line Y through the following circuit: actuating-spring 32', conductor 48, selective key 24', conductor 49, to the sleeve of the front plug 23, through the substation apparatus on line C^2 , back to the tip of the

front plug to conductor 50, through the selective key 24', conductor 51, spring 29', spring 30', conductor 41, to the battery 35, conductor 52, conductor 53, and spring 33'.

5 This current impulse is in a direction to actuate the electromagnets 1 at each of the substations on line Y, and the switch-arm 6 at the substations will be stepped forward to be disposed over the first hole in the ring 7.

10 When the ridge 40' has passed to a position below the actuating-button r' , the cam 34 will have rotated one-half revolution to the position shown in dotted lines, and the switch mechanism will be in the dotted position, as

15 shown. Switch mechanism 28 now closes the following circuit: from the positive side of the battery 35 to conductor 52, to spring 33, spring 32, conductor 47, selective key 24, sleeve of the rear plug, through the electro-

20 magnets 1 on line X, back to the tip of the rear plug, through the selective key 24, through the conductor 46, spring 29, spring 30, conductor 54, conductor 55, and back to the negative side of the battery. The

25 electromagnets on line X will be actuated to step the switch-arm 6 forwardly to be disposed over the first hole, as shown at substation C². The switch mechanism 28', however, short-circuits the line Y through the

30 following circuit: spring 29', spring 31', conductor 48, selective key 24', conductor 49, the sleeve of the front plug, through the line Y, back to the tip of the front plug, to conductor 50, through the selective key 24', to

35 conductor 51, and back to spring 29'. Any static charge on line Y is thus removed. When the contact-ridge 40' assumes a position below the depressed button f^2 , as shown in dotted lines, the cam 34 will have rotated

40 a complete revolution back to the full position and line X is again short-circuited, while another impulse is sent from the battery through the switching mechanism 28' into line Y to actuate electromagnets 1 to step the

45 switch-arms 6 to be disposed over the second hole. However, at the called substation C² a contact-pin 9 is inserted in the second hole, and after this second actuation of the electromagnets 1 the switch-arms 6 at substation C² is in contact with the pin 9. Also at

50 the same time the contact-ridge 40' is in contact with the depressed button f^2 at the central exchange and the following circuit established: from the negative side of the battery 35 to conductor 41, wiper-contact 42,

55 contact-band 36, contact-ridge 40', actuating-button f^2 , spring 42', conductor 41', to the ground and thence through the ground conductor 56 at the substation C² through the relay 11, through conductor 57, to the pin 9, through the arm 6, through conductor 58, to conductor 59, to conductor 60 of the line Y, to the sleeve of the front plug, to the conductor 49, through the selective key 24',

65 conductor 48, actuating-spring 32', spring 33', conductor 53, and through conductor 52 back to the positive side of the battery. The relay 11 at substation C² is thus energized to attract its armature 12, and the switch-lever 13, connected therewith, into en-

70 gagement with the contact 14, and the detent-lever 15 drops to maintain this engagement. Relays 11 at the other substations will not be energized, as substation C² is the only one in

75 which a contact-pin 9 is inserted in the second hole, and as the arms 6 at all the other substations are moved away from their normal contact 10 circuit through the receivers 16 at all the substations will be broken and the subscribers locked out. However, as at

80 substation C² the relay 11 has been energized to close contact between the switch-lever 13 and contact 14, the receiver 16 at this substation will be connected with the line through the contact 14, switch-arm 13, and

85 detent 15 instead of being normally connected with the line through the contact 10 and switch-arm 6. When the contact-ridge 40' is in contact with the depressed actuating-button r^3 , the switching mechanisms 28 and

90 28' will have been actuated to bring all the switch-arms 6 into position over the third hole, and the following circuit will be established through the relay 11 at the substation C³:

95 from the negative side of the battery 35, conductor 41, contact 42, contact-band 36, contact-ridge 40, actuating-button r^3 , spring 42', conductor 41', ground G, thence to the ground conductor 56 at substation C³, relay 11, contact-pin 9, switch-arm 6, conductor 58, con-

100 ductor 59, to conductor 60 of the line X, to the sleeve of the rear plug, through the selective key 24, to conductor 47, to spring 32, spring 33, and conductor 52 back to the positive side of the battery. Relay 11 at substation C³ will now become energized to close

105 contact between the switch-lever 13 and contact 14, and the detent 15 will drop to maintain this connection, relay 11 being the only one connected with line X, which is energized, as at no other of the substations is

110 there a contact-pin in hole No. 3, and, as in line Y, all the other substations will be disconnected and locked from the circuit, the receiver at the substation C³, however, being

115 connected with the line by virtue of the switch-lever 13, contact 14, and detent-lever 15. The arms 6 are stepped around to pass beyond the entire number of holes corresponding with the number of subscribers connected

120 with the line, and when the arms have thus reached the end of their rotation the contact-ridge 40' will be engaged by the starting-button 43, and the actuating-cam 34 will remain stationary. Having thus connected the desired subscribers to the telephone-line and

125 excluded all others, the central operator releases the selective keys 24 and 24' and actuates the ringing-key 26' to send a ringing-current through the following circuit: from the

130

ringing-generator 63 to conductor 64, through spring 65, spring 66, conductor 67 to ground, thence to the ground-conductor 56 at the substation C³ through the signal-bell 19, through the spring 68, spring 69, to conductor 70, switch-lever 13, contact 14, detent 15, conductor 59, conductor 60, to the sleeve of the front plug, to conductor 49, through selective key 24', which is now closed, to conductor 71, through the release-key 25', to conductor 72 and through the actuated ringing-key 26' to conductor 73, back to the generator 63. The called subscriber C² upon receiving the signal removes the receiver from the hook, and subscribers C³ and C² are in telephonic communication. Upon the completion of a conversation the central operator actuates the releasing-keys 25 and 25' to establish the following releasing-circuit: from the positive side of the battery through the release-key 25, to conductor 74, through the selective key 24, to the tip of the rear plug, through the electromagnets 1, connected with the line X, to the sleeve of the rear plug, through the selective key 24, conductor 75, through the actuated release-key 25 and back to the negative side of the battery. The direction of this current is opposite to the setting-up current sent into the line by the switching mechanism 28 and 28', and consequently the polarized electromagnets 1 are energized to withdraw the pawl mechanism 3 from the ratchet-wheels 4 to allow springs 76 to return the switch-arms 6 to their normal contacts 10. In the same manner an actuation of release-key 25' will send a current into the line Y to energize electromagnets 1 to release the switch-arms 6 on said line. At each substation there is also provided a cam-arm 77, adapted to engage the cam-surface 78 at the rear of the detent lever 15, and as said cam-arms are rotated backward upon release by the electromagnets this cam-surface is engaged, whereby the detent-levers at substation C³ C² are raised out of latching engagement with the switch-levers 13, whereby contact between said switch-levers and contacts 14 is broken. Thus upon simultaneous action of keys 25 and 25' all the substation apparatus is simultaneously brought to the normal condition, and central may withdraw the plugs from the jacks.

I also provide ringing-keys 27 27', which enables the operator to connect a substation, such as shown, with a foreign telephone-circuit in which the signal-bells at the substations are connected in bridge of the metallic limbs of the line. If either the called or calling substation be one at which the signal is connected in bridge of the metallic limbs, the central operator actuates either of the metallic ringing-keys 27 or 27', and thus may signal said substation, it being in this case necessary to actuate only the selective keys

and the release-keys connected with the plug which is in association with the multi-party-line.

I thus provide a cord-circuit by means of which it is possible for the operator to establish necessary circuit conditions and to give the necessary signals at the calling and called substations at the same time, thus reducing the time consumed to a minimum. The apparatus which I associate with the cord-circuit is also entirely automatic, the mere actuation of an actuating-button serving to set the apparatus in motion and to check it at the proper instant, all the parts of the apparatus coöperating to produce certain results at the proper instant.

As many modifications may be made without departing from the spirit of the invention, I do not wish to be limited to the exact arrangement as shown; but,

Having described my invention, I wish to secure by Letters Patent the following claims:

1. In a telephone-exchange system, the combination with a central exchange, of telephone-lines, leading therefrom, substations connected with each telephone-line, a cord-circuit at the central exchange, a front and a rear plug for said cord-circuit, a make-and-break switching mechanism associated with each plug, a source of current, and means for alternately actuating said switching mechanisms to repeatedly connect each plug, first with said source; then to cause short-circuiting thereof.

2. In a telephone system, the combination with a central exchange, of telephone-lines leading therefrom, a plurality of substations connected with each line, an operator's cord-circuit at the central exchange, a front and a rear plug for said cord-circuit, a source of current, keys in said cord-circuit for connecting said source of current with said plugs, a make-and-break switching mechanism for each plug associated with said keys and said source of current, a common means for alternately actuating said switching mechanisms to repeatedly connect each plug, first with said source and then to cause short-circuiting thereof.

3. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, a plurality of substations connected with each line, an operator's cord-circuit at the central exchange, a front and rear plug for said cord-circuit, a source of current, keys for connecting said source of current with said plugs, circuit-changing switching mechanism connected with said source of current and said keys, and means for actuating said switching mechanism to alternately interrupt the current-flow from said battery whereby current pulsations are sent through both plugs into the lines connected therewith, and to alternately

short-circuit the plug-conductors whereby the lines connected to said plugs are substantially simultaneously short-circuited, substantially as described.

4. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, substations connected with each telephone-line, an operator's cord-circuit, a front and rear plug for said cord-circuit, a source of current, independent switching mechanism for each plug connected with said plugs and said source of current, and, means for automatically actuating said switching mechanisms to repeatedly interrupt the current-flow to send pulsating currents through both plugs and into the telephone-lines connected therewith, and to short-circuit the cord conductors when the flow therethrough is interrupted, substantially as described.

5. In a telephone-exchange system, the combination with a central exchange, of telephone-lines extending therefrom, substations connected with each line, an operator's cord-circuit, a front and rear plug for said cord-circuit, a source of current, an independent key in said cord-circuit for each plug for connecting said source of current with said plugs, independent switching mechanism for each plug interposed between said source of current and said keys, and means for actuating said switching mechanisms to repeatedly interrupt the current-flow whereby current pulsations may be alternately sent through both plugs and into the lines connected therewith, substantially as described.

6. In a telephone-exchange system, the combination with a central exchange, of telephone-lines extending therefrom, substations connected with each line, an operator's cord-circuit, a front and rear plug for said cord-circuit, a source of current, an independent key in said cord-circuit for each plug for connecting said source of current with said plugs, independent switching mechanism for each plug interposed between said source of current and said keys, means for actuating said switching mechanisms to alternately interrupt the current-flow whereby current pulsations may be alternately sent through both plugs and into the lines connected therewith, and to alternately short-circuit the cord conductors whereby the telephone-lines connected with said plugs are alternately short-circuited to relieve them from static charges, substantially as described.

7. In a telephone-exchange system, the combination with a central exchange, of telephone-lines extending therefrom, substations connected with each line, an operator's cord-circuit, a front and rear plug for said cord-circuit, a source of current, an independent key in said cord-circuit for each plug for connecting said source of current with said plugs, independent switching mechanism for each

plug interposed between said source of current and said keys, means for actuating said switching mechanisms to repeatedly interrupt the current-flow whereby current pulsations may be alternately sent through both plugs and into the lines connected therewith, and an independent releasing-key for each plug whereby said source of current may be bridged across the cord conductors to send through said plugs and the lines connected therewith a current-flow in opposite direction to that of the pulsating current-flow, substantially as described.

8. In a telephone-exchange system, the combination with a central exchange, of telephone-lines extending therefrom, substations connected with each line, an operator's cord-circuit, a front and rear plug for said cord-circuit, a source of current, an independent key in said cord-circuit for each plug for connecting said source of current with said plugs, independent switching mechanism for each plug interposed between said source of current and said keys, means for actuating said switching mechanisms to repeatedly interrupt the current-flow whereby current pulsations may be alternately sent through both plugs and into the lines connected therewith, a source of signaling-current, and an independent ringing-key for each plug whereby signaling-current may be sent substantially simultaneously through both telephone-lines connected with said plugs, substantially as described.

9. In a telephone-exchange system, the combination with a central exchange, of telephone-lines extending therefrom, substations connected with each line, an operator's cord-circuit, a front and rear plug for said cord-circuit, a source of current, an independent key in said cord-circuit for each plug for connecting said source of current with said plugs, independent switching mechanism for each plug interposed between said source of current and said keys, means for actuating said switching mechanisms to alternately interrupt the current-flow whereby current pulsations may be alternately sent through both plugs and into the lines connected therewith and to alternately short-circuit the cord conductors whereby the telephone-lines connected with said plugs are alternately short-circuited to relieve them from static charges, a generator source of signaling-current, and an independent key for each plug whereby signaling-current may be substantially sent simultaneously through both telephone-lines connected with said plugs, substantially as described.

10. In a telephone system, the combination with a central exchange, of telephone-lines leading therefrom, substations connected with each telephone-line, an operator's cord-circuit, front and rear plugs for connecting said cord-circuit with said telephone-line,

a source of current, switching mechanism, means for actuating said switching mechanism for repeatedly interrupting said current-flow whereby pulsating-current is sent alternately through both plugs into the lines to actuate apparatus connected therewith, and means for grounding one side of said source of current after predetermined numbers of pulsations of said current, substantially as described.

11. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, substations provided with substation apparatus connected with said telephone-lines, an operator's cord-circuit, a front and rear plug for connecting said circuit with said telephone-line, a source of current, independent switching mechanism for each plug, means for actuating said switching mechanisms to repeatedly interrupt the current-flow from said source whereby pulsating-current is alternately sent through both of said plugs and into the line connected therewith to actuate substation apparatus, and means upon predetermined numbers of pulsations of said pulsating-current whereby one side of said source of current is grounded to simultaneously actuate additional apparatus at the substations connected with said plugs, substantially as described.

12. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, substations provided with substation apparatus connected with each line, an operator's cord-circuit, a front and rear plug for connecting said cord-circuit with said lines, a source of current, independent switching mechanism for each plug, and actuating means for said switching mechanisms, one position of said actuating means causing one of said switching means to short-circuit its associated plug and causing the other switching mechanism to connect said source of current with said other plug, said actuating means in its alternate position causing the aforesaid switching mechanism to connect said source of current with said aforesaid plug and causing said other switching mechanism to short-circuit said other plug, substantially as described.

13. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, substations connected with each telephone-line and provided with substation apparatus, an operator's cord-circuit, front and rear plugs for connecting said cord-circuit with said telephone-lines, a source of current, an independent selective key for each of said plugs for connecting said source of current therewith, independent switching mechanism interposed between said source of current and each plug, means for alternately actuating said switching mechanism, each switching mechanism in one position causing said plug

and the associated telephone-line to be short-circuited and in its alternative position causing said source of current to be connected with said plug and with the line to actuate substation apparatus, a traveling contact continually connected with one side of said source of current, and associate grounded contacts adapted to be interposed in the path of said traveling contact whereby after predetermined numbers of current pulsations sent into the lines by means of said switching mechanisms, said traveling contact engages said interposed associate contacts to connect said source of current to the ground whereby additional substation apparatus also connected to ground, is substantially simultaneously actuated.

14. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, substations connected with each telephone-line and provided with substation apparatus, an operator's cord-circuit, a front and rear plug for connecting said cord-circuit with said telephone-lines, a source of current, an independent selective key for each plug for associating said source of current therewith and with the line connected thereto, switching mechanism interposed between said source of current and said selective keys, means for actuating said switching mechanism whereby current impulses from said source are alternately sent through the front and rear plugs and into the lines connected therewith, and means at predetermined impulses for grounding one side of said source of current whereby additional grounded apparatus at the substations is actuated, substantially as described.

15. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, substations connected with each telephone-line and provided with substation apparatus, an operator's cord-circuit, a front and rear plug for connecting said cord-circuit with said telephone-lines, a source of current, an independent selective key for each plug for associating said source of current therewith and with the line connected thereto, switching mechanism interposed between said source of current and said selective keys, means for actuating said switching mechanism whereby current impulses from said source are alternately sent through the front and rear plugs into the lines connected therewith, a plurality of grounded contact-buttons, each button corresponding to a substation connected to the lines associated with said plugs, a traveling contact connected with one side of said source, said buttons being adapted to be moved into the path of said traveling contact and means for causing said traveling contact and said switching-mechanism-actuating means to move in unison whereby at

predetermined current pulsations sent into the line said traveling contact is caused to engage the corresponding depressed button whereby said source of current is grounded to actuate the grounded apparatus at the substation.

16. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, a plurality of substations connected with each line and provided with substation apparatus, an operator's cord-circuit provided with a front and rear plug, an independent selective key for each plug, a source of current, switching mechanism interposed between said source of current and said selective keys, actuating means for actuating said switching mechanism whereby current pulsations are sent from said source of current alternately through said selective keys into said plugs and through the lines connected therewith to actuate substation apparatus, a traveling contact connected with one side of said source of current, grounded actuating - buttons adapted to be depressed to be engaged by said traveling contact, said buttons corresponding in position to the numbers of substations connected with the lines associated with said plugs, detent means for preventing motion of said traveling contact, and means upon release of said detent for causing said traveling contact and said switching-mechanism-actuating means to move in unison whereby at certain predetermined current impulses the depressed buttons are engaged by the traveling contact to connect said source of current with the ground whereby grounded apparatus at the calling and called substations is actuated, substantially as described.

17. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, a plurality of substations connected with each line and provided with substation apparatus, an operator's cord-circuit provided with a front and rear plug, an independent selective key for each plug, a source of current, switching mechanism interposed between said source of current and said selective keys, actuating means for actuating said switching mechanism whereby the current pulsations are sent from said source of current alternately through said selective keys into said plugs and through the lines connected therewith to actuate substation apparatus, a traveling contact connected with one side of said source of current, grounded actuating-buttons adapted to be depressed to be engaged by said traveling contact, the buttons corresponding in position to the numbers of substations connected with the lines associated with said plugs, detent means for preventing motion of said traveling contact, means upon release of said detent for causing said travel-

ing contact and said switching-mechanism-actuating means to move in unison whereby at certain predetermined current impulses the depressed buttons are engaged by the traveling contact to connect said source of current with the ground whereby grounded apparatus at the calling and called substations is actuated, an independent selective ringing-key in said cord-circuit for each plug, an actuation of either of said ringing-keys connecting said generator with the associated plug and a line to actuate signal-receiving apparatus at the substation after actuation of said grounded substation apparatus, substantially as described.

18. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, a plurality of substations connected with each line and provided with substation apparatus, an operator's cord-circuit provided with a front and rear plug, an independent selective key for each plug, a source of current, switching mechanism interposed between said source of current and said selective keys, actuating means for actuating said switching mechanism whereby the current pulsations are sent from said source of current alternately through said selective keys into said plugs and through the lines connected therewith to actuate substation apparatus, a traveling contact connected with one side of said source of current, grounded actuating-buttons adapted to be depressed to be engaged by said traveling contact, the buttons corresponding in position to the numbers of substations connected with the lines associated with said plugs, detent means for preventing motion of said traveling contact, means upon release of said detent for causing said traveling contact and said switching-mechanism-actuating means to move in unison whereby at certain predetermined current impulses the depressed buttons are engaged by the traveling contact to connect said source of current with the ground whereby grounded apparatus at the calling and called substations is actuated, an independent selective ringing-key in said cord-circuit for each plug, an actuation of either of said ringing-keys connecting said generator with the associated plug and a line to actuate signal-receiving apparatus at the substation after actuation of said grounded substation apparatus, and an independent releasing-key for each plug for sending a current impulse of opposite polarity to the aforesaid current impulses whereby actuated substation apparatus may be released and restored to its normal position, substantially as described.

19. In a telephone system, the combination with a central exchange, of telephone-lines leading therefrom, substations connected with each telephone-line, and provided with metallic and grounded substation appa-

ratus, an operator's cord-circuit provided with front and rear plugs, a source of current, make-and-break mechanism for each plug for causing pulsating current, an independent selective key for each plug for leading said pulsating current into the associated plug, and a line to actuate the metallic-ally-connected substation apparatus, means for grounding said source of current at certain predetermined pulsations whereby the grounded substation apparatus is actuated, an independent ringing-key for each plug, a generator associated with said keys, actuation of either of said ringing-keys causing current from said generator to pass through the associated plug, and a line to actuate signaling apparatus at the substations at which the grounded apparatus has been actuated, and an independent releasing-key for each plug for connecting said source of current with the telephone-lines to cause a current to flow therethrough in an opposite direction to the aforesaid pulsating-current flow whereby the metallic-ally-connected apparatus is caused to release the substation apparatus, substantially as described.

20. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, substations connected with each telephone-line, a cord-circuit at the central exchange, a front and a rear plug for said cord-circuit, circuit-changing mechanism associated with said cord-circuit, a source of current, and means for actuating said circuit-changing mechanism to interrupt the current-flow from said source, whereby current pulsations are sent through both of said plugs and to the lines associated therewith to actuate substation apparatus and to alternately short-circuit the cord conductors, whereby the telephone-lines are short-circuited to release them from static charges, substantially as described.

21. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, substations connected with each telephone-line, apparatus at each substation adapted for connection with the line conductors and with a third conductor, a cord-circuit at the central exchange provided with a front and rear plug, circuit-changing switch mechanism associated with said cord-circuit, a source of current, means for actuating said circuit-changing mechanism for interrupting the current-flow from said source, whereby current pulsations are sent through both of said plugs to actuate substation apparatus connected with the line conductors, and means after predetermined numbers of current pulsations for connecting said source of current with the third conductor, whereby the apparatus at the substation connected with the third conductor is actuated, substantially as described.

22. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom connected with substations, apparatus at said substations adapted for connection with the line conductors and with a third conductor, a cord-circuit at the central exchange provided with a front and a rear plug, circuit-changing mechanism associated with said cord-circuit, a source of current, means for actuating said circuit-changing mechanism for interrupting the current-flow from said source, whereby current pulsations are sent through both of said plugs and into the lines associated therewith to actuate substation apparatus connected with the line conductors, automatic means at the central exchange for connecting said source of current with the third conductor after predetermined numbers of current pulsations, whereby the substation apparatus connected with the third conductor is actuated, a signal at each substation connected with the line upon actuation of the associated apparatus connected with the third conductor, and means at the exchange for sending signaling-current simultaneously through the signals connected with the lines by the associated apparatus connected with the third conductor, substantially as described.

23. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom and connected with substations, a signal at the substations, a cord-circuit at the central exchange provided with a front and a rear plug, circuit-changing mechanism associated with said cord-circuit, a source of current, means for actuating said circuit-changing mechanism for repeatedly interrupting the current-flow from said source, whereby current pulsations are alternately sent through both of said plugs and into the lines associated therewith to actuate substation apparatus, and means for automatically connecting said source of current in circuit with said substation-signal upon predetermined numbers of current pulsations, substantially as described.

24. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, a substation connected with each telephone-line, a cord-circuit at the central exchange provided with a front and a rear plug, circuit-changing mechanism associated with said cord-circuit, a source of current, means for actuating said circuit-changing mechanism for causing current pulsations to flow alternately through both of said plugs and into the lines to actuate one substation apparatus, and automatic means at the central exchange for causing actuation of other substation apparatus only upon predetermined numbers of current pulsations sent into the line, substantially as described.

25. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, substations connected with each telephone-line, a cord-circuit at the exchange provided with a front and a rear plug, circuit-changing mechanism associated with said cord-circuit, a source of current, means for actuating said circuit-changing mechanism for repeatedly interrupting the current-flow from said source, whereby current pulsations are sent through both of said plugs and through the metallic limbs of the lines associated therewith to actuate one substation apparatus, and automatic means at the central exchange for sending a single impulse from said source to actuate grounded substation apparatus upon predetermined numbers of current impulses sent through the limbs of the lines, substantially as described.

26. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, substations connected with each telephone-line, a cord-circuit provided with a front and a rear plug, a source of current, circuit-changing mechanism, actuating means for said circuit-changing mechanism, means for simultaneously connecting said circuit-changing mechanism with both plugs, whereby current impulses are sent into the lines connected with said plugs, a traveling contact moving in unison with said actuating means, a contact for each substation connected with the plugs disposed in order and adapted to be interposed in the path of said traveling contact, and means for moving said traveling contact and said actuating means, whereby substation apparatus is actuated only upon predetermined numbers of current pulsations through said plugs into the lines connected therewith, substantially as described.

27. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, substations connected with said telephone-lines, an operator's cord-circuit provided with a front and a rear plug, circuit-changing mechanism and a source of current connected with said cord-circuit, switch-keys in said cord-circuit for connecting said switching mechanism simultaneously with both plugs, whereby current pulsations are sent through both plugs and into the lines connected therewith to actuate substation apparatus connected with the line-limbs, grounded apparatus at the substations, and automatic means at the central exchange for connecting said source of current with ground only upon predetermined numbers of current impulses, whereby said grounded substation apparatus is actuated, substantially as described.

28. In a telephone-exchange system, the combination with a central exchange, of telephone-lines leading therefrom, a plurality of

substations connected with each line and provided with apparatus connected to the limbs of the line and with grounded apparatus, a cord-circuit provided with a front and a rear plug, a source of current, circuit-changing mechanism connected with said source, keys in the cord-circuit for connecting both plugs simultaneously with said circuit-changing mechanism, whereby current impulses are sent into the associated lines to actuate the substation apparatus connected therewith, means at the exchange for automatically grounding said source of current only at predetermined numbers of current pulsations, whereby the substation apparatus is thereupon connected with said source of current and actuated thereby, a signal at each substation connected in circuit upon actuation of said grounded apparatus, ringing-keys in said cord-circuit for sending ringing-current through both plugs to simultaneously actuate all the signals connected in circuit by said grounded apparatus, and keys in said cord-circuit for sending a current of opposite polarity through both plugs to simultaneously restore all the substation apparatus to its normal condition after actuation thereof, substantially as described.

29. The combination with a series of party-lines each having a series of stations thereon, of a series of numbered levers or keys each representing a different station on a line, an impulse-sending device, means by which upon moving two of said levers from their normal positions the impulse-sending device will be set for the selection of stations having numbers corresponding to the numbers on the moved levers, and means by which upon operating said impulse-sending device it will automatically select the desired stations one from each of two lines.

30. The combination with a series of party-lines each provided with a series of local stations, and an impulse-sending device, of means by which said impulse-sending device may be set for the connection of two stations located on different lines, and means whereby upon operating said impulse-sending device the local stations for which said device has been previously set will be placed in telephonic connection with each other.

31. The combination with two party-lines each having a series of local stations thereon, and means for sending impulses alternately over the two lines, of means for sending an extra impulse over each line, and means by which the impulse-sending devices may be set so that the extra impulse for each line will come at any desired point within the series of impulses for that line.

32. The combination with a station-calling device, means by which it may be set for the selection of any two desired stations, and means for starting it into operation when so set, of means by which said device may oper-

ate simultaneously on two lines whereby a desired station on one line is placed in telephonic connection with a desired station on a different line.

5 33. The combination with a station-selecting device, and means for setting it for the selecting of any two stations out of a plurality of stations, of a plurality of party-lines each having a plurality of stations thereon, means
10 by which two such lines may be simultaneously connected to said device, and means by which said selecting device will operate simultaneously over both of the connected
15 lines and automatically select desired stations thereon.

34. The combination with a series of party-

lines, each having a plurality of stations thereon, of a station-selecting device, means for connecting two of said lines to said device, and means by which upon operating said device a desired station on one of said lines will be automatically placed in telephonic connection with a desired station on the other line. 20

In witness whereof I hereunto subscribe
my name this 16th day of November, A. D. 1903. 25

GARRISON BABCOCK.

Witnesses:

CHARLES J. SCHMIDT,
LEONARD W. NOVANDER.