

No. 855,545.

PATENTED JUNE 4, 1907.

H. G. WEBSTER.  
TELEPHONE EXCHANGE SYSTEM.

APPLICATION FILED DEC. 16, 1904.

2 SHEETS—SHEET 1.

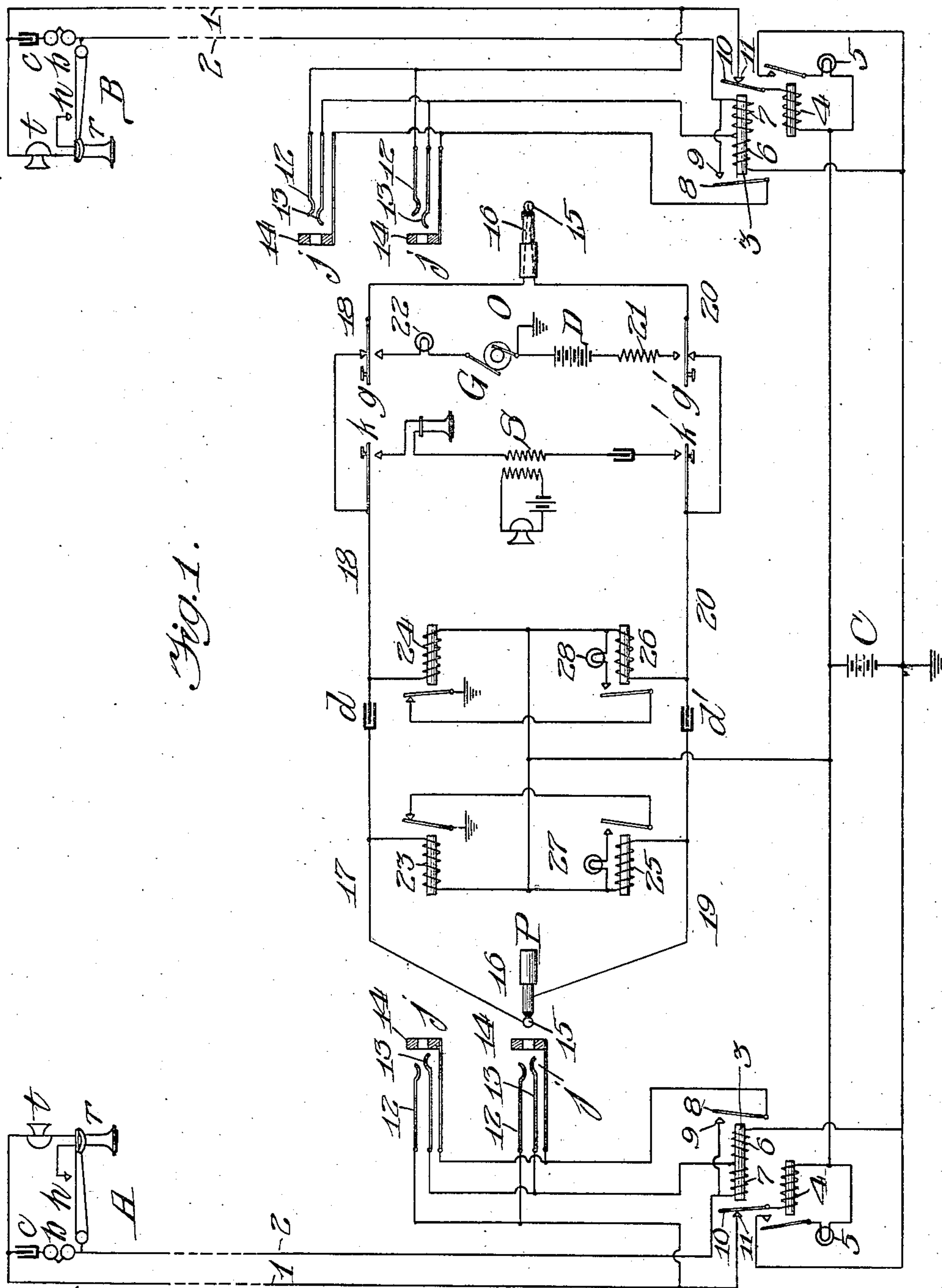


Fig. 1.

Witnesses:

Robert A. Weber  
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Inventor:

Harry G. Webster

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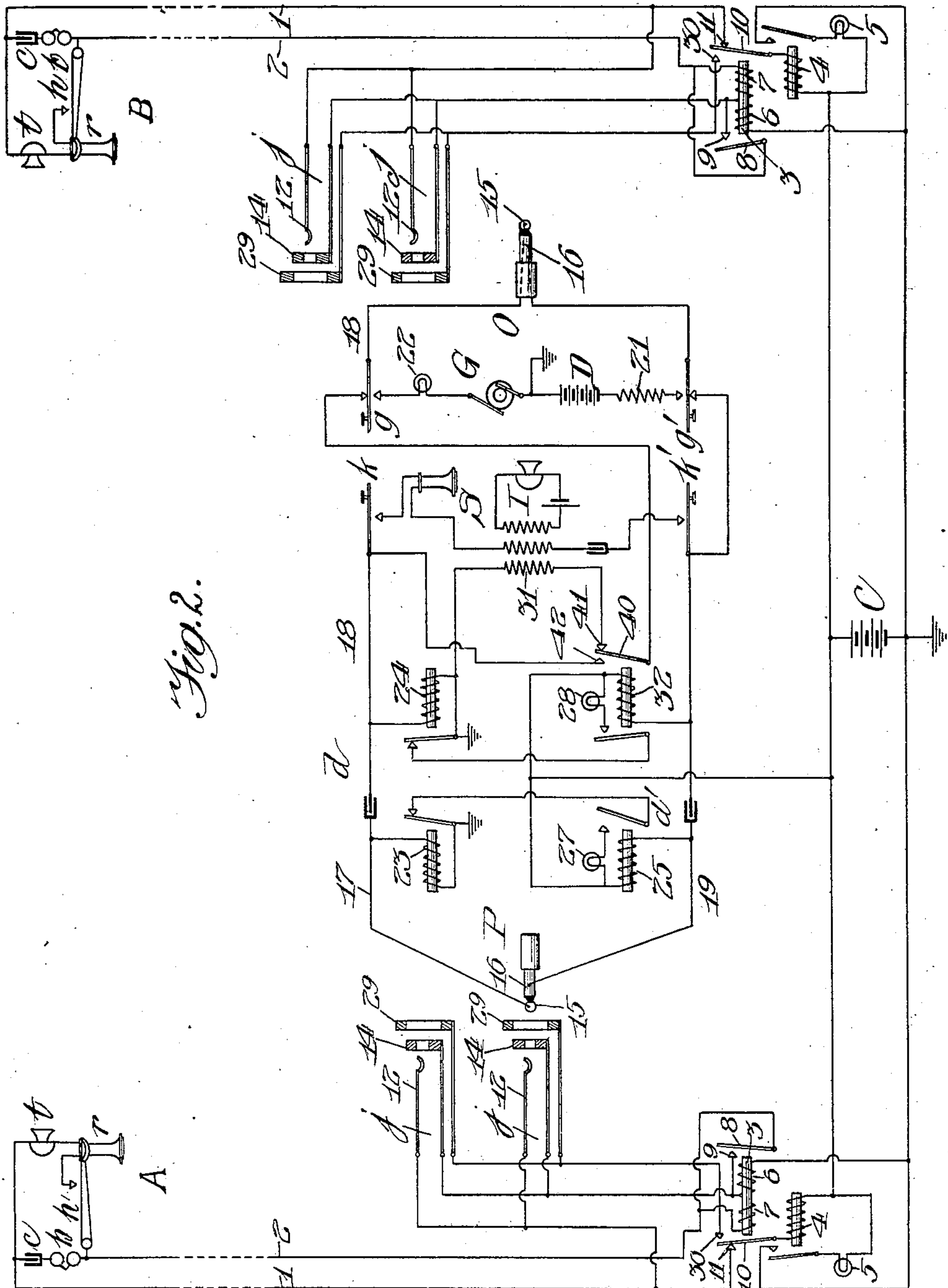


Fig. 2.

Witnesses:

Robert A. Weir  
J. J. Updegraff

Inventor:

Harry G. Webster



# UNITED STATES PATENT OFFICE.

HARRY G. WEBSTER, OF CHICAGO, ILLINOIS, ASSIGNOR TO MILO G. KELLOGG,  
OF CHICAGO, ILLINOIS.

## TELEPHONE-EXCHANGE SYSTEM.

No. 855,545.

Specification of Letters Patent.

Patented June 4, 1907.

Application filed December 16, 1904. Serial No. 237,144.

*To all whom it may concern:*

Be it known that I, HARRY G. WEBSTER, a citizen of the United States, and a resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone-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 telephone exchange systems provided with a central source of current supply in which the lines are provided with three-part spring jacks or connection terminals, and in which the connecting plugs are provided with but two contact pieces, my object being to provide an improved organization of circuits and apparatus for systems of this class.

In accordance with my invention, I provide at the central exchange a signal controlling electromagnet normally under the control of the subscriber whereby he may cause the display of a calling signal such as a lamp, and a relay having two windings differentially connected, adapted when energized to destroy the substation control of the calling signal. The circuit arrangement of my invention is such that upon the insertion of a connecting plug into a spring jack or switching terminal of the line, the differential relay is energized, one of its windings is rendered inoperative and the normal electrical condition of the testing contact pieces of the spring jacks of the line is altered.

My invention will be further understood from the accompanying drawings, in which

Figure 1 illustrates diagrammatically two complete line circuits with appropriate cord connecting apparatus organized in accordance with my invention; and in which Fig. 2 illustrates diagrammatically a modification of my invention showing also diagrammatically two complete line circuits with appropriate cord connecting apparatus.

Like characters refer to like parts in the two figures.

Referring to Fig. 1, the subscriber's apparatus shown at A is represented as consisting of the telephone hook switch *h*, signal bell *b*, condenser *c*, receiver *r* and transmitter *t*; the bell and condenser being normally in bridge of the two line limbs and circuit being closed through the receiver and trans-

mitter upon the elevation of the hook switch. Although I have shown but one arrangement, it will be understood by those skilled in the art that various other arrangements of the subscriber's apparatus may be used, and I do not confine myself to the particular arrangement illustrated. Under normal conditions, the receiver hangs upon its hook switch maintaining its upper contact open and the condenser *c* prevents a normal flow of current from battery C at the central office over the line limbs. When, however, the subscriber removes his telephone from its hook, thus closing the upper contact of hook switch *h* and establishing a relatively low resistance path for the flow of current through the transmitter *t* and receiver *r*, the relay 4 at the central office will be operated by the flow of current from said battery C through the relay winding, armature 10 and anvil 11 of relay 3, limbs 1—2 of the telephone line, windings 7 and 6 of relay 3, and thence to the office return or grounded side of the battery C. This flow of current through relay 4 causes its energization and the consequent illumination of calling lamp 5, but windings 7 and 6 of relay 3 being of substantially equal energizing capacity and connected differentially or in opposition, relay 3 remains unenergized. Each subscriber's line is provided with one or more spring jacks *j*, each having a contact piece 12 and 13 associated with limbs 1 and 2 of the line respectively and a third or testing contact piece 14 which is normally disconnected from the line and consequently from the central battery C. The illumination of signal lamp 5 indicating to the operator that the subscriber has removed his receiver from its hook for the purpose of making a call, she inserts the answering plug P into a spring jack *j* corresponding to the calling signal, thus causing contact piece 15 of the plug to engage contact piece 12 of the spring jack and contact piece 16 of the plug to engage contact pieces 13 and 14 of the spring jack. The contact 13—16 completes a circuit from battery C through relay 25 of the cord circuit, strand 19, contact 13—16 of the plug and spring jack and winding 6 of relay 3 to the ground or return side of the battery. The current through winding 6 of relay 3 thus being increased over that through winding 7, relay 3 becomes energized, breaking the circuit of relay 4 at armature 10 and anvil 11 and causing armature 8



to engage anvil 9, thus removing winding 7 from the circuit of limb 2 by means of the low resistance circuit which may be traced from the left-hand end of winding 7 through anvil 9, armature 8, contact piece 14, contact piece 16 of the plug, contact piece 13 of the spring jack and thence to the right hand end of the said winding. The establishment of this low resistance circuit or short circuit of winding 7 deprives it of current and allows the winding 6 to exercise its full energizing capacity. The circuit of limb 1 having been broken at armature 10 and anvil 11 and calling lamp 5 consequently extinguished, current is now furnished to the substation over a path which may be traced as follows; from battery C, through relay 23 and strand 17 of the cord, contact 15—12 of the plug and spring jack, limbs 1 and 2 of the line, anvil 9 and armature 8 of relay 3, contact 14—16—13 of the plug and spring jack and winding 6 of relay 3 to the return side of the battery. The establishment of the circuit first traced through relay 25 caused its energization, and the consequent attraction of the armature of that relay, closing the local circuit of lamp 27 at that point and were the subscriber's receiver upon its switch hook, the lamp would be illuminated; inasmuch as relay 23 is now energized by current flowing through the line limbs, the attraction of its armature breaks the circuit of lamp 27 and the lamp remains dark, but will become illuminated when the subscriber replaces his receiver, thus breaking the circuit through the said relay 23. The operator is provided with the usual talking apparatus and listening key, secures the number of the line desired—in this case, that of subscriber B—and tests in the usual manner by touching the tip contact piece 15 of calling plug O to the testing contact piece 14 of one of the spring jacks associated with that line. Under normal conditions, these contact pieces 14 are disconnected from the circuits of the line and battery C at armature 8 and anvil 9 and under such conditions, the operator would hear no sound. If, however, the line tested were in use, current would flow from battery C through relay 24, strand 18, tip 15 to test contact piece 14 and thence through armature 8, anvil 9 (relay 3 of the line tested being energized and its contact closed), and windings 7 and 6 of relay 3 to the return side of the battery thus producing the customary "click" in the operator's receiver, indicating the busy condition of the line. After inserting the plug O, the operator actuates her ringing key  $g-g^1$ , relay 3 is energized by current flowing from battery D through resistance 21, strand 20, contact 16—13 of the plug and spring jack and winding 6 to the return side of the battery; while ringing current from generator G flows through lamp 22, strand 18, contact 15—12 of the plug and spring jack, limbs 1 and 2 of

the line to the office return or grounded side of the generator G. Upon the restoration of the ringing key, relay 3 is energized by current flowing from battery C through relay 26, strand 20, contact 16—13 of the plug and spring jack and winding 6 of the relay to the return side of the battery. This current also energizes relay 26, closing the local circuit of lamp 28 which remains illuminated until the local circuit is broken at relay 24 when the subscriber answers, as will be understood from the foregoing description. The two subscribers are now connected for conversation, strands 17 and 18 being inductively united by the condenser  $d$ , and strands 19 and 20 by the condenser  $d^1$ . If either subscriber replaces his receiver, the consequent deenergization of the relay 23 or 24 associated with his line causes the illumination of lamp 27 or 28 respectively, and the lighting of both lamps constitutes the signal for disconnection.

The modification of Fig. 2 differs from the system of Fig. 1 in the arrangement of the cord connecting apparatus; in that the spring jacks  $j$  are provided with but two contact pieces 12 and 14 which engage contact pieces 15 and 16 of the plugs respectively, but are provided with a testing contact piece 29 which does not make contact with the plug when it is inserted into the jack; in the circuit arrangement by which winding 7 of relay 3 is removed from its associated line limb; and in the arrangement of the busy test. The subscriber calls in the usual manner causing the illumination of lamp 5, and upon the insertion of an answering plug P relay 3 is energized by current flowing from battery C through relay 25, strand 19, plug and jack contact 16—14, through winding 6 of relay 3 to the return side of the battery. At the same time, circuit is closed from limb 1 of the line through plug and jack contact 12—15, strand 17 and relay 23 to the return side of the battery. The energization of relay 3 causes armature 10 to break the normal circuit of battery C at anvil 11, thus extinguishing lamp 5, and to engage anvil 30, thus connecting contact piece 29 of the spring jacks to the active side of battery C through the winding of relay 4. At the same time, armature 8 engages anvil 9, thus short circuiting the winding 7. Under this condition, it will be seen that relay 25 is energized, closing the local circuit of lamp 27, and that relay 23 is energized as long as circuit is closed through the substation apparatus, preventing the illumination of lamp 27; but upon the depression of the hook switch, relay 23 becomes deenergized, its armature assuming its normal position causing the illumination of lamp 27. When making a busy test, testing contact piece 29 of the jack tested is normally disconnected, as in the system of Fig. 1; if, however, the line be busy, current will flow



from the active side of battery C through the winding of relay 4, armature 10, anvil 30, contact piece 29, tip contact 15, strand 18, armature 40 of relay 32, anvil 41 and winding 5 31 of the operator's induction coil I to the return or ground side of the battery C. The resistance of winding 31 is sufficiently great to prevent a current flow through the circuit just traced, which would cause the energiza-  
 10 tion of relay 4 and thus a false illumination of lamp 5. Upon the insertion of a calling plug O, a circuit is closed through relay 32 similar to that traced for relay 25, and the circuit of lamp 28 is controlled in a similar manner.  
 15 The energization of relay 32 at this time causes armature 40 to disengage anvil 41, thus disconnecting test winding 31 (which may be common to all of the cord circuits of a position) from contact piece 15 of plug O,  
 20 and by engaging anvil 42 completes the circuit of strand 18 to relay 24 and condenser d. During the actuation of the ringing key, relay 3 is energized by current from battery D through resistance 21, contact 16—14 of the  
 25 plug and spring jack and winding 6 of the relay, the circuit of the ringing generator G being completed through lamp 22, strand 18, plug and jack contact 15—12 and limbs 1 and 2 of the line to the return side of the gen-  
 30 erator, as in the system of Fig. 1. Upon the restoration of the ringing key, relay 32 is again energized and the further progress of the connection will be understood from the foregoing description.

35 It is to be understood that in both figures, the batteries shown separately at C and D may be one and the same, and that the various grounds indicated are the office return or return side of the battery C.

40 While I have shown particular arrangements of cord connecting apparatus in the figures, it will be understood by those skilled in the art that various other arrangements may be used in embodying my invention, and I, therefore, do not wish to be limited to those shown. It will also be understood that various modifications of my invention may be made by those skilled in the art without departing from its spirit, and I do not, there-  
 50 fore, wish to be limited to the two arrangements of the line circuits and apparatus illustrated and described, but claim:—

1. In a telephone exchange system the combination with a metallic telephone line  
 55 extending from a substation to the exchange, of a central source of current, a connection terminal having contact pieces associated with the limbs of the line, and a third contact piece adapted to serve as a testing ter-  
 60 minal, a cord circuit provided with a connecting plug adapted to make connection with said terminal, an electromagnet having a winding connected with a limb of the line, switching mechanism controlled thereby,  
 65 adapted to connect said third contact piece

with a limb of the line at a point between the substation and said magnet winding, and testing means whereby the operator may de-  
 termine such connected condition and means whereby the connection of the plug with the  
 70 connection terminal causes the energization of the electromagnet.

2. In a telephone exchange system, the combination with a metallic telephone line  
 75 extending from a substation to the exchange, of a central source of current, a connection terminal having contact-pieces associated with the limbs of the line, and a third con-  
 tact-piece adapted to serve as a testing ter-  
 80 minal and normally disconnected from said source of current, a cord-circuit provided with a connecting plug adapted to make con-  
 nection with said terminal, an electromagnet having a winding connected with a limb of  
 85 the line, means actuated thereby to connect said third contact-piece to one pole of said source of current, and testing means whereby  
 an operator may determine the altered elec-  
 90 trical condition of said third contact-piece and means whereby the connection of the plug with the connection terminal causes the energization of the electromagnet.

3. In a telephone exchange system the combination with a metallic telephone line  
 95 extending from a substation to the exchange, of a central source of current, a connection terminal having contact pieces associated with the limbs of the line, and a third contact  
 piece adapted to serve as a testing terminal, a  
 100 cord circuit provided with a connecting plug adapted to make connection with said ter-  
 minal, a differentially wound electromagnet having a winding associated with the line,  
 105 switching mechanism controlled thereby, adapted to connect said third contact piece with a limb of the line, and testing means  
 whereby the operator may determine such  
 110 connected condition and means whereby the connection of the plug with the connection terminal causes the energization of the elec-  
 tromagnet.

4. In a telephone exchange system the combination with a metallic telephone line  
 115 extending from a substation to the exchange, of a central source of current, a connection terminal having contact pieces associated with the limbs of the line, and a third contact  
 piece adapted to serve as a testing terminal,  
 120 a cord circuit provided with a connecting plug adapted to make connection with said terminal, a differentially wound electro-  
 magnet having a winding associated with the line, means actuated thereby, adapted to  
 125 alter the normal electrical condition of said third contact piece, and testing means where-  
 by an operator may determine such altered  
 condition and means whereby the connection  
 of the plug with the connection terminal  
 causes the energization of the electromagnet.

5. In a telephone exchange system the 130



combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a connection terminal having talking contact pieces associated with the two limbs of the line respectively, and a third contact piece normally disconnected therefrom, a cord circuit provided with a connecting plug adapted to make connection with said terminal, an electromagnet having a winding connected with a limb of the line, switching mechanism controlled thereby, adapted to connect said third contact piece with a limb of the line at a point between the substation and said magnet winding, and testing means whereby an operator may determine such connected condition and means whereby the connection of the plug with the connection terminal causes the energization off the electromagnet.

6. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a connection terminal having talking contact pieces associated with the two limbs of the line respectively, and a third contact piece normally disconnected therefrom, a cord circuit provided with a connecting plug adapted to make connection with said terminal, an electromagnet having a winding connected with a limb of the line, means actuated thereby, adapted to alter the normal electrical condition of said third contact piece, and testing means whereby an operator may determine such altered condition and means whereby the connection of the plug with the connection terminal causes the energization of the electromagnet.

7. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a connection terminal having talking contact pieces associated with the two limbs of the line respectively, and a third contact piece normally disconnected therefrom, a cord circuit provided with a connecting plug adapted to make connection with said terminal, a differentially wound electromagnet having a winding associated with the line, switching mechanism controlled thereby, adapted to connect said third contact piece with a limb of the line, and testing means whereby the operator may determine such connected condition and means whereby the connection of the plug with the connection terminal causes the energization of the electromagnet.

8. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a connection terminal having talking contact pieces associated with the two limbs of the line respectively, and a third contact piece normally disconnected therefrom, a cord circuit pro-

vided with a connecting plug adapted to make connection with said terminal, a differentially wound electromagnet having a winding associated with the line, means actuated thereby, adapted to alter the normal electrical condition of said third contact piece, and testing means whereby an operator may determine such altered condition and means whereby the connection of the plug with the connection terminal causes the energization of the electromagnet.

9. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a connection terminal having talking contact pieces associated with the two limbs of the line respectively, and a third contact piece normally disconnected from said source, a cord circuit provided with a connecting plug adapted to make connection with said terminal, a differentially wound electromagnet having a winding associated with the line, switching mechanism controlled thereby, adapted to connect said third contact piece with said source, and testing means whereby an operator may determine such connected condition and means whereby the connection of the plug with the connection terminal causes the energization of the electromagnet.

10. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a connection terminal having talking contact pieces associated with the two limbs of the line respectively, and a third contact piece normally disconnected from said source, a cord circuit provided with a connecting plug adapted to make connection with said terminal, an electromagnet having a winding connected with a limb of the line, switching mechanism controlled thereby, adapted to connect said third contact piece with said source, and testing means whereby an operator may determine such connected condition and means whereby the connection of the plug with the connection terminal causes the energization of the electromagnet.

11. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having contact pieces associated with the limbs of the line, and a third contact piece normally disconnected from said source and adapted to serve as a testing terminal, a cord circuit provided with a connecting plug adapted to make connection with said terminal, an electromagnet associated with a limb of the line, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator, means



for securing the energization of said electromagnet over a circuit including a portion of a talking strand of the cord circuit and means controlled by said electromagnet to alter the electrical condition of said third contact piece, and testing means whereby an operator may determine such altered condition.

12. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having contact pieces associated with the limbs of the line, and a third contact piece normally disconnected from said source and adapted to serve as a testing terminal, a cord circuit provided with a connecting plug adapted to make connection with said terminal, an electromagnet associated with a limb of the line, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator, means for securing the energization of said electromagnet over a circuit including a portion of a talking strand of the cord circuit and means controlled by said electromagnet to cause the establishment of a connection from said third contact piece to a source of current, and testing means whereby an operator may determine the presence of such connection.

13. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having contact pieces permanently connected with the limbs of the line, and a third contact piece adapted to serve as a testing terminal, a cord circuit provided with a connecting plug adapted to make connection with said terminal, an electromagnet associated with a limb of the line, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator, means for securing the energization of said electromagnet over a circuit including a portion of a talking strand of the cord circuit and means controlled by said electromagnet to cause the establishment of a connection from said third contact piece to a limb of the line, and testing means whereby an operator may determine the presence of such connection.

14. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having contact pieces associated with the limbs of the line, and a third contact piece adapted to serve as a testing terminal, a cord circuit provided with a connecting plug adapted to make connection

with said terminal, a differentially wound electromagnet associated with the line, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator, means for securing the energization of said electromagnet over a circuit including a portion of a talking strand of the cord circuit and means controlled by said electromagnet to alter the electrical condition of said third contact piece, and testing means whereby an operator may determine such altered condition.

15. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having contact pieces associated with the limbs of the line, and a third contact piece adapted to serve as a testing terminal, a cord circuit provided with a connecting plug adapted to make connection with said terminal, a differentially wound electromagnet associated with the line, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator, means for securing the energization of said electromagnet over a circuit including a portion of a talking strand of the cord circuit and means controlled by said electromagnet to cause the establishment of a connection from said third contact piece to a source of current, and testing means whereby an operator may determine the presence of such connection.

16. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having contact pieces associated with the limbs of the line, and a third contact piece adapted to serve as a testing terminal, a cord circuit provided with a connecting plug adapted to make connection with said terminal, a differentially wound electromagnet associated with the line, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator, means for securing the energization of said electromagnet over a circuit including a portion of a talking strand of the cord circuit and means controlled by said electromagnet to cause the establishment of a connection from said third contact piece to a limb of the line, and testing means whereby an operator may determine the presence of such connection.

17. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator



normally under control of the substation, a connection terminal having talking contact pieces permanently connected with the two limbs of the line respectively, and a third contact piece normally disconnected therefrom, a cord circuit provided with a connecting plug adapted to make connection with said terminal, an electromagnet associated with a limb of the line, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator, means for securing the energization of said electromagnet over a circuit including a portion of a talking strand of the cord circuit and means controlled by said electromagnet to alter the electrical condition of said third contact piece, and testing means whereby an operator may determine such altered condition.

18. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having talking contact pieces permanently connected with the two limbs of the line respectively, and a third contact piece normally disconnected therefrom, a cord circuit provided with a connecting plug adapted to make connection with said terminal, an electromagnet associated with a limb of the line, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator, means for securing the energization of said electromagnet over a circuit including a portion of a talking strand of the cord circuit and means controlled by said electromagnet to cause the establishment of a connection from said third contact piece to a source of current, and testing means whereby an operator may determine the presence of such connection.

19. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having talking contact pieces permanently connected with the two limbs of the line respectively, and a third contact piece normally disconnected therefrom, a cord circuit provided with a connecting plug adapted to make connection with said terminal, an electromagnet associated with a limb of the line, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator, means for securing the energization of said electromagnet over a circuit including a portion of a talking strand of the cord circuit and means controlled by said electromagnet to cause the establishment of a connection from said third contact piece to a limb of the line, and

testing means whereby an operator may determine the presence of such connection.

20. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having talking contact pieces associated with the two limbs of the line respectively, and a third contact piece normally disconnected therefrom, a cord circuit provided with a connecting plug adapted to make connection with said terminal, a differentially wound electromagnet associated with the line, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator, means for securing the energization of said electromagnet over a circuit including a portion of a talking strand of the cord circuit and means controlled by said electromagnet to alter the electrical condition of said third contact piece, and testing means whereby an operator may determine such altered condition.

21. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having talking contact pieces associated with the two limbs of the line respectively, and a third contact piece normally disconnected therefrom, a cord circuit provided with a connecting plug adapted to make connection with said terminal, a differentially wound electromagnet associated with the line, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator, means for securing the energization of said electromagnet over a circuit including a portion of a talking strand of the cord circuit and means controlled by said electromagnet to cause the establishment of a connection from said third contact piece to a source of current, and testing means whereby an operator may determine the presence of such connection.

22. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having talking contact pieces associated with the two limbs of the line respectively, and a third contact piece normally disconnected therefrom, a cord circuit provided with a connecting plug adapted to make connection with said terminal, a differentially wound electromagnet associated with the line, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator, means for se-



curing the energization of said electromagnet over a circuit including a portion of a talking strand of the cord circuit and means controlled by said electromagnet to cause the establishment of a connection from said third contact piece to a limb of the line, and testing means whereby an operator may determine the presence of such connection.

23. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having contact pieces associated with the limbs of the line, a cord circuit provided with a connecting plug adapted to make connection with said terminal, an electromagnet having two opposing windings of substantially equal energizing capacity normally in bridge of the line limbs with said source of current, a third contact piece included in a branch controlled by said electromagnet, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator and means whereby a separate circuit connection is established from a line limb to a point intermediate of the said windings upon the connection of said plug with said terminal.

24. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having contact pieces associated with the limbs of the line, a cord circuit provided with a connecting plug adapted to make connection with said terminal, an electromagnet having two opposing windings of substantially equal energizing

capacity normally in bridge of the line limbs with said source of current, a third contact piece included in a branch controlled by said electromagnet, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator and means whereby a direct connection is established from a line limb to a point intermediate of the said windings upon the connection of the said plug with said terminal.

25. In a telephone exchange system the combination with a metallic telephone line extending from a substation to the exchange, of a central source of current, a line indicator normally under control of the substation, a connection terminal having contact pieces associated with the limbs of the line, a cord circuit provided with a connecting plug adapted to make connection with said terminal, an electromagnet having two opposing windings of substantially equal energizing capacity normally in bridge of the line limbs with said source of current, a third contact piece included in a branch controlled by said electromagnet, switching mechanism controlled by the electromagnet adapted upon its energization to destroy the substation control of said indicator and means whereby a low resistance connection is established from a line limb to a point intermediate of the said windings upon the connection of the said plug with said terminal.

In witness whereof, I hereunto subscribe my name this 29th day of November A. D., 1904.

HARRY G. WEBSTER.

Witnesses:

L. D. KELLOGG,  
G. E. MUELLER.