

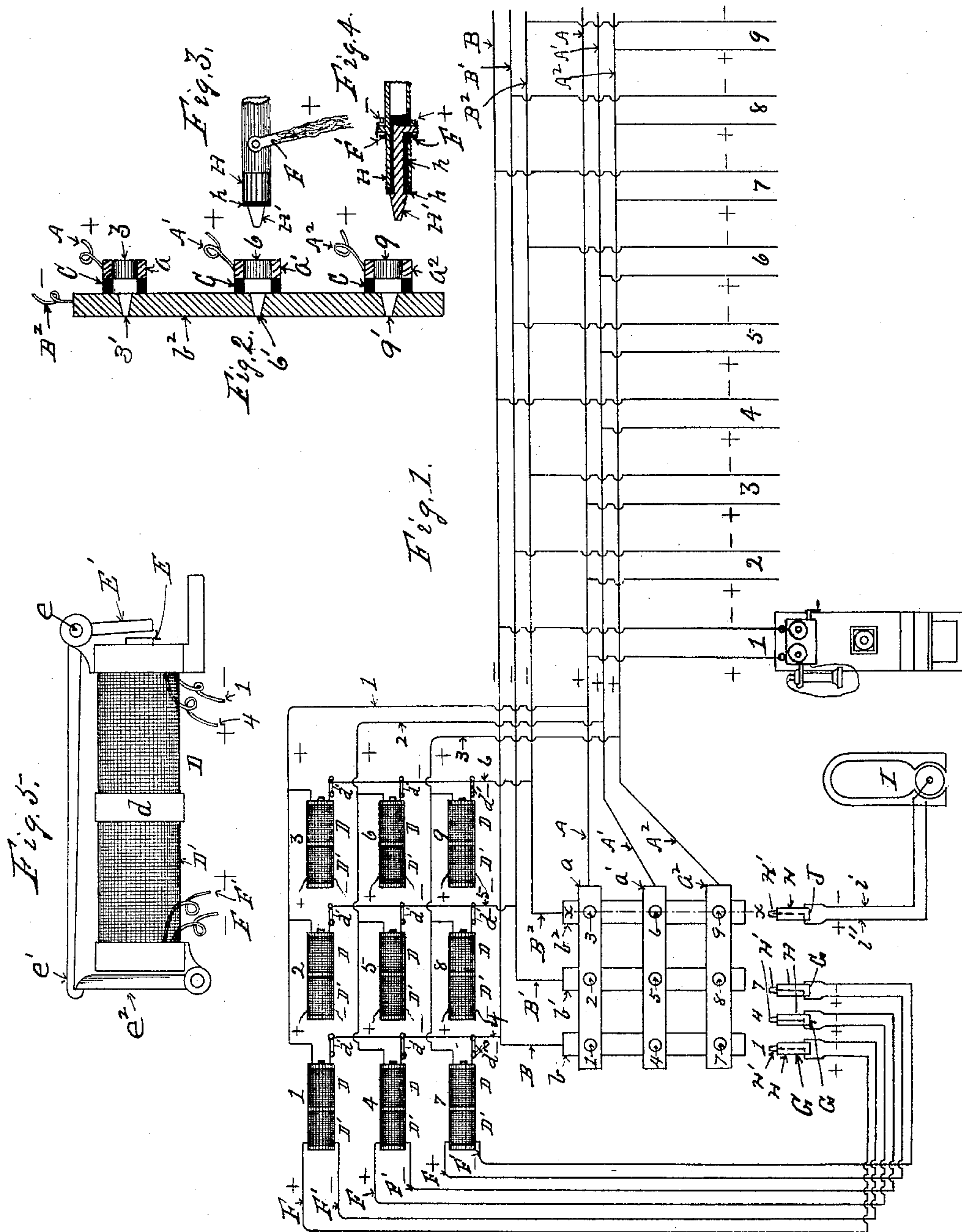
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H. P. SNOW.

TELEPHONE SYSTEM AND TELEPHONE EXCHANGE MECHANISM.

No. 590,633.

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WITNESSES:

Fred Einfeldt  
J. J. Basette

INVENTOR

Harlen P. Snow

BY

J. S. Sturgeon

ATTORNEY



# UNITED STATES PATENT OFFICE.

HARLEN P. SNOW, OF ERIE, PENNSYLVANIA.

## TELEPHONE SYSTEM AND TELEPHONE-EXCHANGE MECHANISM.

SPECIFICATION forming part of Letters Patent No. 590,633, dated September 28, 1897.

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*To all whom it may concern:*

Be it known that I, HARLEN P. SNOW, a citizen of the United States, residing at the city of Erie, in the county of Erie and State of Pennsylvania, have invented certain new and useful Improvements in Telephone Systems and Telephone-Exchange Mechanisms; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, forming part of this specification.

This invention relates to improvements in telephone systems and telephone-exchange mechanisms, and has for its objects the combination of a series of outgoing line-wires and a series of return line-wires with telephone-exchange mechanism in such manner that a number of telephones may be installed and operated on said line-wires equal to the product of the number of outgoing line-wires multiplied by the number of return line-wires, each of which telephones being by said line-wires provided with a complete metallic circuit connecting the same with the exchange-switchboard, which circuit in its operation is entirely independent of and does not in any manner interfere with the metallic circuits of any of the other telephones installed on said line-wires.

To accomplish these results, my telephone system and telephone-exchange mechanism consists in the combination of a series of positive line-wires, each of which is connected to a corresponding bar on the exchange-switchboard, and a series of negative line-wires, each of which is connected to a corresponding bar on said switchboard, all of said bars being insulated from each other and adapted to be connected in circuit by means of switch-plugs hereinafter described, the positive line-wires operating as outgoing line-wires and the negative line-wires as return line-wires, or vice versa, as the case may be. At convenient points adjacent to the exchange-switchboard a branch wire extends from each positive line-wire to and connects with the positive ends of the primary coils of a series of induction-

coils equal in number to the number of positive line-wires, and likewise a branch wire extends from each negative line-wire to and connects with the negative ends of the primary coils of a like number of induction-coils, and from the secondary coils of each of these induction-coils a positive and a negative wire extends to and connects with a switchboard-plug, whereby the secondary coil of any one of said induction-coils may be at once electrically connected with the circuit of any telephone installed on said outgoing and return line-wires connected with said switchboard. These features of my invention, together with other features thereof hereinafter referred to, will be hereinafter fully described, and particularly pointed out in the claims, and are illustrated in the accompanying drawings, forming part of this specification, in which—

Figure 1 is a diagrammatic view of a telephone system and telephone-exchange mechanism, some duplicate portions thereof being omitted, embodying this invention. Fig. 2 is an enlarged vertical section of the exchange-switchboard on the line  $x x$  in Fig. 1. Fig. 3 is an enlarged view in elevation of one of the switchboard-plugs. Fig. 4 is a central longitudinal section of the same. Fig. 5 is an enlarged side elevation of one of the combined induction-coils and drop mechanisms forming part of the exchange mechanism of this invention.

In the drawings illustrating this invention but six main line-wires  $A, A', A^2, B, B',$  and  $B^2$  are shown, together with the number of telephone-stations which may be installed thereon, and so much of the telephone-exchange mechanism as will clearly illustrate the operation of the same. Of these main line-wires  $A, A', A^2$  are designated on the drawings as positive line-wires and  $B, B', B^2$  as negative line-wires, and the positive line-wires are treated as outgoing wires and the negative line-wires as the return-wires of the circuits.

The line-wires  $A, A', A^2$  are connected with switchboard-bars  $a, a', a^2$  and the line-wires  $B, B', B^2$  with switchboard-bars  $b, b', b^2$ , these bars  $a, a', a^2$  and  $b, b', b^2$  being insulated from each other by means of insulating material  $C$ , and from each of the line-wires  $A, A', A^2$  adjacent



to the switchboard a branch wire extends to and connects with the positive ends of the primary coils of a series of induction-coils equal in number to the number of positive  
 5 main line-wires, and from each of the line-wires B B' B<sup>2</sup> adjacent to the switchboard a branch wire extends to and connects with the negative ends of the primary coils of a series of induction-coils equal in number to  
 10 the number of negative main line-wires, said connections in this case being from the line A by wire 1 to the induction-coils 1, 2, and 3, from the line A' by wire 2 to the induction-coils 4, 5, and 6, from the line A<sup>2</sup> by wire 3 to  
 15 the induction-coils 7, 8, and 9, from the line B by wire 4 to the induction-coils 1, 4, and 7, from the line B' by wire 5 to the induction-coils 2, 5, and 8, and from the line B<sup>2</sup> by wire 6 to the induction-coils 3, 6, and 9. From  
 20 this construction it will be observed that a number of independent circuits are formed, each of which comprises the primary coil of one of said induction-coils, and it is also obvious that parts of either the outgoing or re-  
 25 turn line-wires may be common to more than one of said circuits; but it is also well known that the currents of two or more circuits will travel on the same wire substantially at the same time, each of said currents leaving said  
 30 common path by the connection completing its own circuit without any interference with other currents passing over said common path and leaving it by other connections completing their respective circuits. It will be  
 35 observed, however, that the wires 4, 5, and 6 connect with the induction-coils 1, 2, 3, 4, 5, 6, 7, 8, and 9 by means of small switches *d'*. These switches are shown in the diagrammatic view Fig. 1 as immediately adjacent to  
 40 the induction-coils, so as to be operated to cut any induction-coil out of circuit when connection is made from another telephone-station through the switchboard with the tele-  
 45 phone-circuit in which such induction-coil is situated, as and for the purpose hereinafter set forth. It is obvious, however, that these switches may be located so as to be operated by the insertion of the switch-plugs in the  
 50 switchboard, and as the location or arrangement for operating them is not a material feature of my invention the form of switch shown in the drawings and herein described is deemed a sufficient illustration thereof.

The induction-coils 1 2 3, &c., I preferably construct in the form illustrated in the  
 55 enlarged view Fig. 5, in which the induction coil is combined with and operates drop mechanism. In this construction D is the primary coil, and D' the secondary coil, these coils being wound on a continuous core E, and are insulated from each other by means of a non-conductor *d*. This coil is provided with an armature E', pivoted at *e* and operating a lever-catch *e'* for retaining the drop *e*<sup>2</sup> in place  
 60 until released by the raising of the catch *e'*. I can, however, use induction-coils of any or-

dinary construction in lieu of the one shown, in which case I use drop mechanism of any ordinary construction for indicating calls at the switchboard.

From the secondary coils of each of the induction-coils 1 2 3, &c., wires F and F' lead to switchboard-plugs G, adapted to be placed in any of the holes 1 2 3, &c., in the switchboard-bars *a a' a*<sup>2</sup> for the purpose hereinafter set forth. These plugs G are preferably  
 75 so made that the wire F' connects with the outer shell H of the plug and the wire F with the conical part H' thereof, these portions of the plug being insulated from each other by  
 80 insulating material *h*, (see Fig. 4,) so that when one of the plugs G is inserted in any one of the holes 1 2 3, &c., the wire F' is connected with one of the switchboard-bars *a a' a*<sup>2</sup>, and therethrough with the main line-wire  
 85 connected therewith, and the other wire F with one of the bars *b b' b*<sup>2</sup>, and therethrough with the main line-wire connected therewith, so as to form a complete circuit from the secondary coil of the induction-coil connected  
 90 with the plug G so inserted through the switchboard-bars in which the plug is inserted and the main line-wires connected therewith to the telephone-station on said lines corresponding in number with the number of the  
 95 hole in the switchboard in which the plug is so inserted.

In the diagrammatic drawing Fig. 1 I have only shown connecting-wires F F' and switch-plugs G from the secondary coils of the in-  
 100 duction-coils 1, 4, and 7. The connecting wires and plugs from the induction-coils 2, 3, 5, 6, 8, and 9, being identical in construction and operation with those shown, are omitted to avoid complicating the drawings  
 105 by a repetition thereof.

I is an ordinary magneto having wires *i i'* leading therefrom to a plug J of the same construction as the plugs G, hereinbefore described, so that when inserted in any of the  
 110 holes 1 2 3, &c., a circuit is formed between the magneto through the main line-wires connected therewith to the telephone-station on said lines corresponding in number with the number of the hole in the switchboard-bars  
 115 in which said plug is inserted.

The telephone-stations are preferably connected by branch wires to the main line-wires A A' A<sup>2</sup> and B B' B<sup>2</sup> in the following manner: Station No. 1 with the positive line A and the  
 120 negative line B, station No. 2 with the positive line A and the negative line B', station No. 3 with the positive line A and the negative line B<sup>2</sup>, station No. 4 with the positive line A' and the negative line B, station No.  
 125 5 with the positive line A' and the negative line B', station No. 6 with the positive line A' and the negative line B<sup>2</sup>, station No. 7 with the positive line A<sup>2</sup> and the negative line B, station No. 8 with the positive line  
 130 A<sup>2</sup> and the negative line B', and station No. 9 with the positive line A<sup>2</sup> and the negative



line B<sup>2</sup>. These connections, however, may be varied, if desired.

In operation the telephone-station desiring to communicate with another telephone-station rings up the exchange in the usual manner, and the current in passing through the induction-coil in circuit with said station operates the armature *e* so as to raise the catch *e'* and release the drop *e''*, which then falls, exposing the number of the station calling, the number of the station desired being then given. The exchange-operator then inserts the magneto-plug J into the hole on the switchboard corresponding in number to that called for and rings up the station connected therewith, after which the plug J is withdrawn and the plug G corresponding to the number of the station calling is inserted in the hole in the switchboard corresponding in number with that called for, and at the same time the switch connecting the induction-coil of the number called for is opened. The two telephone-stations are then in circuit with each other through the secondary coil of the induction-coil connected with the calling-circuit and the two stations can communicate freely without interference from or with any other stations then using the lines.

To more clearly illustrate the operation of this system, by referring to the diagrammatic Fig. 1 of the drawings, suppose station No. 1 desires to communicate with station No. 7. Station No. 1 rings up the exchange and calls for No. 7. The operator then rings up No. 7 and inserts the plug G connected with induction-coil No. 1 in hole No. 7 on the switchboard and at the same time opens the switch *d'*, as shown in dotted lines, connecting one side of the primary coil of the induction-coil No. 7 with the branch wire 4 from the main line-wire B. The parties at stations Nos. 1 and 7 are then in direct communication with each other through the induction-coil No. 1 and may communicate freely without interfering with the operation of other stations on the main line-wires.

In the accompanying drawings, illustrating this invention, I have shown the same as embodying three outgoing and three return line-wires conveniently connected up so as to furnish nine complete metallic circuits, each connected to and adapted to operate a telephone-station. It is obvious, however, that the connections therein shown and the construction and arrangement of the different parts of the system and mechanism may be greatly varied and modified in the actual construction and installation thereof without in any manner departing from the spirit of the invention herein illustrated and described. It is also clear that any convenient number of outgoing and return main line-wires may be utilized by proportionally increasing the number of induction-coils in each series connected with a line-wire, together with a like increase in the telephone

connections and in the switchboard mechanism and apparatus adapted to be connected therewith, the limit of this increase only being dictated by convenience in the construction and operation of the system and apparatus. Therefore, having thus fully described my invention so as to enable others to construct and operate the same, I do not limit myself to the construction and arrangement thereof herein shown and described; but

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination in a telephone system, of a telephone-exchange switchboard, a series of two or more outgoing line-wires, each of which is connected with an insulated bar on the switchboard, a like series of two or more return line-wires, located substantially parallel to said series of outgoing line-wires, each connected with another insulated bar on said switchboard, a series of branch wires from each outgoing line-wire, each of which connects said line-wire with a telephone-station, and a like series of branch wires from each return line-wire, each of which connects with one of the series of telephone-stations installed on said lines, substantially as set forth.

2. The combination in a telephone system, of a telephone-exchange switchboard, a series of two or more outgoing line-wires, each of which is connected with an insulated bar on said switchboard, a series of like number of return line-wires, each of which is connected with one of another series of insulated bars on said switchboard, a series of induction-coils equal in number to the multiple of the outgoing and return line-wires, a series of which coils corresponding in number with the number of outgoing line-wires, being connected with each outgoing line-wire, and a series of said coils like in number being connected with each return line-wire, substantially as and for the purpose set forth.

3. In a telephone system, the combination of an exchange-switchboard, a series of outgoing line-wires, a series of return line-wires, each outgoing line-wire being paired with each of the return line-wires so as to form a circuit therewith, a series of induction-coils, one in circuit with each of said pairs of wires, and a switch-plug connected with the secondary of each of said induction-coils, substantially as and for the purpose set forth.

4. The combination in a telephone system, comprising exchange-switchboard mechanism, of a series of outgoing line-wires and a series of return line-wires, a series of telephone-stations connected from said outgoing to said return line-wires, a series of induction-coils, the primary coils of which are connected in groups with each outgoing line-wire and in other groups with each return line-wire, switch mechanism by means whereof said primary coils may be cut out of circuit with the outgoing or return line-wires when desired, and connecting-wires from the sec-



ondary coil of each of said induction-coils to a switchboard-plug, adapted to connect two bars on the switchboard and the outgoing and return line-wires connected therewith in circuit with the secondary coil of the induction-coil connected with such switchboard-plug, substantially as and for the purpose set forth.

5. In a telephone-exchange mechanism, the combination of a switchboard comprising insulated bars adapted to connect outgoing and return line-wires in circuit, a series of outgoing main line-wires, a series of return line-wires each of which is so connected with each outgoing line-wire so as to form a circuit therewith, a series of induction-coils equal in number to the multiple of the outgoing and return line-wires, connections between each outgoing main line-wire and a number of said induction-coils equal to the number of outgoing main line-wires, and a like connection between each return line-wire and a like number of said induction-coils as are connected with each outgoing line-wire, switch-plugs adapted to complete circuits between the outgoing and return line-wires of the system through the switchboard-bars, and connections between said plugs and the secondary of each induction-coil, substantially as and for the purpose set forth.

6. The combination in a telephone system, of a telephone-exchange switchboard, a series of outgoing line-wires connected with insulated bars thereon, and a series of return line-wires connected with other insulated bars thereon, a series of branch wires from each outgoing line-wire, each of which connects with a telephone-station, a series of branch wires from each return line-wire, each of which connects with one of said telephone-stations, a branch wire from each of said outgoing line-wires connecting with the primary coils of a series of induction-coils, a branch wire from each of said return-wires connecting with the primary coils of a series of the same induction-coils, connecting-wires from

the secondary coils of each of said induction-coils to switchboard-plugs, substantially as and for the purpose set forth.

7. The combination in a telephone-exchange system, of a switchboard, a number of insulated bars thereon, a like number of outgoing line-wires, each connected with one of said insulated bars, a like number of induction-coils, one of which is connected with each outgoing line-wire, a like number of other insulated bars on said switchboard, a like number of return line-wires, each of which connects with one of said insulated bars and also with one of said induction-coils, switches adapted to cut said induction-coils out of circuit, conductors from the secondary coil of each of said induction-coils, and a switch-plug on each of said conductors adapted to connect two of the switchboard-bars in circuit with such secondary coil, substantially as and for the purpose set forth.

8. The combination in a telephone-switchboard mechanism, of a series of bars insulated from each other adapted to be connected to outgoing line-wires, a series of bars crossing said first-named bars and insulated therefrom and from each other adapted to be connected with return line-wires, induction-coils connected with said outgoing and return line-wires, switch-plugs connecting with the secondary coils of said induction-coils adapted to be inserted in said switch-plug openings, whereby any one of said outgoing and any one of said return line-wires may be connected in circuit through said switchboard-bars with the secondary coil of any one of said induction-coils, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

HARLEN P. SNOW.

Witnesses:

FRED EINFELDT,  
C. B. HAYES.