(No Model.) 3 Sheets—Sheet 1.

C. E. CHINNOCK.

TELEPHONE SYSTEM AND APPARATUS.

No. 260,939. Patented July 11, 1882.

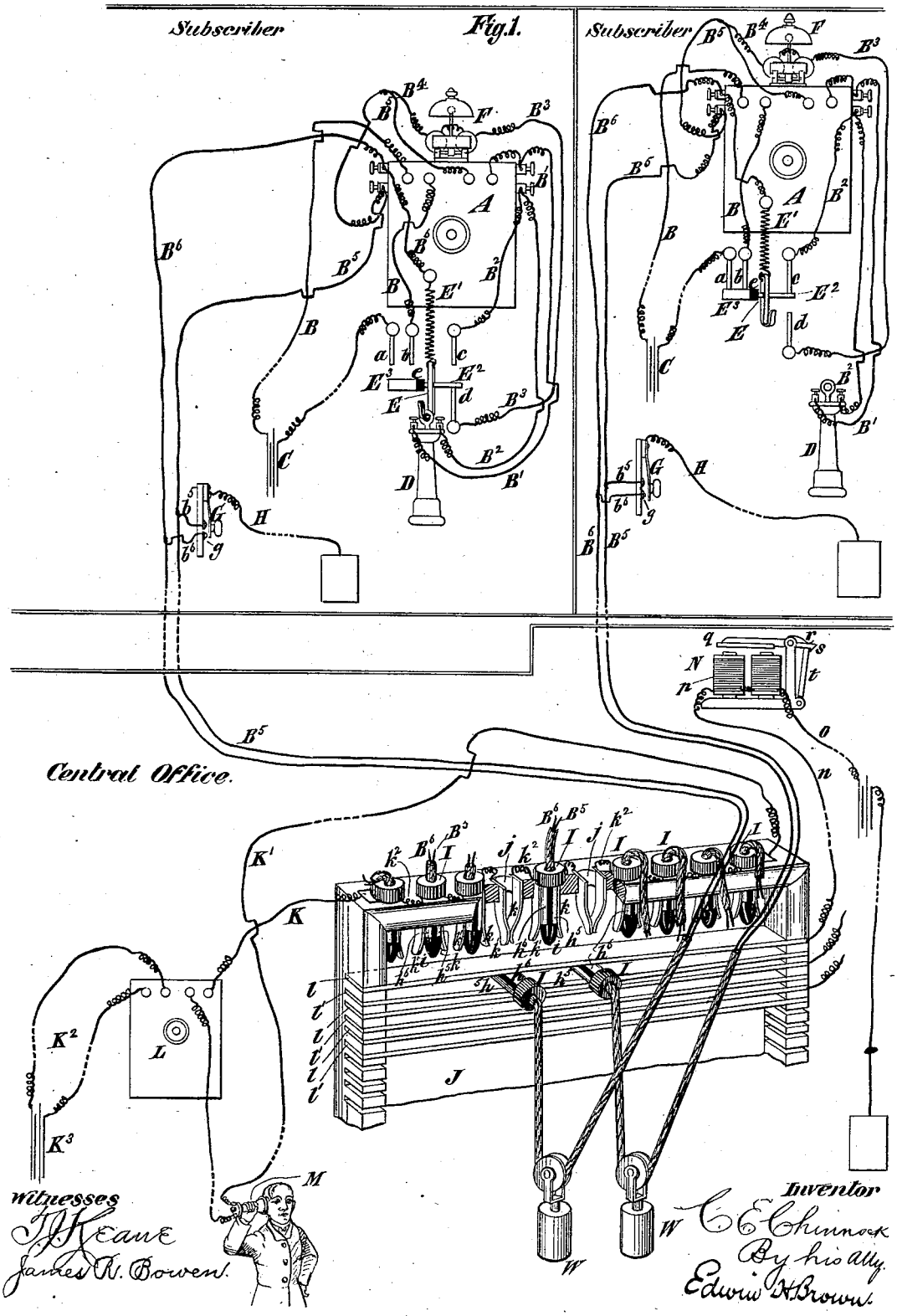

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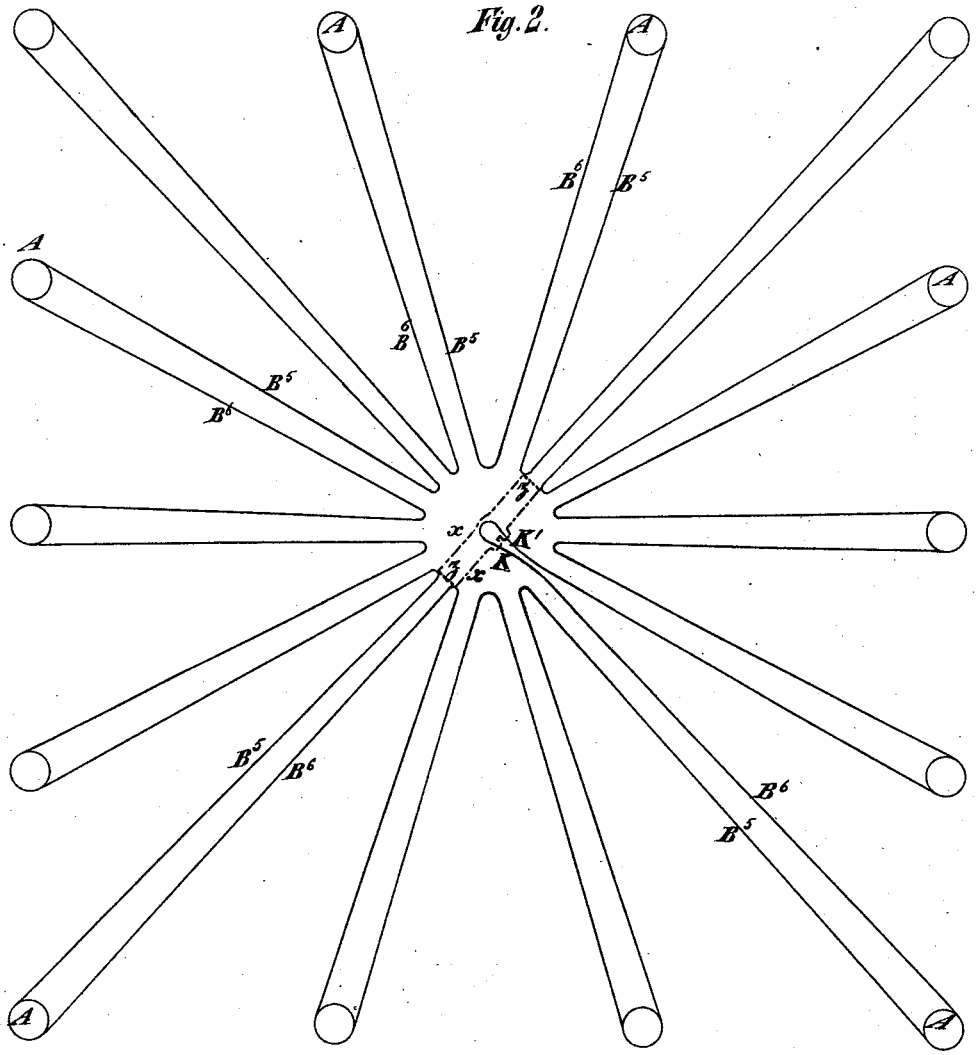
Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

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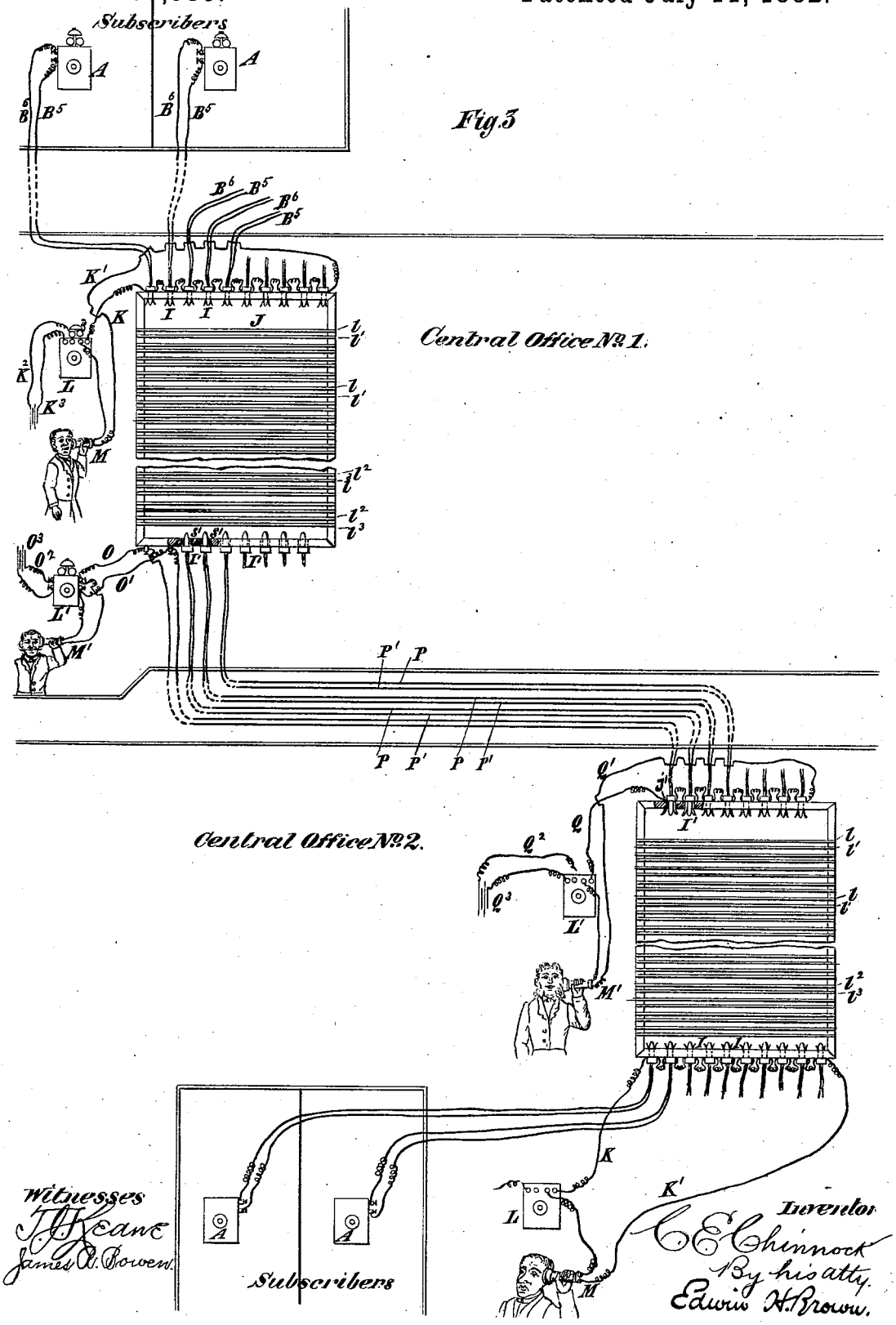

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UNITED STATES PATENT OFFICE.

CHARLES E. CHINNOCK, OF BROOKLYN, NEW YORK.

TELEPHONE SYSTEM AND APPARATUS.

SPECIFICATION forming part of Letters Patent No. 260,939, dated July 11, 1882.

Application filed April 8, 1882. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. CHINNOCK, of Brooklyn, in Kings county, and State of New York, have invented a certain new and useful Improvement in Telephones, of which the following is a specification.

The improvement consists in the combination, in a telephone system, of a central office, a complete metallic circuit comprising pairs of wires constituting loops extending between the central office and the places of business or residence of subscribers, means in the central office whereby the subscribers may indicate to an attendant there that they desire to be put in communication with others, and means whereby pairs of wires or loops which extend between the subscribers and the central office may be removed from the circuit aforesaid, the said circuit may be closed at the place of removal, and the subscribers thus cut out of the circuit may be put into communication.

The improvement also consists in the combination, in a telephone system, of a central office, a complete metallic circuit comprising pairs of wires or loops extending to the central office and to the places of business or residence of subscribers, means in the central office whereby the subscribers may indicate to an attendant there that they desire to be put in communication with others, and means whereby pairs of wires or loops which extend between these subscribers and the central office may be removed from the circuit aforesaid, the said circuit may be closed at the place of removal, and the removed pairs of wires or loops may be united together to form a private complete metallic circuit, affording communication between the subscribers to whom the pairs of wires or loops so removed and united belong.

The improvement also consists in the combination, with telephone-instruments in a central office and at subscribers' places of business or residence, of a complete metallic circuit comprising pairs of wires constituting loops extending between the central office and the several subscribers' places of business or residence, means whereby any of the said pairs of wires or loops may be removed from the circuit, and means whereby, on the removal of any of the said pairs of wires, the circuit may be closed at the place of their removal. Preferably the means for closing the circuit will operate automatically on the removal of the said pairs of wires.

The improvement also consists in the combination, with telephone-instruments in a central office and at subscribers' places of business or residence, of a complete metallic circuit comprising pairs of wires constituting loops extending between the central office and subscribers' places of business or residence, means whereby any of the said pairs of wires or loops may be removed from the circuit and connected electrically with another pair of the said wires or loops, and means for closing the said circuit at the points whence the said pairs of wires or loops were removed from it.

In the accompanying drawings, Figure 1 is a view of a telephonic apparatus embodying my invention. Fig. 2 is a diagram illustrative thereof, and Fig. 3 is a diagram illustrative of other features of the same.

Similar letters of reference designate corresponding parts in all the figures.

I have drawn lines around all the devices which are located in the several subscribers' places of business or residence, and marked said lines with the word "subscriber." Likewise I have drawn a line around all the devices which are arranged in the central office, and marked the line with the words "central office" to conduce to a clear understanding of my improvement.

A designates a number of telephone-transmitters severally located at subscribers' houses or places of business. These transmitters may be of any approved kind.

The ends of the primary wire of the induction-coil of each transmitter are connected by a wire, B, with a battery, C, and two contact-pieces, *a b*.

From one end of the secondary wire of the induction-coil a wire, B', extends to a telephone-receiver, D. A wire, B^2, extends from this receiver to the contact-piece *c* of a switch, E. From an opposite contact-piece, *d*, a wire, B^3, leads to one end of the wire of the electromagnet of an electro-magnetic call-bell, F, arranged on the box of the telephone-transmit-

ter. A wire, B^4, leads from the other end of the electro-magnet of this call-bell to a wire, B^5, which extends from the other end of the secondary wire of the induction-coil to the central office.

The switch E consists of a metallic bar which is suspended by a metallic spring, E′, at the upper end, and is provided at the lower end with a hook on which the telephone-receiver D may be hung.

To the switch-bar E is attached a metallic cross-bar, E^2, having affixed to it at one end a metallic block, E^3, which, however, is insulated from it by a piece of insulating material, *e*. A wire, B^6, extends from the spring E′ to the central office.

When the telephone-receiver is hung on the hook of the switch-bar E, the latter is drawn down so that its cross-bar E^2 breaks contact with the contact-piece *c* and makes contact with the contact-piece *d*, and the block E^3 breaks contact with the contact-pieces *a b*. The electric circuit then extends along the wire B^6 to the spring E′, thence along the switch-bar E to its cross-bar E^2, thence to the contact-piece *d*, thence along the wire B^3 to the electro-magnet of the call-bell F, and thence along the wire B^5 back to the central office. The call-bell F is then in circuit and the telephone-transmitter A and receiver D are out of circuit. When, however, the telephone-receiver is taken off the hook of the switch-bar E, the latter, under the influence of the spring E′, rises, so that its cross-bar breaks contact with the contact-piece *d* and makes contact with the contact-piece *c*, and the block E^3 makes contact with the contact-pieces *a b*. The circuit then extends along the wire B^6 to the spring E′, thence to the bar E, thence to the cross-bar E^2, thence to the contact-point *c*, thence along the wire B^2 to the receiver D, thence along the wire B′, thence through the secondary wire of the induction-coil, and thence along the wire B^5 back to the central office. The block E^3 at the same time, by connecting the contact-pieces *a b*, completes the circuit through the primary wire of the induction-coil. The call-bell F is then out of circuit and the telephone-transmitter A and receiver D are in circuit.

From the wires B^5 B^6, adjacent to the telephone transmitter and receiver branch wires b^5 b^6 extend to contact-pieces *g*. A spring-switch, G, connected with a ground-wire, H, is arranged adjacent to these contact-pieces, and may be pressed against them by the subscriber to establish communication between the wires B^5 B^6 and the ground-wire H, for a purpose which I shall hereinafter explain.

The wires B^5 B^6 are provided at the central office with flexible extensions, which are together inclosed in an insulating-casing of any suitable kind, and are connected with plugs I. The plugs I severally consist of two metallic terminal plates, h^5 h^6, affixed to opposite sides of a plug of insulating material, *i*, and their plates are electrically connected with the flexible extensions of the wires B^5 B^6. Except when subscribers are put in communication with one another, the plugs I are inserted in holes *j* in a switch-board, J. These holes *j* are furnished with pairs of metal contact-pieces *k k′*, which, when the plugs are inserted in the holes, make electrical contact with their plates h^5 h^6, but which, when the plugs are withdrawn, spring together and make electrical contact with one another. The contact-pieces *k* of each pair of contact-pieces *k k′* are connected by wires k^2 with the contact-pieces *k′* of the adjacent pair of said contact-pieces. The outer contact-pieces, *k k′*, of the pairs which are nearest the ends of the switch-board are connected by wires K K′ with the secondary wire of the induction-coil of a telephone-transmitter, L, and with a telephone-receiver, M, both of which instruments are located in the central office. The primary wire of the induction-coil of the telephone-transmitter L is connected by a wire, K^2, with a battery, K^3.

On the switch-board J are metal bars *l l′*, arranged in pairs close together, and secured at the ends in such manner as to be insulated from each other. The spaces between the pairs of bars are such that the plugs I may be inserted between them.

To cause the bars to hug the plugs tightly when the latter are inserted between them the spaces between the bars of each pair are preferably somewhat narrower than the plugs, so that when the plugs are inserted the bars will be slightly spread apart.

The circuit extends along the wire K to the first contact-piece, *k*, thence to the plate h^6 of the contiguous plug I, thence along the subscriber's wire B^6, which is connected to that plug, thence back along the corresponding wire, B^5, to the plate h^5 of said plug, and from this plate h^5 to the contiguous contact-piece *k′*. From this contact-piece *k′* the circuit extends along the wire k^2, which connects said contact-piece with the contact-piece *k* of the next pair of contact-pieces. Thence it extends along the plate h^6 of the plug I, which fits between said pair of contact-pieces, to the wire B^6, which is connected with said plate, then back along the wire B^5 to the plate h^5 of said plug, and thence to the contact-piece *k′*, against which the said plate bears. In the same manner it extends to the remaining pairs of contact-pieces *k k′*, plugs I, and wires B^6 B^5. The contact-piece *k′* of the last pair of contact-pieces is connected to the wire K′. Thus it will be seen that the circuit extends from the central office to the several subscribers without going through the earth at all. If any of the plugs I are withdrawn from their contact-pieces *k k′*, the latter make contact with each other and continue the circuit to the next plug.

The attendant in the central office has of course to constantly keep his receiver M to his ear. Any subscriber desiring to communicate with another subscriber takes down his tele-

phone-receiver and applies it to his ear, thereby also switching his call-bell out of circuit and his telephone-transmitter in circuit. He then tells the attendant in the central office what subscriber he desires to converse with. The attendant then attracts the attention of the latter by operating his call-bell and puts the two subscribers into communication with each other by withdrawing the plugs I from the holes *j* in the switch-board and inserting them between a pair of bars, *l l'*. Communication is thus established between two subscribers by a private or special circuit, no part of which passes or is continued through the earth.

The bar *l* of each pair of bars *l l'* is connected by a wire, *n*, to one end of the coils of electro-magnets *p* comprised in an electro-magnetic annunciator, N, the other end of said coils being connected with a battery and the ground by a wire, *o*. The armature *q* of the annunciator is pivoted to its support and normally raised from the electro-magnets by a spring, *r*. It carries beyond the pivot a hook, *s*, which normally engages with the top of a plate, *t*, that is hinged in place at the bottom and has a tendency to drop forward.

When the subscribers who were conversing no longer desire to remain in communication either pushes his spring-switch G down on its contact-pieces *g*, whereupon a circuit is established from the ground-wire H along either the wire B^5 or B^6 to the bar *l*, thence along the wire *n* to the electro-magnetic annunciator N, and thence along the wire *o* to the ground. Thereupon the armature *q* is attracted by the electro-magnets, the hook *s* is disengaged from the plate *t*, and the latter drops forward and exhibits a number indicative of the pair of bars *l l'* with which the annunciator is connected. The attendant in the central office then removes the plugs I of these subscribers' wires from the bars *l l'* and replaces them in the holes *j*.

In order that my improvement may be the more clearly understood, I will briefly recapitulate its primary features, making reference to the diagram, Fig. 2. A designates the subscribers' telephone-transmitters. B^5 B^6 represent wires extending therefrom to the central office. K K' are wires leading to the attendant's telephone-instruments at the central office.

It will be seen that a complete metallic circuit is obtained with but two wires extending between the central office and each subscriber. All earth-currents are therefore totally eliminated and much of the induction ordinarily experienced is obviated.

The dotted lines *x x* indicate the connection which is made between two subscribers when their plugs I are inserted between a pair of bars *l l'*. It will be seen that in this way a complete metallic circuit is formed between two subscribers by means of their same two wires. The same good results are due to this complete metallic circuit as to the main circuit which extends to the central office.

The dotted lines *z z* indicate the continuation of the main circuit by the contact-pieces *k k'* at the place whence the two subscribers who were put into communication with each other were withdrawn from the main circuit.

In brief, it may be said that a single continuous metallic circuit extends from the central office to and from each of the subscribers. The wires leading to the several subscribers may be regarded as "bights" or "loops" in the main circuit.

I do not wish to confine myself to the use of both the branch wires b^5 b^6, as either can be made to suffice; but I prefer to use both, as then the plugs I can be inserted between the pairs of bars *l l'* without regard to which of their plates k^5 k^6 makes contact with the bar *l*, so as to make it possible to operate the annunciator N.

Preferably I employ, in connection with the cased flexible extensions of the wires B^5 B^6, weights W, attached to pulleys which travel on the said flexible extensions. These weights are advantageous because they keep the same taut and prevent them from becoming entangled.

As all the subscribers' wires are included in the main circuit, save while they are connected to establish communication between them and other subscribers, it is obvious that when any subscriber lifts his receiver off its switch-bar and places it to his ear preparatory to conversing with the attendant at the central office he can hear any order given to the attendant by another subscriber, and can defer beginning conversation with the attendant until that order is finished. Thus much confusion in the giving of orders to the attendant may be avoided. Of course when two subscribers are put in communication in the manner before explained they have a private circuit, and nothing they may then say will be heard by other subscribers.

I will now proceed to describe with reference to Fig. 3 the means whereby communication is afforded between different central offices. I have here shown two central offices provided with switch-boards J, wires B^5 B^6 leading to and from subscribers, and the various other devices already described.

On the switch-boards J are, in addition to the pairs of bars *l l'*, which are employed to establish communication between two subscribers, other pairs of similar bars, l^2 l^3, which are reserved for use in establishing communication between the central offices.

In each central office there is a telephone-transmitter, L', and a receiver, M'. In central office No. 1 the secondary wire of the induction-coil of the transmitter L' and the receiver M' are connected to wires O O', which terminate in a plug, I', like the plugs I, heretofore described, fitting in a hole, *j'*, in the switch-board J of central office No. 2. A wire, O^2,

connects the primary wire of the said transmitter L′ with a battery, O³.

Pairs of wires P P′ extend between the central offices and are provided with plugs I′. The plugs which are at one end of these wires fit in holes *j′* in the switch-board J of central office No. 2, and the plugs I′, which are at the other end of these wires, fit in metallic sockets *s′* in the switch-board J of central office No. 1. The holes *j′* are provided with contact-pieces, which are similar to those in the holes *j*, and act in conjunction with the plates of the adjacent plugs I′, as do the contact-pieces *k k′* in conjunction with the plates of the plugs I. Adjacent contact-pieces of the holes *j′* are connected by intermediate wires.

The sockets *s* of the switch-board J in central office No. 1 continue the electric circuit between the plates of the plugs I′, which fit in them.

Wires Q Q′ connect the contact-pieces of the holes *j′* nearest the ends of the switch-board with the secondary wire of the induction-coil of the transmitter L in central office No. 2, and with the receiver L′ in said office.

A wire, Q², connects the primary wire of the induction-coil of the transmitter just mentioned with a battery, Q³.

It will be seen that the wires O O′, P P′, and Q Q′ are thus included in a continuous circuit.

When one of the subscribers—say, for instance, subscriber No. 1, of central office No. 2—desires to communicate with one of the subscribers—say, for instance, subscriber No. 2 of central office No. 1—the attendant listening at the receiver M′ in the central office first named notifies the attendant at the receiver M′ in the other central office, and thereupon the plugs I′ of a pair of the wires P P′ are inserted in corresponding pairs of bars in the two central offices and the plugs I of the wires B B⁶ of the subscribers are inserted in the same pairs of bars. Thus a complete metallic circuit is formed between the two subscribers.

I do not confine myself to this combination of parts, as the wires O O′ may be permanently connected with the wires Q Q′, and the wires P P′ need not be in circuit therewith. In such case the wires P P′ will never be in circuit except when used to establish communication between subscribers.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a telephone system, the combination of a central office, a complete metallic circuit comprising pairs of wires constituting loops extending between the central office and the places of business or residence of subscribers, means in the central office whereby the subscribers may indicate to an attendant there that they desire to be put in communication with others, and means whereby pairs of wires or loops which extend between the subscribers and the central office may be removed from the circuit aforesaid, the said circuit may be closed at the place of removal, and the subscribers thus cut out of the circuit may be put into communication, substantially as specified.

2. In a telephone system, the combination of a central office, a complete metallic circuit comprising pairs of wires or loops extending to the central office and to the places of business or residence of subscribers, means in the central office whereby the subscribers may indicate to the attendant there that they desire to be put in communication with others, and means whereby pairs of wires or loops which extend between these subscribers and the central office may be removed from the circuit aforesaid, the said circuit may be closed at the place of removal, and the removed pairs of wires or loops may be united to form a private complete metallic circuit, affording communication between the subscribers to whom the pairs of wires or loops so removed and united belong, substantially as specified.

3. The combination, with telephone-instruments in a central office and at subscribers' places of business or residence, of a complete metallic circuit comprising pairs of wires constituting loops extending between the central office and the several subscribers' places of business or residence, means whereby any of the said pairs of wires or loops may be removed from the circuit, and means whereby, on the removal of any of the said pairs of wires or loops, the circuit may be closed at the place of their removal, substantially as specified.

4. The combination, with telephone-instruments in a central office and at subscribers' places of business or residence, of a complete metallic circuit comprising pairs of wires constituting loops extending between the central office and the subscribers' places of business or residence, means whereby any of the said pairs of wires or loops may be removed from the circuit, and means whereby, on the removal of any of the said pairs of wires or loops, the circuit will be automatically closed at the place of their removal, substantially as specified.

5. The combination, with telephone-instruments in a central office and at subscribers' places of business or residence, of a complete metallic circuit comprising pairs of wires extending between the central office and the subscribers' places of business or residence, plugs I, provided with metallic plates connected with the pairs of wires and insulated from each other, and the contact-pieces *k k′*, substantially as specified.

6. The combination, with telephone-instruments in a central office and at subscribers' places of business or residence, of a complete metallic circuit comprising pairs of wires constituting loops extending between the central office and subscribers' places of business or residence, means whereby any of the said pairs of wires or loops may be removed from the circuit and connected electrically with another pair of the said wires or loops, and means for closing

the said circuit at the points whence the said pairs of wires or loops were removed from it, substantially as specified.

7. The combination, with telephone-instruments in a central office and at subscribers' places of business or residence, of a complete metallic circuit comprising pairs of wires extending between the central office and subscribers' places of business or residence, the plugs I, having metallic plates connected to the pairs of wires, but insulated from each other, the contact-pieces *k k'*, and the pairs of bars *l l'*, substantially as specified.

8. The combination, with telephone-instruments in a central office and at subscribers' places of business or residence, of a complete metallic circuit comprising pairs of wires extending between the central office and subscribers' places of business or residence, the plugs I, having metallic plates connected to the pairs of wires, but insulated from each other, the contact-pieces *k k'*, the pairs of bars *l l'*, and the annunciators N, substantially as specified.

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