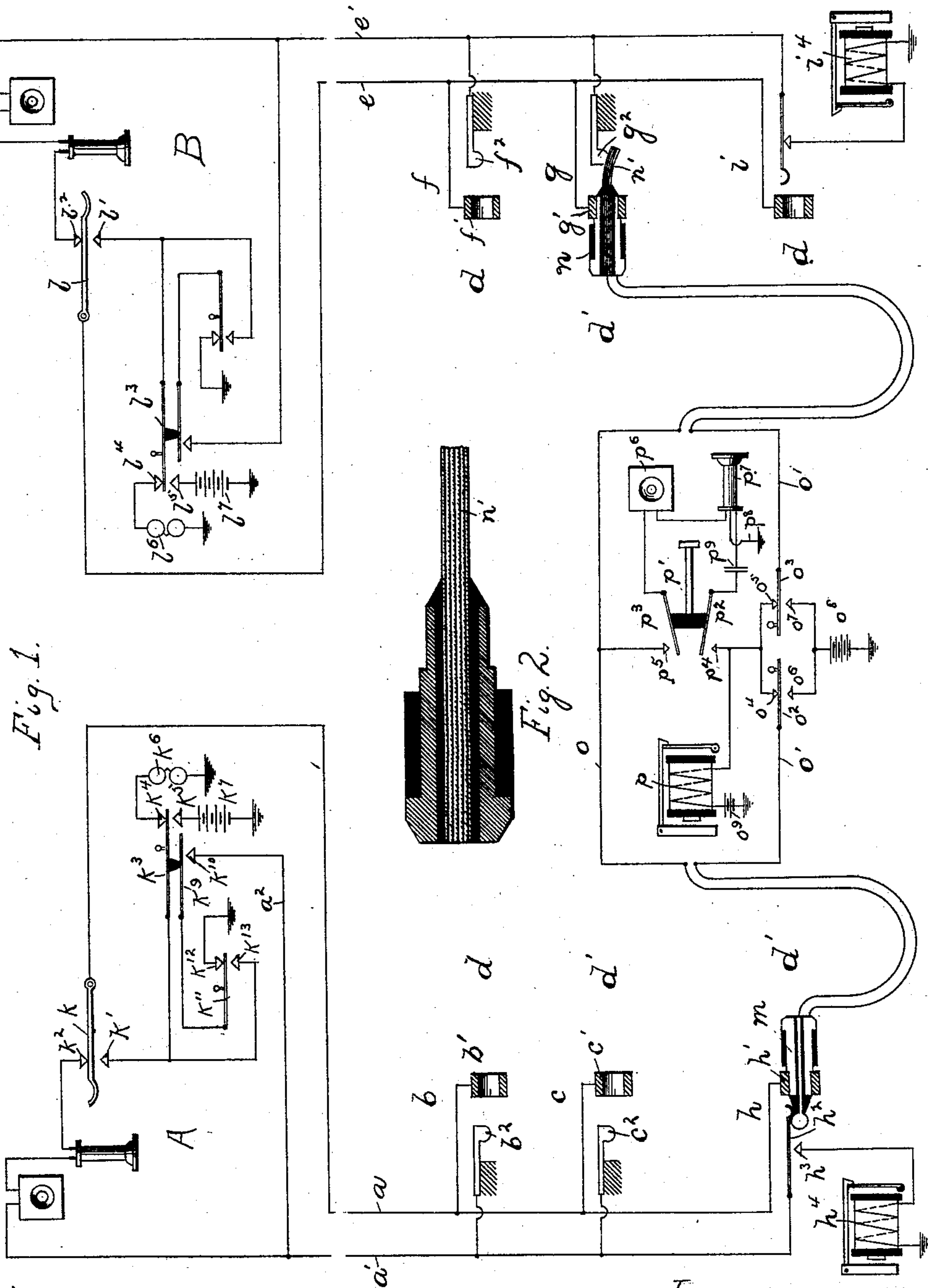


(No Model.)

C. F. G. M. B. DE LA TOUANNE,
TELEPHONE EXCHANGE APPARATUS.

No. 535,745.

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Witnesses:

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UNITED STATES PATENT OFFICE.

CHARLES FELIX GASTON MARIE BIGOT DE LA TOUANNE, OF PARIS, FRANCE.

TELEPHONE-EXCHANGE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 535,745, dated March 12, 1895.

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To all whom it may concern:

Be it known that I, CHARLES FELIX GASTON MARIE BIGOT DE LA TOUANNE, a citizen of France, residing at Paris, France, have invented a certain new and useful Improvement in Telephone-Exchange Apparatus, (Case No. 1,) 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 apparatus, and its object is to reduce the number of contacts at the switch board for each telephone line, and at the same time to facilitate making the calls between the subscribers' stations and the central office, and the connection and disconnection of the lines.

My invention consists, first, in a telephone system in which each subscriber is provided with a pair of keys, whereby when one key is depressed one limb of the line is connected with said subscriber's generator, or source of ringing currents, and when both keys are depressed both limbs are so connected; each subscriber being also provided with an individual annunciator at the central office, which is connected with the limb last to be connected with the generator, whereby both keys must be depressed in sending a calling signal; means being provided whereby the individual annunciator is disconnected from the calling subscriber's line by the act of making connection with said line at the central office, the clearing-out annunciator being simultaneously connected with that limb which is adapted to be connected with the subscriber's generator when the first key is depressed, whereby but a single key need be depressed in sending a clearing-out signal.

My invention consists, second, in a telephone system comprising two limbs, a ground connection through an annunciator from each of said limbs, a source of electricity having one pole grounded, means for connecting said source of electricity with one of said limbs, whereby the annunciator in the ground connection therefrom will be operated, means being also provided for grounding the end of the other of said limbs, whereby the current which does not pass to ground through said first annunciator will be shunted past the annunci-

ator connected with said second limb so as not to operate the same.

My invention consists, third, in a line switch in which the line spring, as heretofore constructed, is replaced by a rigid contact piece, the plug being provided with a yieldingly mounted tip, whereby, when said plug is inserted in the switch, contact will be maintained between the contact piece and the plug tip by the resiliency of the latter.

Each subscriber's line is connected at the central office according to the parenthesis system, with a switch upon each of the sections of the switch board, said switches preferably comprising a ring connected with one limb of the telephone line, which ring may also serve as the test ring, and a rigid contact piece connected with the second limb of the telephone line. Upon some one of the sections of the switch board each subscriber is provided with an individual or answering spring jack switch and an individual annunciator. This answering switch comprises a ring connected with one limb of the telephone line and a line spring connected with the second limb, the line spring normally resting against its contact anvil which is connected to ground through the individual annunciator.

The operator's apparatus comprises a pair of plugs, one of which is of ordinary construction comprising a metallic tip and a metallic sleeve adapted to make contact when inserted in the subscriber's answering switch with the line spring and the test ring respectively. The other plug is of novel construction and is adapted to be inserted into the line switches, which, as before stated, are provided with rigid contact pieces, and, in order to effect an electrical contact between the tip of said plug and said rigid contact piece, the former is adapted to be flexed transversely and is made resilient so that a firm pressure between the tip of the plug and the contact piece may be maintained. The sleeves of the plugs are united by a strand as are also the tips. In a ground connection from the sleeve strand is included the clearing out annunciator, which, when connection is made with any line will thus be in electrical connection with the limb of the telephone line opposite to that to which the individual annunciator is nor-

mally connected. The operator is provided with a telephone set which is adapted to be bridged between the sleeve and tip strands of the plug connection by means of a bridging-in key. Keys are provided in the sleeve strand through the agency of which either section of the sleeve strand may be independently connected with the generator of ringing currents, which is included in a ground connection.

Each subscriber is provided with a key which normally rests in position to include the subscriber's bell in circuit, and which, when depressed, disconnects the bell from the circuit and connects one limb of the telephone line with the generator. Each subscriber is also provided with a second key which, when depressed, serves to connect the second limb of the telephone line with the generator. The individual annunciator being connected with the second limb it is necessary in sending a calling current to depress both keys. When the subscribers are in communication the clearing out annunciator is included in a ground connection from the first limb so that to send in a clearing out signal it is necessary to depress but the first key.

By the above arrangement it will be observed that all ringing currents are provided with a ground return, while the talking circuit is completely metallic. It is to be further noted that calling currents are sent over one limb of the telephone line while clearing out currents are sent over the other limb. By this system the individual annunciator of the called subscriber is included in a ground connection from the talking circuit, and it will be observed that, if the calling subscriber should send in the clearing out signal before the called subscriber should hang up his telephone, a portion of the clearing out current would be shunted past the clearing out annunciator and pass to ground through the individual annunciator of the called subscriber, thus giving a false signal. To prevent such an occurrence, I provide means at the subscriber's station for closing to ground the limb which is not connected with the generator, thus furnishing a path of low resistance to ground, which shunts the clearing out current past the individual annunciator of the called subscriber.

My invention may be used in connection with any suitable test system.

The test system that I have particularly illustrated is that described in Letters Patent No. 442,143, granted to Charles E. Scribner December 9, 1890.

My invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic illustration of my invention. Fig. 2 is a detail view of the connecting plug provided with a resilient tip.

Like letters refer to like parts in both figures.

Referring to Fig. 1, the subscriber's station

A is connected with the central office by means of the limbs a, a' , the limb a being connected with the ring of a spring jack upon each section of the switch board at the central office, two sections only of the switch board being illustrated. Thus, the ring b' of the spring jack b is connected with the limb a , as is also the ring c' of the spring jack c , the spring jack b being placed upon the section d of the switch board while the spring jack c is placed upon the section d' . The other limb a' of the telephone line is connected with the contact piece b^2 of spring jack b and with contact piece c^2 of switch c . Likewise subscriber B is connected with the central office by limbs e, e' , the limb e being connected with ring f' of switch f upon section d of the switch board, and with ring g' of switch g upon section d' . The limb e' is connected with contact piece f^2 of switch f , and with contact piece g^2 of switch g .

Each subscriber is provided at the central office with an individual annunciator and an individual answering jack which are placed upon some one section of the switch board, each subscriber being thus provided with a spring jack upon each section of the multiple switch board, and, in addition, an answering jack and an individual annunciator placed upon some one of said sections.

In Fig. 1 the answering jack h and individual annunciator h^4 of subscriber A are represented as upon the section d' of the board, while the answering jack i and individual annunciator i^4 of subscriber B are represented as being upon section d . The answering jack comprises a ring h' connected with the limb a of the telephone line, a line spring h^2 connected with the limb a' and normally resting upon its contact anvil h^3 which is connected to ground through the individual annunciator h^4 . The answering jack i of other subscribers' lines are similarly constructed and similarly connected with their individual annunciators.

At the subscriber's station the telephone hook k normally rests against contact k' which is in electrical connection with a key k^3 adapted to make contact either with contact point k^4 or contact point k^5 , said key normally resting against contact k^4 which is connected to ground through a bell k^6 . The contact point k^5 is connected to ground through a source of calling currents k^7 which may be either a battery or generator, the key k^3 being provided with a handle by means of which it may be depressed to make connection with the battery to send a calling current over the line.

Movable with the key k^3 but insulated therefrom is a second key k^9 , which, when depressed by the act of depressing key k^3 , makes contact with contact point k^{10} connected by conductor a^2 with the limb a' of the telephone line. Key k^9 is in electrical connection with a key k^{11} which normally rests against a contact point k^{12} connected with ground and when depressed is adapted to make connec-

tion with a back contact k^{13} which is in electrical connection with the contact point k' of the telephone switch.

Subscriber B is likewise provided with a telephone hook l , moving between contact points l' and l^2 and with a key l^3 moving between contact points l^4 and l^5 to close circuit through the bell l^6 or the battery l^7 .

The operator's apparatus comprises a pair of plugs m and n having their tips connected by a tip strand o and their sleeves connected by a sleeve strand o' . In the sleeve strand is included a pair of keys o^2 o^3 , normally resting against contact points o^4 o^5 to maintain the two sections of the sleeve strand in electrical connection. Back contact points o^6 o^7 are connected with one pole of a battery or generator o^8 , the other pole of which is grounded, whereby either section of the sleeve strand may be connected with the battery o^8 to send a calling current over the line. Between the sleeve strand o' and ground is placed the clearing out annunciator p , and in this ground connection is included a battery o^9 adjusted as to potential so that it will prevent a passage of the talking currents to ground through the clearing out annunciator. Between the sleeve strand o' and the tip strand o is bridged the operator's telephone set, a bridging-in key being provided, whereby the connection may be made or broken. This key comprises a plunger p' and springs p^2 p^3 adapted to make contact with contact points p^4 p^5 when the plunger is depressed, and to break contact therewith when the plunger is raised. The transmitter p^6 and receiver p^7 are included in circuit between said springs and the receiver is provided with a half connection p^8 to ground, the purpose of which will be hereinafter described. Between the receiver and the spring p^2 is placed a condenser p^9 , the function of which will be described hereinafter.

One of the plugs of each set is provided with a flexible tip n' , best shown in Fig. 2, which may be formed from a number of wires bunched together, or in any preferred manner, the idea being to render the tip resilient, whereby it may be flexed transversely. In this connection I do not desire to limit myself to the precise construction of resilient tip illustrated, but desire to claim this feature broadly. Each plug is also provided with a sleeve, as usual, adapted, when inserted in the switch, to make contact with the ring.

All of the switches, with the exception of the answering jack, are provided with fixed contact pieces instead of the flexible springs as heretofore used, the electrical connection between the tip of the plug and the contact piece being maintained by the resiliency of the tip.

I will now describe the operation of the system. Suppose the subscriber at station A desires to talk with the subscriber at station B. The first operation is to depress keys

k^3 and k^{11} , thus completing circuit from ground through battery k^7 , key k^3 , key k^{11} , key k^9 , limb a' , spring contact h^2 of the answering jack, contact h^3 , individual annunciator h^4 , to ground. The operator at section d' seeing the drop fall inserts the plug of her set which is provided with the fixed tip, and which may be called the answering plug, in the answering jack of subscriber A, which jack, as before stated, is supposed to be located upon section d' . By the insertion of the plug, line spring h^2 makes contact with the tip of the plug, being thereby raised from its contact anvil h^3 to cut the individual annunciator h^4 out of circuit. The sleeve of the plug makes contact with the ring h' . Thus the sleeve strand of the operator's plug connectors is connected with the limb a of the telephone line and the tip strand with the limb a' . The operator then depresses her bridging-in key p' , thus throwing her telephone set in circuit between the tip and sleeve strands of the plug connectors. Having received the order from subscriber A to connect with subscriber B, she proceeds to test the line of subscriber B to determine whether or not said line is in use. If the line of subscriber B is in use the rings f' , g' , &c., of the several spring jacks connected with said line will be electrified to a potential above that of the earth, since the battery o^9 of the operator's apparatus with which the line may at the time be connected, will be electrically connected with said rings through the sleeve strand of said operator's apparatus. It is evident, therefore, that if the operator at section d' , who has received the order for the connection, makes connection from ring g' of the spring jack at her board to ground through a telephone and hears a click, it will be notice to her that the line is busy, and if she hear no click, that the line is free. Such a connection is obtained by touching the tip n' of the operator's plug to the ring g' , her bridging-in key p being already depressed, circuit being thus closed from ring g' to tip n' and the tip strand o , spring p^3 , operator's telephone set to ground by half connection p^8 .

In order to prevent the battery o^9 from sending current through the telephone set when the bridging-in key is depressed, the condenser p^9 is placed between said battery and said telephone set.

Suppose that the operator finds that the line is free. She then inserts plug n into switch g and depresses key o^3 , thus sending current from battery o^8 to key o^3 , sleeve strand o' , sleeve of plug n , ring g' , limb e , telephone hook l , which is depressed, the telephone being hung thereon, key l^3 and bell l^6 to ground, thus apprising subscriber B that he is wanted at the telephone. Subscriber B having answered, the operator raises her bridging-in key p' and the subscribers are in connection, the circuit being as follows: from the telephone set of subscriber A over limb a' to

spring contact h^2 , tip of the plug m , tip strand o , tip of plug n , contact piece g^2 , limb e' , telephone set of subscriber B, contact l^2 , telephone hook l , limb e , ring g' , sleeve of plug n , sleeve strand o' , sleeve of plug m , ring h' , limb a , telephone hook k , contact k^2 , back to telephone set of subscriber A. The subscribers having completed their conversation hang up their telephones and depress their clearing out keys. Suppose both hang up their telephones and A depresses key k^3 , circuit is then closed from ground through battery k^7 to key k^3 , telephone hook k , limb a , sleeve strand o' , clearing out annunciator p to ground, the potential of battery k^7 being sufficient to overcome battery o^9 . A portion of the current also passes from sleeve strand o' to limb e , telephone hook l , key l^3 , through bell l^6 to ground. The operator seeing the drop of the clearing out annunciator fall, disconnects the lines. If, instead of A sending in the clearing out signal, B had depressed key l^3 , circuit would be closed in a similar manner through clearing out annunciator p .

It will be observed that in the operation as above described, both subscribers hung up their telephones before A sent in the clearing out signal. If, however, A sends in the clearing out signal before B hangs up his telephone, the portion of the clearing out current that is shunted past clearing out annunciator p , and ordinarily actuates the bell of subscriber B, would pass to limb e' of the line of subscriber B, and has a tendency to pass to ground through the individual annunciator i^4 of said subscriber, thus throwing down the drop and giving a false signal. By the arrangement of the simultaneously acting keys k^3 and k^9 , however, this false signal is prevented, for, by the depression of key k^3 to send in the clearing out signal, key k^9 is simultaneously depressed to ground the end of limb a' of the line of subscriber A, which is in electrical connection with the tip strand o and limb e' of the line of subscriber B. A shunt circuit is thus provided around the individual annunciator of the called subscriber, and the current passing through said annunciator is rendered insufficient to throw down the drop.

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

1. The combination with a telephone line comprising two limbs, of a source of calling currents, a key adapted to be depressed to connect said source of currents with one limb of said telephone line, and a second key adapted, when depressed in addition to said first key, to connect said source of currents with said second limb; whereby when one of said keys is depressed one of said limbs is connected with said source of calling currents, and when both keys are depressed both of said limbs are so connected, substantially as described.

2. The combination with a telephone line comprising two limbs, of an individual an-

nunciator normally in a ground connection from one of said limbs and adapted to be disconnected therefrom when connection is made with said subscriber's line as a calling subscriber, a grounded source of electricity at the subscriber's station, a pair of keys adapted, when depressed, to connect said source of electricity with the limb connected with said individual annunciator, whereby a calling current may be sent through said individual annunciator, a grounded clearing out annunciator adapted to be connected with said second limb by the act of connecting with the line, said second limb being alone connected with the source of electricity when one of said keys is depressed; whereby a clearing out current may be sent through said clearing out annunciator, substantially as described.

3. The combination with the two limbs of a telephone line in electrical connection at one end, of a connection to ground from each of said limbs containing an annunciator, a grounded source of electricity, a switch for connecting the end of one of said limbs with said source of electricity, whereby the annunciator connected with said limb may be operated, and means for simultaneously grounding the end of the other of said limbs, whereby the portion of the current not passing to ground through said first annunciator will be shunted past said second annunciator, and said second annunciator be unaffected, substantially as described.

4. The combination with a metallic circuit extending between two subscribers' telephones, of a clearing out annunciator in a ground connection from one of the limbs of said circuit, an individual annunciator in a ground connection from the other of said limbs, a grounded source of electricity at the subscriber's station, a switch adapted to connect with said source of electricity the end of the limb to which said clearing out annunciator is connected, whereby a clearing out signal may be transmitted, and a simultaneously actuated switch adapted to connect the end of the other limb to ground, whereby such portion of the current as does not pass by the clearing out annunciator to ground will be shunted past the individual annunciator and the latter prevented from giving a false signal, substantially as described.

5. The combination with a switch socket provided with a rigid contact, of a plug provided with a resilient tip adapted when the plug is inserted in the socket to be bent aside and form a rubbing contact with said rigid contact, substantially as described.

In witness whereof I hereunto subscribe my name this 30th day of June, A. D. 1893.

CHARLES FELIX GASTON MARIE

BIGOT DE LA TOUANNE.

Witnesses:

W. CLYDE JONES,

GEORGE L. CRAGG.