

(No Model.)

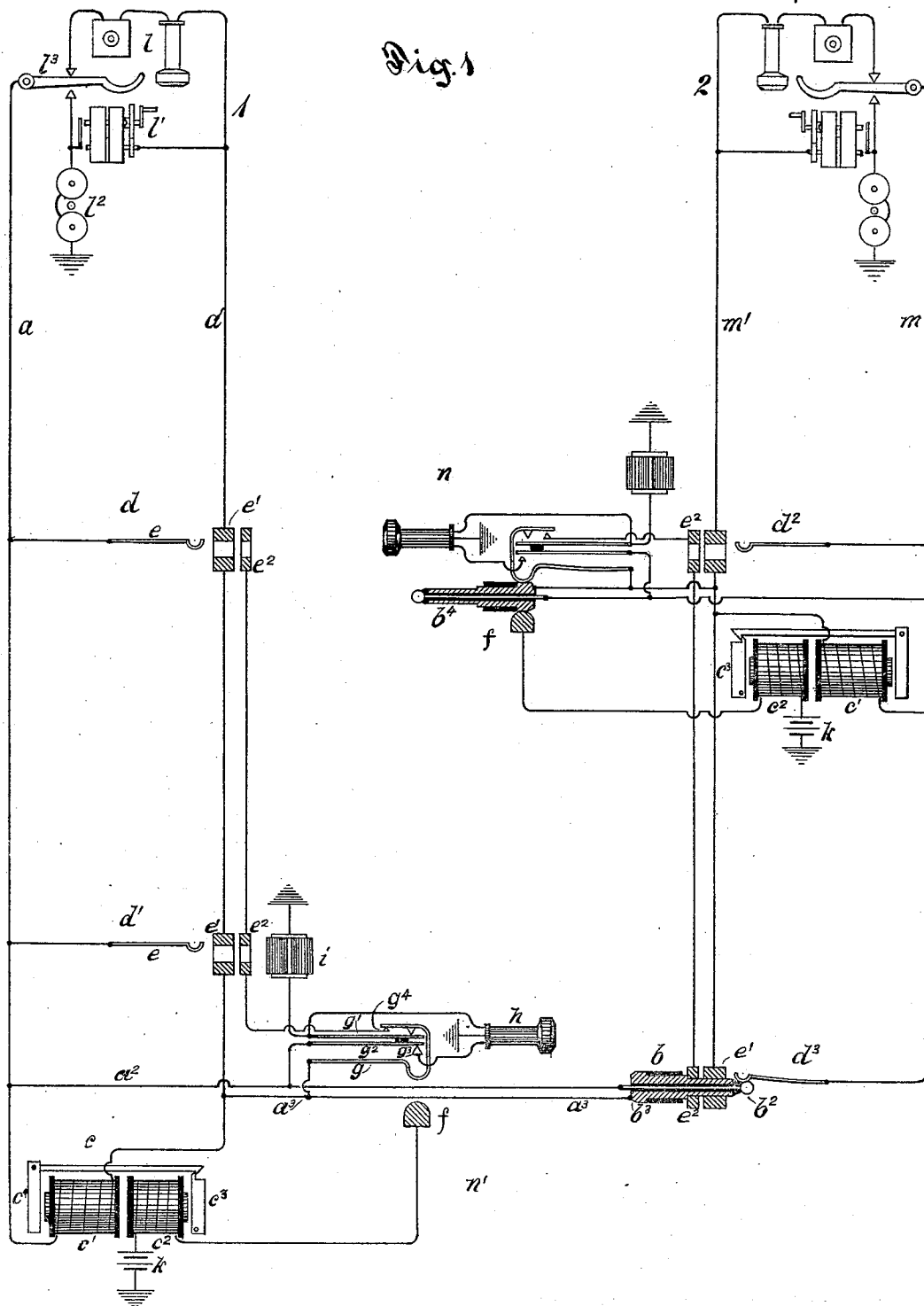
2 Sheets—Sheet 1.

C. E. SCRIBNER.

MULTIPLE SWITCHBOARD SYSTEM FOR TELEPHONE EXCHANGES.

No. 508,054.

Patented Nov. 7, 1893.



WITNESSES

Wm. Carpenter
Lucile Russell

INVENTOR

Charles E. Scribner
By *Frank R. McBerty* Atty

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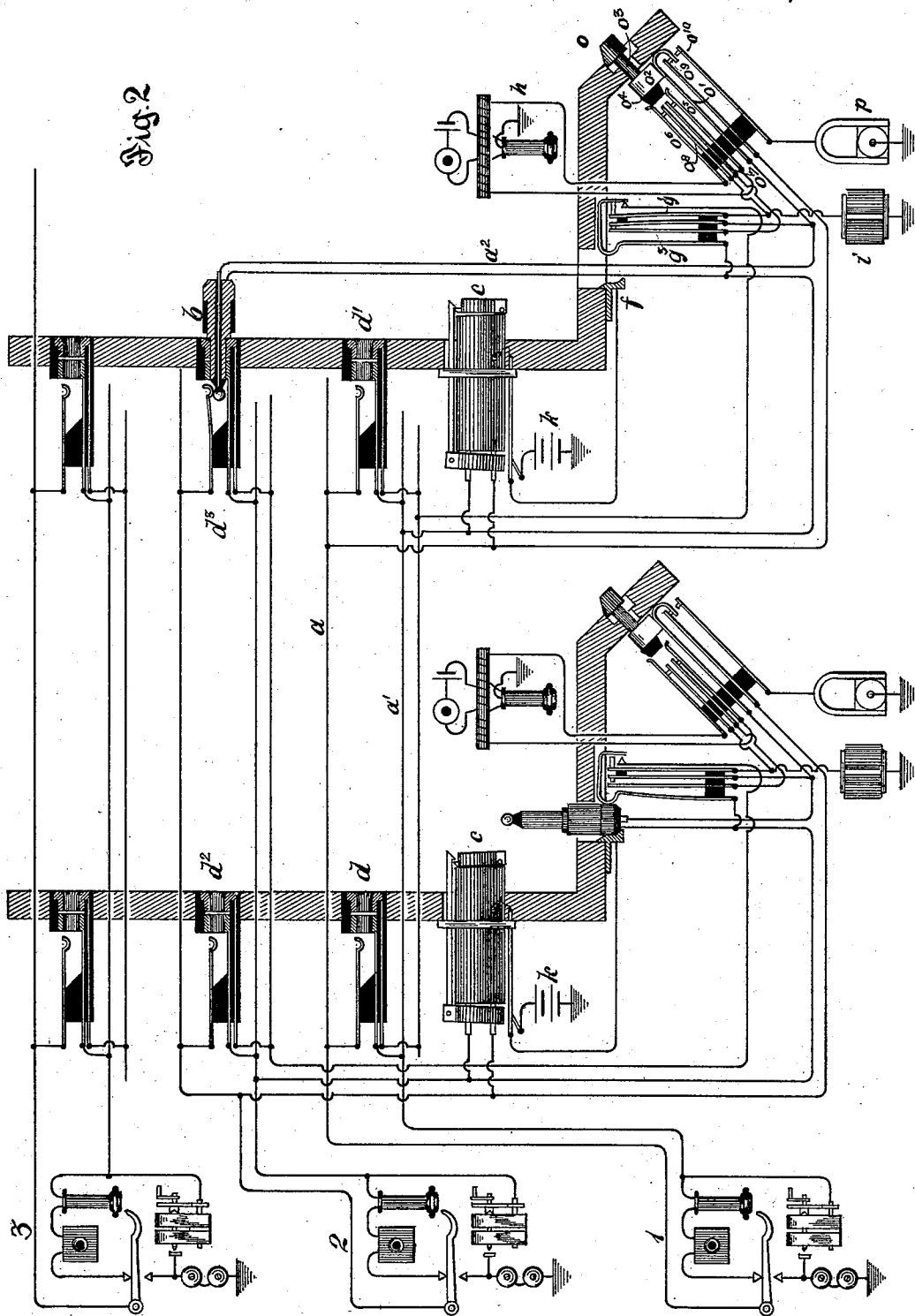
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UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN
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MULTIPLE-SWITCHBOARD SYSTEM FOR TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 508,054, dated November 7, 1893.

Application filed February 7, 1893. Serial No. 461,386. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Multiple Switchboards for Telephone-Exchanges, (Case No. 316,) 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 switching apparatus for central offices of telephone exchange systems; more particularly to the signal receiving devices of the different lines located at the exchange, and means for preventing the operation of the same during connection between the lines.

As is well known in the art, a telephone exchange system ordinarily comprises line circuits extending from the different substations of the system to a common central office and each connected thereat with some form of signal receiving device by which the subscriber at the substation may indicate to the attendant at the central office that he desires a connection with some other line; and also with one or more sockets or springjacks by which the operator at the central office may establish electrical connection with the line circuit, to communicate with the subscriber or to connect the line with any other of the exchange system. In some switching systems, in addition to these parts, the different sides of each line circuit terminate in different contact pieces of a terminal plug adapted for insertion into any springjack or socket. Thus by the simple insertion of the plug of any line into the socket of another line, the two lines are connected together into a continuous loop circuit.

My invention herein has especial reference to this particular type of switchboard,—which is generally known as the single-cord system,—although it may be readily adapted for use with the former system. In any of these systems it is customary for a subscriber desiring a connection to operate the signal sending device at his substation to actuate the signal receiver or annunciator of his particular line at the central office in order to attract

the attention of the operator to his line; and having obtained the connection with the desired line, and having finished his conversation, again to operate his source of signaling current to indicate to the operators at the exchange that the connection with the called line is no longer desired,—it being understood by the operators at the central office that when a call signal is received from a line already connected, the signal is to indicate that connection with the line may be removed. It will be noted, however, that the particular responsive devices or “individual annunciators” of both of the connected lines are in the circuit of the two lines, or in such branches thereof that they receive more or less of the final signaling current or disconnection signal; but it is desirable that both of the annunciators should not be actuated by this disconnection signal on account of the confusion which would arise therefrom. In exchange systems comprising a large number of telephone lines, this liability to confusion becomes very greatly increased. In such exchange systems the lines are commonly divided into groups at the central office, each group comprising just so many lines that one or two operators can attend to all the calls from them—ordinarily about two hundred to three hundred. In a central office thus organized, the annunciators of two lines which it may be required to connect together may be in different groups, located upon different portions of the switchboard and under the care of different attendant operators. In this case, if both annunciators should respond to a signal for disconnection, the attendant at the portion of the switchboard at which the connection between the lines was made would understand that the lines were to be disconnected; but the operator having charge of the annunciator of the answering line would have no information that a connection already existed from that line to another, and would proceed to connect her telephone with the line to receive an order. Thus in order to prevent confusion in the central office, it becomes necessary to provide some means by which the individual annunciator of an answering line may be rendered inoperative or irresponsive to signaling currents as long as the connection exists to the line. It is to this

requirement of the switching system that my invention particularly addresses itself.

In my improved switching system I provide an annunciator having an indicator and two separate electromagnets, one of which—which I designate the “operating magnet”—is adapted to actuate the indicator to display the required signal in response to a signaling current, and the other of which—the “retaining magnet”—when energized, acts to prevent the actuation of the indicator and the display of the signal; in addition thereto, I provide switch springs of the form generally known as a “cord switch,” in connection with a socket adapted to receive the terminal plug of each line, and a battery and circuit connections such that whenever the terminal plug of one line is lifted from its socket and inserted into the springjack of another line, the battery circuit is closed through the retaining magnet of the line with which connection is thus made to retain that annunciator irresponsive to signaling currents over the line circuits, while at the same time the annunciator of the calling line remains sensitive to such currents. Thus in the normal condition of any line its annunciator responds to a call signal sent from the substation of the line, but when the signal for disconnection is sent from either substation of two lines connected together at the central office, only the annunciator of the calling line, at the portion of the switchboard where the connection is made, is operated.

Such “retaining” annunciators as are required in my invention are well known in the art to which my invention pertains; I have described a form which is particularly well adapted to use therewith in my application, Serial No. 420,310, filed February 4, 1892, (Case No. 252); also the cord switches comprising switch-springs in connection with a plug socket, adapted to be actuated to change the circuits by the removal of the terminal plug from its socket, I have described in various applications, among which is my application, Serial No. 312,920, filed June 1, 1889, (Case No. 195.)

My invention, then, comprises a telephone line connected with springjacks or branch terminal sockets at a central office and terminating in the different contact pieces of a terminal plug, a retaining annunciator having its operating coil connected with the line circuit and cord switch actuated by the removal of the terminal plug from its socket, and circuit connections, whereby when the plug is inserted into the springjack of another line, a battery circuit is completed through the retaining coil of the individual annunciator thereof to render it responsive to signaling currents through its operating coil.

I have illustrated my invention in the accompanying drawings, Sheets 1 and 2.

Figure 1, Sheet 1, is a conventional diagram displaying in as simple manner as possible, two telephone lines extending from sub-

stations to a central office and each terminating in a plug thereat, and connected with an individual annunciator at one of two sections of switchboard and with springjacks or branch terminal sockets upon each of the switchboards. Fig. 2, Sheet 2, represents in greater detail two telephone lines connected with terminal plugs, annunciators and springjacks upon two sections of switchboard at the central office, and a third line connected only with springjacks upon the switchboards, and the operator's connecting appliances comprising telephone sets and calling generators and the different keys for connecting and disconnecting the telephones and for sending call signals over the line circuits being shown.

Referring to Fig. 1, the line circuit from substation 1 may readily be traced over the line wires a a' to the apparatus at the central office and connected thereat by wires or conductors a^2 a^3 to the tip and sleeve b^2 and b^3 of a terminal plug b . An individual annunciator c is connected with the line circuit at the central office; the annunciator comprises, essentially, an operating coil c' , a retaining coil c^2 , a heavy shutter c^3 of magnetic material constituting the armature of magnet c^2 , pivoted at its lower edge so as to fall outwardly when released, and an armature c^4 for magnet c' pivoted at its upper edge and provided with an arm carrying a catch engaging with the shutter c^3 and holding it normally in the position shown. When the armature c^4 is attracted to its magnet c' , the magnet c^2 not being energized, the shutter c^3 is released and allowed to fall to indicate the signal; but when the magnet c^2 is energized, the armature c^3 is strongly attracted and remains in its vertical position whether engaged by the catch carried by armature c^4 or not. The magnet c' is included in a closed branch circuit between the different sides a a' of the line circuit. Two springjacks or branch terminal sockets d and d' are also connected with the line circuit; each springjack comprises a spring contact or line spring e , a tubular contact ring e' , and a narrow test ring e^2 ; the line springs e and the contact rings or thimbles e' are connected in multiple with the different sides of the line circuit respectively; the test rings e^2 are connected together by a conductor, but are normally insulated from the line. The plug b when not in use rests in a socket, one side of which is formed by the block f of conducting material, the other side of the socket being formed by the curved spring g which is normally forced outwardly by the plug; other springs g' and g^2 are provided, and a contact point g^3 is so disposed that when the spring g is forced outwardly by the presence of the plug in the socket, the contact point carried by the spring is separated from the spring contact g' and at the same time the resiliency of the contact spring g^2 carries it away from contact point g^3 . Another contact point g^4 is provided near the curved portion of spring g against which the latter closes when the plug is removed.

The contacts g' and g^3 constitute the terminals of an operator's telephone set h which is thus normally disconnected from the line circuit; contact spring g' is also connected through a retardation coil i to earth. Contact spring g^2 is permanently connected with the conductor a^2 which is united with one side a of the line circuit. Contact g^4 is connected with the test ring e^2 . The metallic block f is connected by a conductor through the retaining coil c^2 of the annunciator and battery k to earth. The retaining coil c^2 is thus located in a circuit with the grounded battery k , which circuit extends normally through the block f to the sleeve b^3 of the terminal plug b , but which does not find circuit at any other point to earth. The apparatus at substation 1 is of ordinary character, comprising simply a telephone set l , a magneto generator l' , and call bell l^2 , and a gravity switch l^3 adapted to support the telephone and to connect the call bell to one side of the line circuit when the telephone is hung upon the hook, but to disconnect the same when the telephone is removed from the hook. The apparatus of lines $m m'$, to station 2, is of precisely similar character. It may be supposed that the annunciator c and the terminal plug b of line to station 1 are located upon one section n of switchboard at the central office, while the annunciator c and terminal plug b^4 of lines to station 2 are situated upon another section of the switchboard; the springjack d of line to station 1 and springjack d^2 of line to station 2 may be supposed to be located upon the board n , the jacks d' and d^3 being upon switchboard n' .

In the drawings, the two substations are shown as connected; station 1 being supposed to have initiated the call. The operations involved in thus establishing connection may be briefly traced: The subscriber at station 1, desiring to be connected to another substation of the exchange system, rotates his generator l' —his telephone receiver being on the switch hook—whereby the generator armature is automatically brought into the circuit in the well known manner, and sends current over the lines $a a'$ to the central office, where it finds circuit through the operating coil c' of the individual annunciator c , thereby disengaging shutter c^3 and allowing it to display the signal. The operator at board n' , whereat this annunciator is located, upon seeing the indicator fall, lifts the plug b from its socket; the spring g is thus connected with one side of her telephone h while the spring g' is connected with the other side of the same, bridging her telephone receiver h between the sides of the line circuit and enabling her to receive the order from substation 1. Having learned that connection with station 2 is desired, she proceeds to test that line to determine whether it is already in use or not—this being necessary in order that she may avoid connecting to a line which is already in use at the switchboard n . The operation of testing consists in

applying the tip b^2 of the plug b to the test ring e^2 of the spring-jack at board n of the line desired. If the line be not in use, all the test rings e^2 of the different jacks of the line are insulated from earth; but if it be in use the test rings are connected to earth through the sleeve of the plug by means of which the existing connection is made, the terminal plug of the line tested, the retaining coil c^2 of its annunciator and the battery k , whereby the test rings will be electrified to a difference of potential from the earth, and current will escape through the plug by means of which the test is made to the operator's telephone, through one half the coil thereof to earth, producing a click in the telephone. Thus if the test ring e^2 of jack d^2 should be tested, in its present condition, by applying to it the tip b^2 of a plug connected as plug b is, current would flow from battery k through the retaining coil of annunciator c of line to station 2, thence to the socket piece f , to the sleeve of plug b^4 , thence to the wire m' , to the ring e' of jack d^3 , to the ring e^2 of the same jack, thence to the ring e^2 of jack d^2 , thence to the tip of test plug b , thence to the spring g^2 of the cord switch of that plug, thence through one half the operator's telephone h to earth. Supposing that the operator at board n' , having tested, finds line to station 2 not in use; she then inserts the plug b entirely into the jack d^2 , whereby the lines $a a'$ are connected through conductors a^2 and a^3 and the tip and sleeve of plug b with the corresponding portions of the springjack d^2 , and thence with the lines $m m'$ respectively. At the same time circuit is provided with the battery k through the retaining coil c^2 of the individual annunciator of line to station 2, thence to the socket piece f , to the sleeve of plug b^4 , to the contact ring e' , thence to the sleeve of plug b , over wire a^3 to spring g , thence to spring contact g' and through retardation coil i to earth, returning to battery k . The coil c^2 of the individual annunciator of line to station 2 is thereby energized so that it holds the shutter c^3 of the annunciator firmly whether the latter is disengaged from the catch arm or not. Hence, when the connected subscribers have completed their conversation, either may send the signal for disconnection by rotating his generator without operating the annunciator of line to station 2. The signaling current will find circuit, for example, over lines $a a'$ to lines $m m'$, a portion of the current being shunted through the operating coils c' of the annunciators of both lines; the annunciator of the line to station 1 will be operated thereby since its retaining coil c^2 is not energized; but the annunciator of lines to station 2 will not respond.

In Fig. 2 I have shown precisely similar apparatus, the operator's apparatus being shown in greater detail. Thus, a key o is shown at each operator's table, whereby she is enabled to disconnect her telephone set from the line circuit, and to send call signals over any line

with which the terminal plug *b* is connected. The key comprises a spring *o'* carrying a block *o³* through which slides a plunger *o²*; the plunger *o²* carries at one extremity a plug *o⁴* of insulating material which, when thrust forward, enters between springs *o⁵* *o⁶* and separates them from the contact points *o⁷* *o⁸* against which they normally rest. The plunger *o²* may also be depressed, whereby the spring *o'* is separated from the contact spring *o⁸* against which it normally rests and closed upon a contact *o¹⁰* which is connected to one terminal of a grounded generator *p*. The contacts *o⁷* *o⁸* are connected with contact *g³* and spring *g'* of the cord switch; the contact springs *o⁵* *o⁶* constitute the terminals of the operator's telephone set *h*. Thus when the plunger *o²* is thrust inwardly the telephone set is disconnected from the cord switch whatever may be the position of the latter. The spring *g'* is connected with the conductor *a²* extending to the tip of plug *b* while its normal resting point *o⁹* is connected with one side *a* of the line circuit. Thus when the plunger *o²* is pushed downwardly, the tip of the plug *b* is disconnected from its own line circuit and is connected with one pole of the grounded generator, whereby calling current is sent over the side *m* of any line with which the plug may be connected through the bell of the particular sub-station of that line.

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

1. The combination with a telephone line extending from a substation to a central office and connected with springjacks thereat and terminating in a loop plug, of a self retaining annunciator having its operating coil connected with said line circuit, a socket for receiving said terminal plug when out of use, a cord switch in said socket, a local circuit extending from ground through the retaining coil of said annunciator a battery and normally closed contacts of said cord switch and connected with contact pieces upon the springjacks, and means for closing the said springjack contacts to earth when connection is made therewith; whereby the self retaining annunciator is prevented from being operated by currents in the line when connection is made to any springjack of the line, substantially as described.

2. In combination, two telephone lines each

extending from a substation to a central office and connected with springjack switches thereat, of two self retaining individual annunciators each having its operating coil connected with its particular line circuit, terminal plugs with which each line is connected, and a cord switch for each terminal plug, normally open local circuits each extending from earth through the retaining coil of one annunciator, through normally closed contact points of the cord switch of the corresponding line, and terminating in normally insulated contact pieces of the springjacks of the same line, and a grounded connection from that contact piece of each terminal plug which connects with that contact piece of the springjack which terminates the local circuit, one of said terminal plugs being inserted in a springjack of the other line; whereby the individual annunciator of the calling line remains responsive to signaling currents in the line circuit and the individual annunciator of the answering line is prevented from responding to such currents, substantially as described.

3. The combination with a telephone line extending from a substation to a central office and connected thereat with springjack switches upon different switchboards and with a terminal plug at one of the switchboards, of a socket and cord switch for said terminal plug, separate contact pieces of said socket and cord switch, a conducting sleeve on said terminal plug adapted to connect the said separate contact pieces when the plug is in the socket, an individual self retaining annunciator having its operating coil connected with the line circuit, a normally open branch circuit extending from earth through the retaining coil of the annunciator, through the said separate contact pieces of the cord switch and the metallic conducting ring of the plug and thence connected with contact pieces of the springjacks of the line; whereby the retaining coil is disconnected from the contact pieces of the springjacks when the terminal plug is lifted from its socket, substantially as described.

In witness whereof I hereunto subscribe my name this 11th day of November, A. D. 1892.

CHARLES E. SCRIBNER.

Witnesses:

ELLA EDLER,
WALTER L. SMITH.