

(No Model.)

2 Sheets—Sheet 1.

C. E. SCRIBNER.

MULTIPLE SWITCHBOARD SYSTEM FOR TELEPHONE EXCHANGES.

No. 552,723.

Patented Jan. 7, 1896.

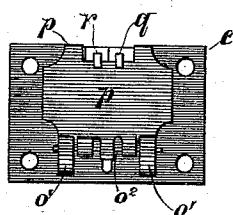
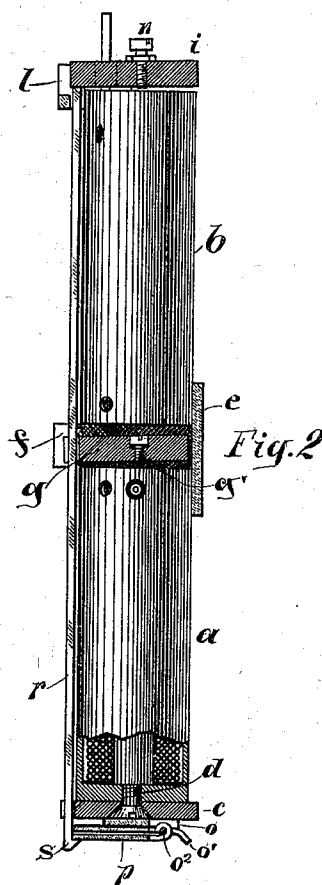
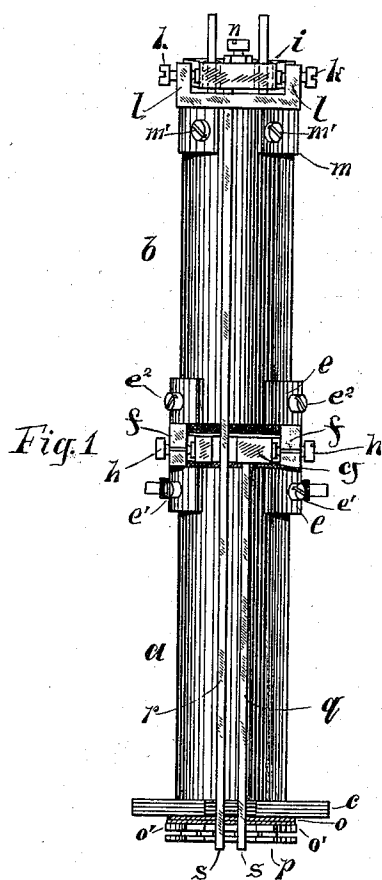


Fig. 3

WITNESSES

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(No Model.)

2 Sheets—Sheet 2.

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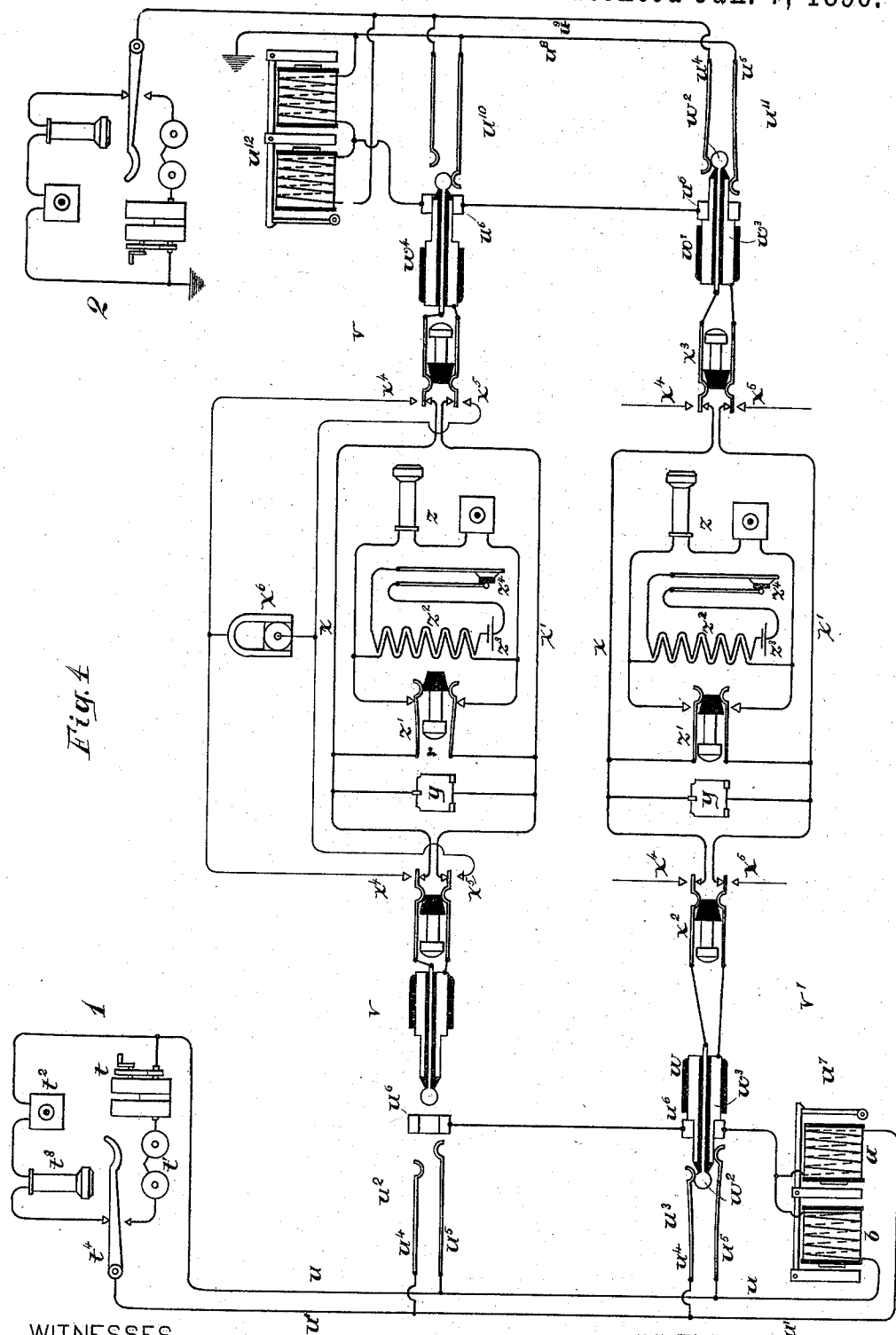


Fig. 4

WITNESSES
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Charles E. Scribner
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UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN
ELECTRIC COMPANY, OF SAME PLACE.

MULTIPLE-SWITCHBOARD SYSTEM FOR TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 552,723, dated January 7, 1896.

Application filed March 5, 1892. Serial No. 423,918. (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-Switchboard Systems for Telephone-Exchanges, (Case No. 294,) 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 switchboard systems for telephone-exchanges, more particularly to the individual annunciators of lines connected therewith and their circuits.

The object of my invention is to provide apparatus for indicating to the attendant operator primary signals from a calling-line, said apparatus being, however, so constituted as to fail to respond to signals subsequent to the establishment of connection with the line whether they be from the exchange to the sub-station or from the sub-station to the exchange, and to accomplish this without including contact-points in line-circuit.

It will be understood that unless the individual annunciator of a line were thus rendered unresponsive to signaling-currents sent upon the line subsequent to the connection with the line the individual annunciator would respond to such signals, and since the individual annunciators of the line to which connections exist may be on some section of switchboard distant from that one upon which the connection is established confusion would arise. The attendant operator at the distant board seeing the annunciator respond would be obliged to determine in each instance whether the operation of the annunciator indicated a call from its particular sub-station or was the result of the sending of a call-signal to the sub-station from some other section of switchboard.

My invention may be generally described as comprising an individual annunciator having two separate electromagnets normally included in series in the line-circuit, adapted to actuate an indicator when simultaneously energized, but to retain the indicator unresponsive when only one is energized, in combination with means for short-circuiting one of

the electromagnets when connection is established to a line. Thus the primary calling-signal from the exchange traverses both coils of the electromagnet, actuating the indicator and attracting the attention of the attendant operator to its particular line. After connection has been established with the line, however, calling-signal sent upon the line is wholly shunted from one of the annunciator magnets, and the indicator therefore remains unaffected. A suitable clearing-out annunciator may be provided in connection with the cord-circuit or connecting outfit of the attendant operator, which shall receive all or a portion of such subsequent signaling-current and respond thereto to indicate the signal to the operator. A construction well adapted to attain this end consists in providing an annunciator with two electromagnets, each with a separate armature actuating an independent catch or detent engaging with a common shutter. When the coils are simultaneously energized, both attract their armatures, thus disengaging both detents from the shutter and allowing it to fall to indicate the signal. When either one of the coils is alone energized it disengages its particular catch from the shutter; but this is prevented from falling by the other detent, which is unactuated. In connection with this form of annunciator a well-known form of spring-jack may be employed, consisting of two insulated line-springs and a test-ring insulated from both line-springs, in connection with a loop-plug, having contact-pieces adapted to make connection with the line-contacts of the jack, respectively, and to cross together one of the line-contacts and the test-ring. The two coils or magnets of the individual annunciator are connected in series in a bridge connection joining the two sides of the line-circuit, and a branch connection is made from the bridge-wire at a point midway between the two coils to the test-ring. When, now, a loop-plug is inserted into a jack of the line to which the annunciator belongs, one of the coils is short-circuited through a path from one of the line-springs directly to the test-ring through the corresponding contact-piece of the loop-plug. In order to test at any section of switchboard to determine whether the line is al-

ready in use through a connection at some other switchboard, I provide a test system whereby the operator by inserting one of her loop-plugs to a slight distance into a jack of the line to which she desires to connect, so that the line, contacts of the loop-plug make connection with the two contacts which are crossed together when the plug is fully inserted into the jack may determine whether such a crossed or short circuit already exists between those contact-pieces. A telephone-receiver is placed in circuit between the different contact-pieces of the loop-plug and a source of slight telephonic current in a parallel circuit with the receiver so as normally to find circuit therethrough and thus to produce a slight noise therein. If, now, when two contact-pieces of the loop-plug are applied to the test-ring and one line-contact, as described, of the spring-jack, the said contacts of the spring-jack are already short-circuited or crossed together by the appropriate contact-piece of the loop-plug at some other switchboard, the telephonic current will be wholly shunted from the telephone-receiver, and thus silence will result in the telephone. This silence is therefore interpreted by the operator making the test to be an indication that the line tested is already in use.

I do not claim this system of testing in connection with this particular switchboard system, but have made it the subject of a separate application, (Case No. 291,) Serial No. 421,174, filed February 11, 1892.

My invention is adapted for use in connection either with metallic or grounded line-circuits.

My invention is illustrated in the accompanying drawings, Sheets 1 and 2.

Figure 1, Sheet 1, is a plan of my improved individual annunciator. Fig. 2 is a side elevation thereof, portions of the annunciator being shown broken away to disclose the construction thereof in central longitudinal section. Fig. 3 is another elevation thereof showing the shutter. Fig. 4 is a diagram showing two sub-stations connected by line-circuits, which are metallic and grounded, respectively, each connected with its particular spring-jacks at an exchange and with an individual annunciator of the pattern shown in Figs. 1, 2, and 3, the two lines being connected through the medium of a pair of loop-plugs and their customary cord-circuit. An additional pair of loop-plugs with their cord-circuit is shown, one of the plugs being shown in position for testing one of the lines. The cord-circuits are equipped with the usual calling and listening appliances and with the test system which I have described.

Referring to Sheet 1, I will describe in detail the individual annunciator therein depicted.

The annunciator is provided with two tubular magnets *a* and *b*. The magnet *a* is secured to a plate *c* by a screw *d*, (shown in Fig. 2,) through the plate *c* and the shell of magnet

a into the core of the magnet. A sleeve *e* of non-metallic metal is provided upon the farther extremity of magnet *a* rigidly secured to the shell of the magnet by screws *e'*. This sleeve is provided with an opening at its upper portion and with posts or projections *f* extending upwardly on opposite sides of this opening. Between these posts and projecting through the opening is placed an armature *g* supported on trunnions *h h* in the posts *f* at its upper edge, and facing the presented poles—the shell and pole respectively—of the magnet *a*. A small screw or stud *g'* is inserted in the armature *g* opposite the core of magnet *a* and adjustable toward it, to prevent the armature from coming into contact with the poles of the magnet and being retained by the residual magnetism. A continuation of the sleeve *e* receives the closed extremity of the tubular magnet *b* and is secured to it by screws *e''*. The two magnets are thus arranged coaxially so as to take up as little space laterally in a switchboard as possible. The open or farther end of the magnet *b* is provided with an armature *i* presented to its poles. This armature is pivoted at its upper edge on trunnions *k k* carried in posts *l l* projecting from a piece *m* of non-metallic metal, rigidly secured to the shell of the magnet *b* by screws *m' m'*. This armature also is provided with an adjustable stop-screw *n* to prevent its too close approach to the poles of the magnet *b*.

Upon the plate *c* of the magnet are mounted two smaller plates *o o'*, the latter having projections at its lower edge which are curved or bent around the two extremities of the short wire *o''*. A third plate of metal *p* is placed before these other plates having also projections at its lower edge bent into a circle or loop surrounding the wire *o''*. The arrangement thus constitutes a hinge upon which the plate *p* of the shutter of the drop is supported, its center of gravity being in front of and above its point of support *o''*, wherefore it tends to fall outward. The armatures *g* and *i* carry two arms *q* and *r*, respectively, rigidly secured to them and free to move when the armature is actuated. These arms carry at their forward extremities detents or catches *s*, which, in the normal position of the armatures, engage with the upper edge of the shutter *p* and prevent it from falling. When one of the magnets *a* or *b* is energized, its particular armature is attracted, raising its catch and disengaging it from the shutter *p*; but the shutter is prevented from falling by its engagement with the other catch. When both of the magnets are simultaneously energized, both detents are disengaged from the shutter, which accordingly falls, indicating the reception of the signal. The shutter is subsequently replaced to its normal position by the attending operator.

Referring now to Fig. 4, the apparatus at the sub-stations 1 and 2 is of the ordinary

character, and consists of a calling-generator t and a signal-bell t' , and a telephone-transmitter t^2 and receiver t^3 in different branches from one side of line, and a gravity-switch t^4

5 connected to the other side of the line-circuit and adapted to connect the telephone apparatus or the calling apparatus alternately in the line-circuit according to the position of the switch. This sub-station apparatus—for example, at station 1—is connected by lines $u u'$ to spring-jacks $u^2 u^3$ upon two sections of multiple switchboard $v v'$. Each of these spring-jacks is provided with two line-springs $u^4 u^5$, of different lengths, which are connected to the different sides $u' u$ of the line-circuit, and a test-ring u^6 . An individual annunciator u^7 , such as that shown in Sheet 1, is provided at the exchange, having its two coils a and b connected in series in a bridge between the different sides $u' u$ of the line-circuit. A branch extends from the conductor joining the two coils a and b of the individual annunciator to the test-rings u^6 of the line to which the annunciator belongs. The individual annunciator u^7 of lines from sub-station 1 may be considered as being located upon the switchboard v' of the exchange and near the jack u^3 upon the same board.

The apparatus of sub-station 2 is connected by similar lines $u^8 u^9$ with similar apparatus, spring-jacks u^{10} and u^{11} and annunciator u^{12} , upon the same switchboards $v v'$, the annunciator u^{12} being placed upon the board v near its spring-jack u^{10} so as to be under the care of another attendant operator. Line u^8 is continued through earth to sub-station 2 in the usual manner, instead of being a complete metallic conductor. Loop-plugs $w w'$ are provided, each having two contact-pieces, a tip w^2 and a sleeve w^3 , the former adapted to make contact with the shorter line-spring u^4 of the spring-jack into which it may be inserted, and the latter with both the longer line-spring u^5 and the test-ring u^6 of the jack. The like contact-pieces of the two plugs are connected to the cord-strands—the conductors $x x'$. Calling-keys $x^2 x^3$ of well-known form are included in the conductors $x x'$, each key being adapted to disconnect both contacts of one of the loop-plugs from those of the other and to connect them to the terminals $x^4 x^5$ of the calling-generator x^6 .

A clearing-out annunciator y is included in a bridge connection between the different conductors $x x'$ of the cord-circuit. A telephone-set z is connected with the contact-points of the listening-key z' , whose contact-springs are connected to the different conductors $x x'$ of the cord-circuit, whereby the telephone-set z is connected in a bridge-conductor between the cord-strands $x x'$ when the plunger of the key z is depressed. An induction-coil z^2 is connected with each operator's telephone-set, its secondary being placed in a parallel circuit with the telephone-set and its primary being included in a local circuit with a battery z^3 and a microphone z^4 , which is kept in

continuous slight vibration. By this arrangement a slight continuous rustling noise is produced in the telephone-receiver z .

In the operation of the system shown, a calling-signal from a sub-station—station 1, for example—traverses the line-circuit, as $u' u$, to the exchange, where it finds circuits through the two coils a and b of the annunciator u^7 which is thus operated, as described in connection with the detailed description thereof. The attendant operator at board v' seeing the indicator of the annunciator fall inserts a loop-plug w into the spring-jack u^3 of that line at her board, and depresses the plunger of key z' , thereby looping her telephone into the circuit from sub-station 1 over a path which may be traced as follows: from sub-station 1 over line u to line-spring u^5 , thence to the sleeve w^3 of plug w , thence through the contacts of one side of the calling-key x^2 to the conductor x' , to one spring of the key z' , thence through the corresponding contact to the telephone-set z , thence through the other contact-point and spring of the key z' to the conductor x , thence through the other side of key x^2 to the tip of connecting-plug w , thence to the shorter line-spring u^4 of the jack u^3 , over line u' to sub-station. The operator is thus enabled to communicate with the subscriber at station 1, and ascertains with what station he desires a connection—we will assume, for example, station 2. The operator then proceeds to test the line called for to determine whether it is already in use or not at some other section of switchboard. This operation of testing may be most readily followed by referring to the cord-circuit at board v , the plug w^4 of which is shown in the act of testing the spring-jack u^{10} of lines to station 2. The plug is inserted until the tip thereof makes contact with the longer line-spring of the spring-jack, the sleeve making contact with the test-ring of the jack, the operator at the same time fixing her attention upon the rustling noise in her telephone. If, now, the test-ring u^6 and the line-spring u^5 be crossed together by the presence of a loop-plug in some other spring-jack of the line, the current from the secondary of induction-coil z^2 will find a short circuit through the two contact-pieces of the key z' , the two conductors $x x'$, the contacts of the calling-key, to the tip and sleeve of the plug w^4 , respectively, and thence to the line-spring u^5 and the test-ring u^6 , respectively, of the jack into which the plug is inserted, thence to the spring-jack at which these contact-pieces are crossed together by a sleeve or loop-plug therein. The rustling sound will, therefore, wholly disappear from the telephone z , and its disappearance will be an indication to the operator making the test that the line tested is already in use.

Assume that the operator at board v' upon making such a test finds lines to station 2 not in use. She then inserts plug w' entirely into the jack u^{11} , thus looping the two sub-stations into a continuous circuit, which may be traced as before from sub-station 1 to the

conductors $x x'$, thence through the calling-key x^3 to the tip and sleeve, respectively, of the plug w' , thence to the corresponding contact-pieces of the jack w^{11} , thence over lines $w^8 w^9$ to sub-station 2. The operator then depresses the plunger of calling-key x^3 , thereby disconnecting the two contact-pieces of the plug w' from the cord-circuit $x x'$ and connecting them to the terminals $x^4 x^5$ of the calling-generator x^6 , looping the calling-generator into the line-circuit to station 2. Current flows from the generator over the lines $w^8 w^9$, a portion of it escaping through the coil a of the individual annunciator u^{12} . The armature of magnet a will thus be attracted and its catch or detent raised out of engagement with the shutter; but the coil b being short-circuited through the test-ring w^6 the sleeve of the plug w' and the long line-spring of the jack w^{11} will not be energized, and hence its detent will retain the shutter of the individual annunciator in position.

When the subscriber at station 2 has removed his telephone from his switch-hook t^4 , the two subscribers will be in telephonic communication. The operator at board v' will be enabled to hear the conversation between the subscribers, since her telephone-set z is in a bridge connection between the two sides of the circuit. Having ascertained that they are actually in communication, she raises the plunger of key z' , thereby disconnecting her telephone-set from the circuit.

When the subscribers have completed their conversation, one of them—as, for example, subscriber at station 1—may send a disconnection signal to the exchange by again rotating his generator t . The current will find circuit to the spring-jack w^3 , whence a portion of it will traverse the coil a of the individual annunciator u^7 , but will fail to operate it because coil b is short-circuited by the sleeve w^3 of the loop-plug w in jack w^3 , as before traced. Another portion of the calling-current will find circuit through the contact-pieces of the connecting-plug to the conductors $x x'$, thence to the clearing-out annunciator y in connection with them, thus operating the clearing-out annunciator and notifying the attendant at board v' that connection between the two lines is no longer desired. Still another portion of the current escapes through the conductors $x x'$ to the contact-pieces of the plug w' and thence over the lines $w^8 w^9$, a portion being shunted through the coil a of the individual annunciator u^{12} of that line, which will, however, fail to respond to the current.

It is obvious that numerous other arrangements of circuit might be devised for use in connection with my improved individual annunciator to prevent its operation when a connection is established with a line. Hence I do not limit myself to the precise construction shown.

Many other test systems may be employed with equal facility in connection with my invention. I have shown and described the

one herein merely on account of its special adaptability in connection with the three contact-pieces, two of which are crossed together by the establishment of connection with a line.

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

1. The combination with two electro magnets permanently included in the same electric circuit, of means for interrupting the current through one of the magnets and mechanism actuated by the magnets when simultaneously excited; substantially as described.

2. The combination with two electro magnets permanently included in the same electric circuit, of means for diverting the current from one of the electro magnets, and indicating mechanism actuated by the electro magnets when simultaneously excited; substantially as described.

3. The combination with a telephone line, of a switch for making connection with the line, two electro magnets connected with the line circuit, an indicator, and intermediate mechanism between the magnets and the indicator, adapted to display the indicator when the magnets are simultaneously excited, and switch contacts for interrupting the current through one of the magnets when connection is made with the line; substantially as described.

4. The combination with a telephone line circuit of an individual annunciator having two independent electro-magnetic helices, indicating mechanism adapted to be actuated by the said helices when they are simultaneously energized, and means for short circuiting one of said electro-magnetic helices when a connection is established to the telephone line, substantially as described.

5. In combination with a telephone line extending from a substation to a central station, spring jacks at the central station, each having three contact pieces, insulated from each other, two of said contact pieces being connected to the different sides of line respectively, an individual annunciator having two electro-magnetic helices each having an armature and indicating mechanism adapted to be actuated when both armatures are simultaneously attracted and to be prevented from operating by either armature when unattracted, a conductor including the two helices of the annunciator in series in the line circuit, and a branch conductor connecting from a point midway between the two helices to the remaining contact pieces of the spring jack, substantially as described.

6. The combination with a telephone line extending from a substation to a central station, of spring jacks at the central station each having three insulated contact pieces, two of which are connected to the different sides of the line circuit, an individual annunciator having two electro-magnetic helices each provided with an armature and an indi-

ator adapted to be operated by the two armatures when they are simultaneously actuated but to be retained by either of the armatures when unactuated, the said electro-magnetic helices being included in series in the line circuit and being connected at a point midway between them to the remaining contact piece of the spring jacks of the line, a loop plug adapted for insertion into a jack of the line, having two contact pieces one of which is adapted to make contact with one of the line contacts of the jack and the other of which is arranged to make contact with both the remaining line contact and extra contact piece of the spring jack, whereby one of the said electro-magnetic helices is short circuited when the loop plug is inserted into a spring jack, substantially as described.

7. The combination with a telephone line extending from a substation to a central station, spring jacks at the central station each having three insulated contact pieces two of which are connected to the different sides of line respectively, an individual annunciator having two electro-magnetic helices and indicating mechanism adapted to be actuated by the said electro-magnetic helices when they are simultaneously energized, but to remain unaffected by one helix alone, said helices being connected in series in the line circuit and having a connection from a point midway between them to the extra contact piece of the spring jacks of the line, a loop plug having two contact pieces one adapted to connect with one line contact of the spring jack, and the other to connect with both the remaining line contact and the extra contact piece when the plug is inserted into the spring jack, and a clearing-out annunciator in a circuit between the different contact pieces of the loop plug, whereby the individual annunciator of the line is rendered inoperative and the clearing-out annunciator is connected to the line, substantially as described.

8. The combination with two telephone lines extending from a substation to a central station, signal sending apparatus at each of the substations included in the line circuit, two groups of spring jacks at the exchange each spring jack having three insulated contact pieces two of which are connected to the different sides of one line circuit respectively, two individual annunciators each having two electro-magnetic helices and an indicator adapted to be actuated by the two helices when simultaneously energized, both helices of one of the annunciators being included in each of the line circuits and being connected at a point midway between the two helices to the remaining or ex-

tra contact pieces of the spring jacks of its particular line, two connecting plugs each having two contact pieces one of which is adapted to make contact with one of the line contacts of the jack into which it is thrust, and the other to cross together the remaining contact pieces of the jack, one plug being inserted in one jack of each group, conductors connecting the different contact pieces of the two plugs, and a clearing-out annunciator in circuit between the different contact pieces of the plugs, whereby signals may be sent from the substation to the exchange, the individual annunciators being rendered unresponsive to such signaling currents and the clearing-out annunciator being provided to receive and respond to them, substantially as described.

9. The combination with a signaling apparatus at a substation of a line circuit extending to a central station connected to two contact pieces of each of several spring jacks, an individual annunciator having two electro-magnetic helices and indicating mechanism adapted to be operated by the said helices when both are simultaneously energized, extra contact pieces upon each of the spring jacks electrically connected together and to the conductor joining the two helices at a point midway between them, a loop plug having two contact pieces one adapted to connect with one of the line contacts and the other with the other of the line contacts and the extra contact piece of a jack into which it may be inserted, a source of electricity, and a key adapted to loop said source of electricity into circuit between the different contact pieces of the said loop plug, whereby a signal may be sent over the line circuit to the exchange to operate the individual annunciator thereat, and the other signals may be set from the exchange to the substation over the same line circuit without operating the individual annunciator, substantially as described.

10. The combination with a drop shutter *p* pivoted below the center of gravity, of the electro-magnet *a*, and its armature *g*, carrying the catch *q* engaging with the shutter *p* to retain it from falling, and the electro-magnet *b* and armature *i* thereof carrying the catch *r* adapted also to engage with the shutter *p*, substantially as described.

In witness whereof I hereunto subscribe my name this 12th day of February, A. D. 1892.

CHARLES E. SCRIBNER.

Witnesses:

FRANK R. MCBERTY,
DE LANCEY A. CAMERON.