

(No Model.)

2 Sheets—Sheet 1.

C. E. SCRIBNER.
MULTIPLE SWITCHBOARD SYSTEM FOR TELEPHONE EXCHANGES.
No. 488,038. Patented Dec. 13, 1892.

Fig. 1

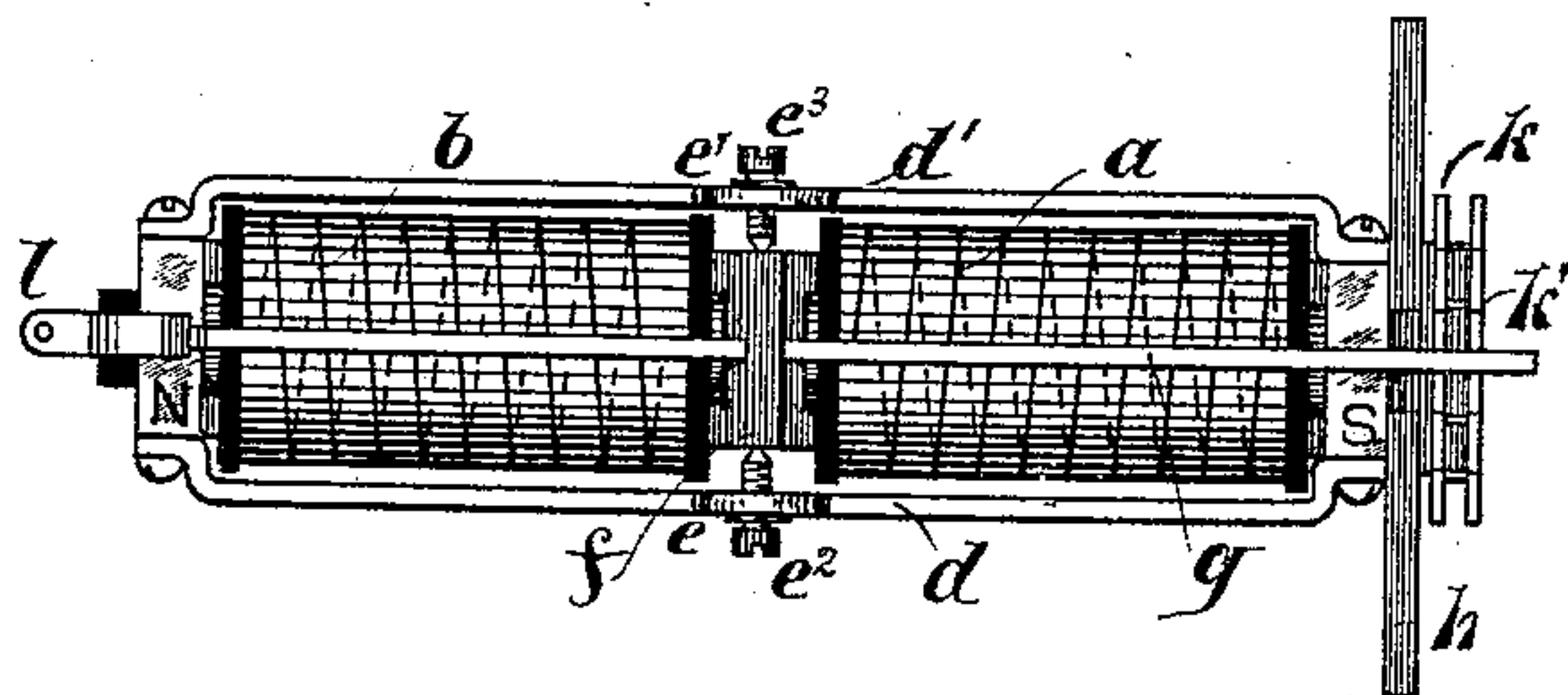


Fig. 2

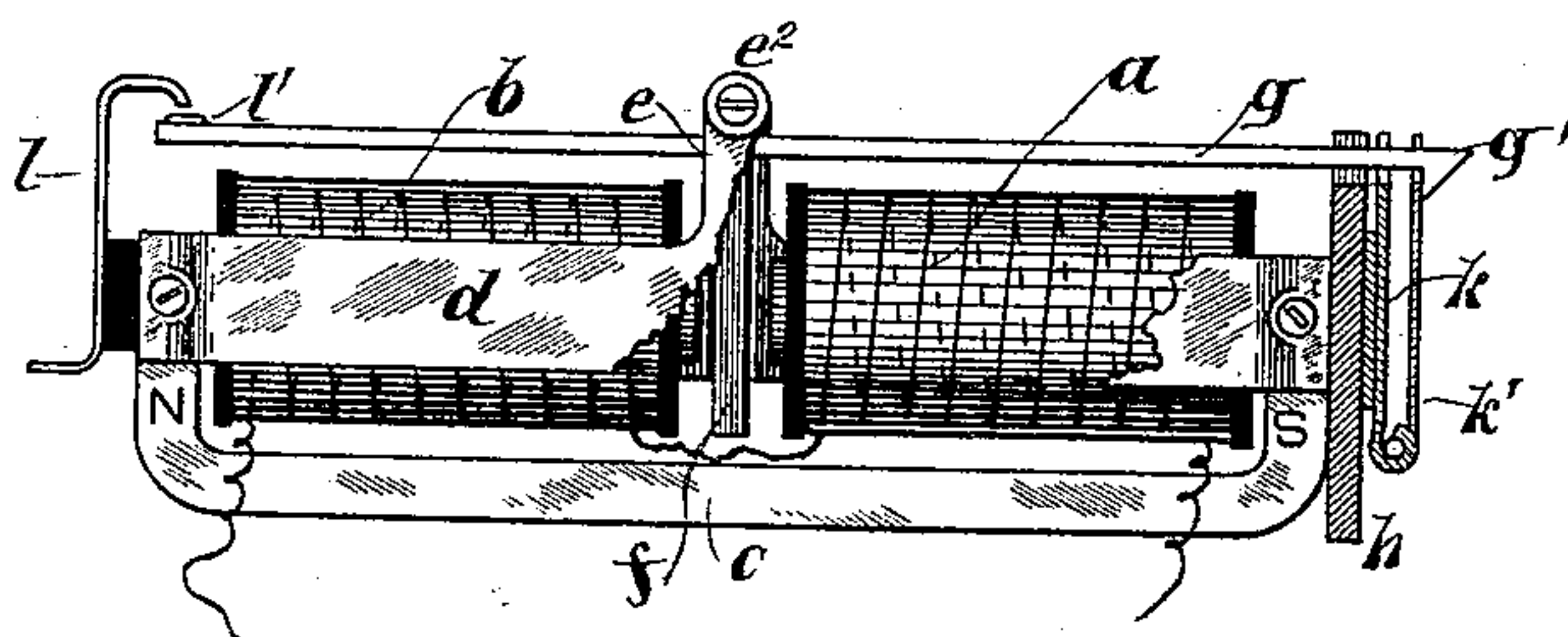
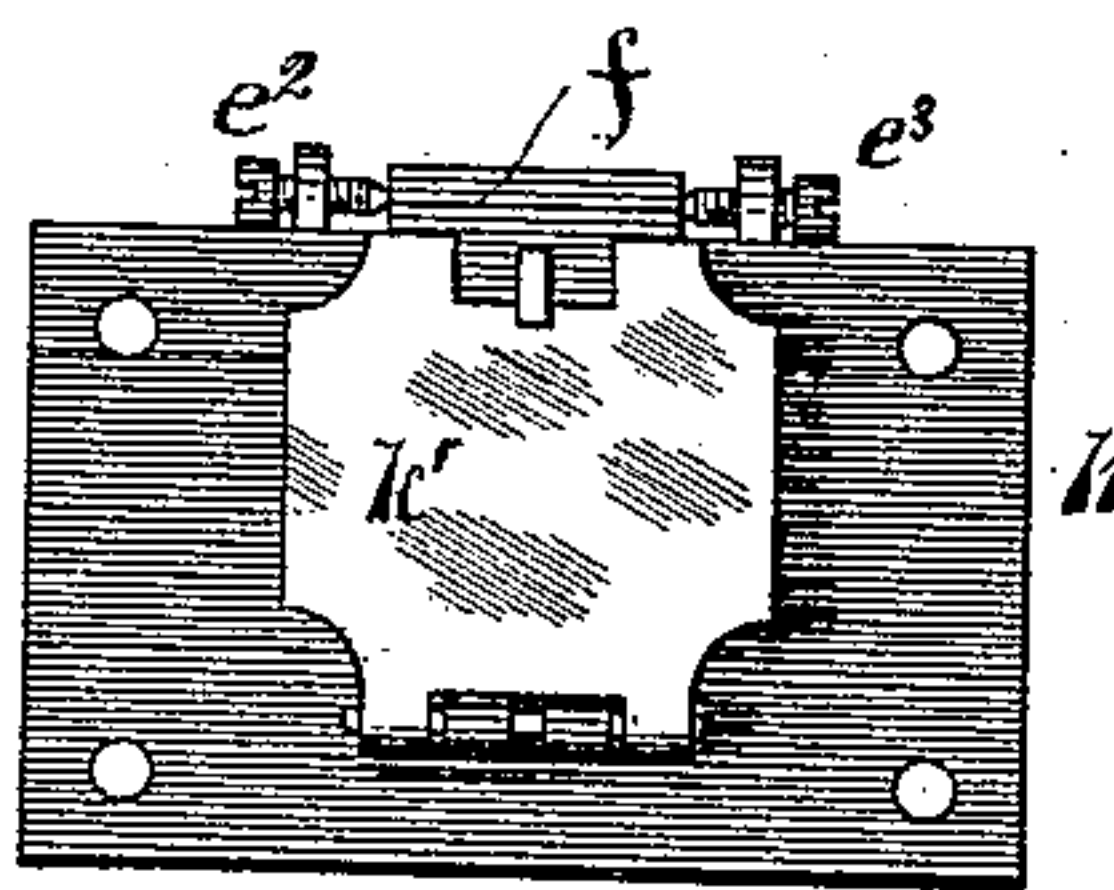


Fig. 3



WITNESSES
George L. Cragg
Frank R. McBerty.

INVENTOR
Charles E. Scribner
BY *Parton & Brown* ATTYS.

(No Model.)

2 Sheets—Sheet 2.

C. E. SCRIBNER.

MULTIPLE SWITCHBOARD SYSTEM FOR TELEPHONE EXCHANGES.

No. 488,038.

Patented Dec. 13, 1892.

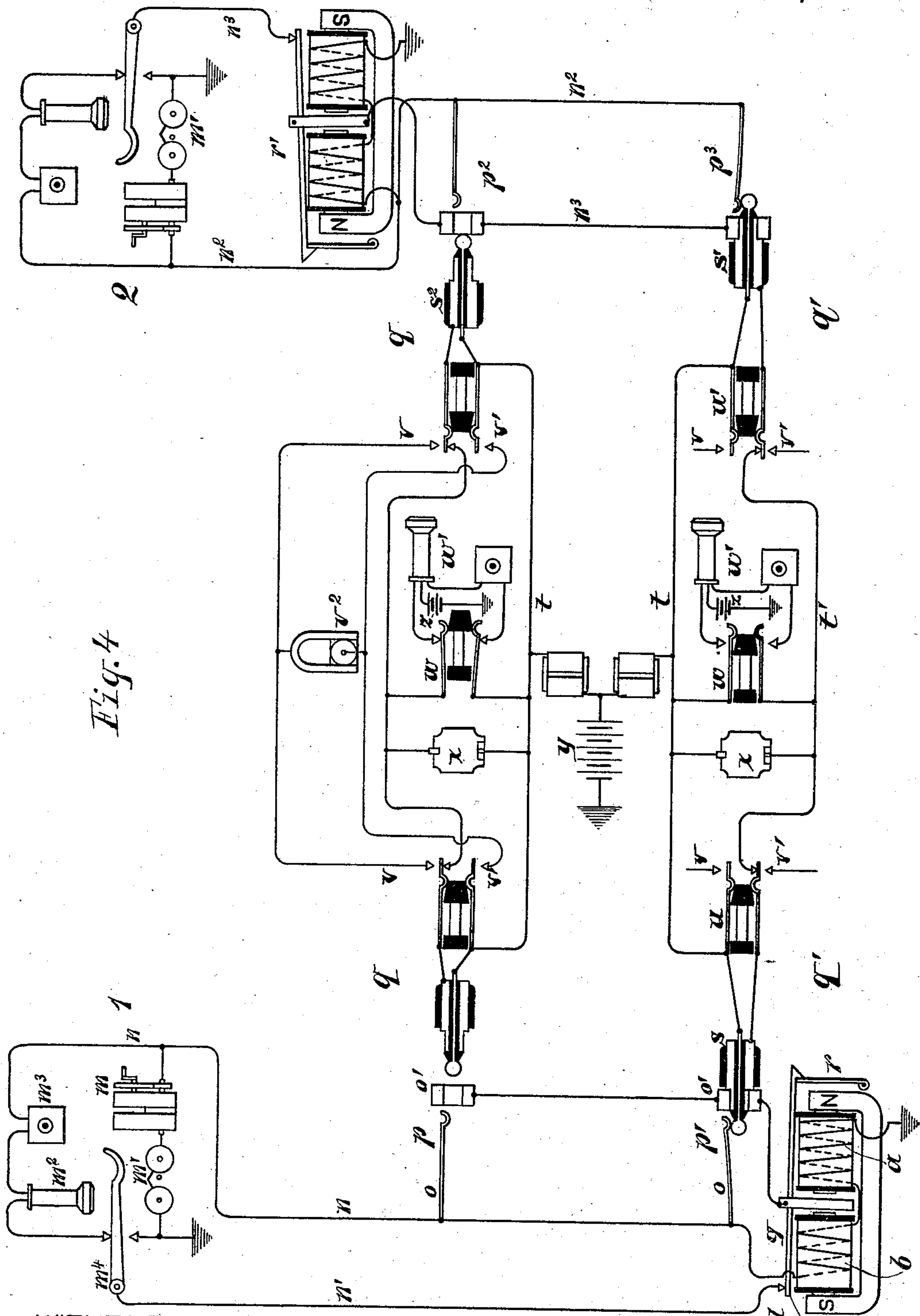


Fig. 4

WITNESSES
George Cragg
Frank R. McBerty

INVENTOR
Charles E. Scribner.
BY *Garton & Brown* ATTYS.

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. 488,038, dated December 13, 1892.

Application filed April 18, 1892. Serial No. 429,664. (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. 302,) 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 multiple-switchboard systems in which the individual annunciator of a telephone-line remains permanently connected to the line-circuit while the line is in use. Its object is to provide a system of this type in which the operation of the individual annunciator by signaling-currents sent subsequent to the establishment of a connection with the line may be prevented and to provide suitable means for testing at one board to determine whether a line is in use at some other switchboard or not.

It will be understood that in multiple-switchboard systems if the individual annunciators of all the lines should remain permanently connected to the line and be free to operate while the line was in use the signal for disconnection or similar signals sent over the line during its use would operate the individual annunciators of both lines, thus calling the attention of two operators at different boards to the line-circuit and causing confusion. Moreover, in multiple-switchboard exchange systems in which a spring-jack for each line is placed upon each section of multiple switchboard it becomes necessary for the operator at each section of switchboard to be enabled to determine at her own board whether any particular line is in use through a connection established at some other switchboard or not. To this end it is customary to provide a testing-contact upon each spring-jack of the line, all the testing-contacts of one line being connected together, and means for altering the electrical condition as to their difference of potential from the earth through the establishment of connection with the line. In order to economize space, the test-rings or test-

side of the line-circuit, and being thus permanently connected with the line-circuit have received induced static charges or potential differences from the earth by inductive and other influences external to the exchange and have thus given false signals when tested. In my invention is provided an individual annunciator having its electro-magnet polarized so as to attract its armature in response to currents of a particular direction, having one of its coil-terminals connected to the line-circuit and the other to earth and in connection with the cord-circuit or connecting-circuit at the exchange a battery of such polarity that when the cord-circuit is employed in establishing connection with the line the battery will find circuit through the polarized individual annunciator of that line and will tend to retain the individual annunciator unresponsive, the strength of the battery being such as to prevent its operation by any ordinary signaling-current. I employ spring-jacks of the usual construction—that is, having two contact-pieces, a line-spring and a test-ring, the test-rings being connected together; but in my system the test-rings are normally disconnected from the line-circuit and are connected to the corresponding side thereof only during the existence of a connection with the line. This connection between the line-circuit and the test-rings is effected by an electro-magnetic device adapted to be energized by a battery in connection with the cord-circuit in a manner similar to the energization of the individual annunciator of the same line. In practice I have found it convenient to provide the individual annunciator with contact-points, one connected with the test-rings and the other with the corresponding side of the line-circuit, arranged in such relation as to be closed together when the annunciator is energized by the battery in connection with the cord-circuit. The normally-insulated test-rings are thus during connection with a line electrically crossed with any source of electricity, as the retaining-battery in the cord-circuit, which may be connected to the line, and therefore when tested, for example, with a test-plug connected through an appropriate responsive device to earth will produce a re-

sponse, thus indicating to the operator test-
 ing that the line is in use. I have found a
 suitable individual annunciator for this pur-
 pose to be a polarized annunciator of ordinary
 5 character having its armature so weighted or
 adjusted as to hang in an intermediate or
 neutral position between two electro-magnets
 and to be attracted by one or the other in re-
 sponse to currents in proper direction to en-
 10 ergize one or the other coil. In connection
 with the armature is provided a catch, which
 in its neutral position engages with a shutter
 to prevent it from falling and with an arm
 carrying a movable contact-piece and holding
 15 it separated from this corresponding contact-
 anvil. When a calling-signal is sent from the
 sub-station over the line, the signaling-cur-
 rent being of proper direction, the armature
 is attracted to one of the electro-magnets and
 20 releases the shutter, thus indicating the sig-
 nal to the attending operator. When the con-
 nection has been established to the line by
 means of a cord-circuit having a battery con-
 nected to it, the current from the battery finds
 25 circuit from the annunciator, as described, in
 a direction to cause the armature to be at-
 tracted to the other electro-magnet, thus re-
 taining the shutter inoperative, and at the
 same time closing the contact-pieces together,
 30 thus connecting the normally-open side of the
 line-circuit to the test-rings of its spring-
 jacks.

My invention is illustrated in the accompa-
 nying drawings, Sheet 1 and Sheet 2.

35 Figures 1, 2, and 3, Sheet 1, represent a po-
 larized individual annunciator such as that
 described. Fig. 1 is a plan thereof. Fig. 2 is
 a side elevation thereof, showing a portion of
 the frame supporting the armature broken
 40 away, so as to disclose the armature and the
 electro-magnet poles. Fig. 3 is a front eleva-
 tion of the annunciator. Fig. 4, Sheet 2, is a
 diagrammatic representation of the exchange
 organized in accordance with my invention,
 45 comprising two sub-stations connected to the
 exchange by metallic circuits, each line-cir-
 cuit being provided with spring-jack switches
 upon two sections of multiple switchboard
 and with an individual annunciator at one
 50 of the switchboards. A cord-circuit is shown
 at each of the switchboards, that at one of the
 boards being in position of testing one of the
 lines to determine whether it is already in
 use or not.

55 Referring to Sheet 1, a b are two electro-
 magnets having their free poles presented to-
 ward each other. Magnets a and b are joined
 at their other ends by bar c of steel, which is
 permanently polarized. The bar c thus serves
 60 to impart a permanent electro-magnet polar-
 ity to the cores of magnets a and b in a cer-
 tain direction, and at the same time to com-
 plete their magnetic circuit. Two plates or
 bars d d' of non-magnetic material are se-
 65 cured at their extremities to magnet c , carry-
 ing at their central portions upwardly-pro-

jecting posts or extensions e e' , provided with
 adjustable trunnions e^2 e^3 . An armature f of
 soft iron is pivoted at its upper edge upon the
 trunnions e^2 e^3 , so as to be suspended verti- 70
 cally midway between the presented poles of
 the electro-magnets a and b and to be free to
 swing toward the one or the other, according
 to which is most strongly energized. The ar-
 mature f preferably extends to within a slight 75
 distance of the heel piece or bar c , so as to
 nearly complete the magnetic circuit of that
 coil toward which it is more strongly attracted.
 An arm g is rigidly secured at right angles to
 the armature f , extending on both sides there- 80
 of. A plate h is secured to one end of the
 electro-magnet system and carries upon its
 front a number-plate k and a shutter or shield
 k' , hinged at its lower edge and of such size 85
 and shape as to conceal the number-plate k
 when in the position shown, as in the usual
 individual annunciator. The shutter k' is
 normally retained in the position shown by a
 catch g' upon a corresponding extremity of
 the arm g , engaging with the upper edge of 90
 the shutter. The catch is of such length as
 to allow to the arm g a slight downward move-
 ment in excess of that required to retain the
 shutter. At the other extremity of the bar c
 is provided a contact-anvil l , rigidly secured 95
 to the bar c , but insulated therefrom by an
 interposed hard-rubber plate. A contact-
 piece l' is provided upon the corresponding
 extremity of the bar g , adapted to be closed
 against the contact-anvil l when that end of 100
 the arm g is raised to a sufficient amount.

The normal position of the armature is as
 shown in Fig. 2, the armature being in its in-
 termediate or neutral position, the contact-
 points being open or separated, and the shut- 105
 ter being in a position to conceal the number
 upon the plate. When a current of suitable
 direction is sent through the coils a b of the
 annunciator, the armature f is attracted to-
 ward the coil a , raising the catch g' out of en- 110
 gagement with the shutter k' and allowing
 the latter to fall, disclosing the number or
 name upon the plate k to the attending oper-
 ator. When current is sent in the opposite
 direction through the coils a b , the armature 115
 f is attracted to the coil b , closing the con-
 tact-points l l' while still retaining the shut-
 ter k' .

Referring now to Sheet 2, Fig. 4, I will de-
 scribe the exchange system therein repre- 120
 sented. The apparatus at the exchange may
 be of the ordinary character, comprising a
 magneto-generator m , adapted to send alter-
 nating currents, and a signal-bell m' and a
 telephone-receiver m^2 and transmitter m^3 in 125
 different branches from one side n of the
 line-circuit, and a gravity-switch m^4 , con-
 nected with the other branch n' of the line-
 circuit and adapted to connect the signaling
 apparatus or a telephone apparatus alter- 130
 nately into line-circuit, according to the posi-
 tion of the switch-lever. An earth connec-

tion is attached to that side of the branch containing the generator and signal-bell, which is adapted to be connected with the side n' of the line-circuit, in order that signaling-currents may be sent or received either through the metallic circuit $n n'$ or the grounded circuit made up of side n of the circuit and the earth. The lines $n n'$ extend to the exchange where the line n is connected to the line-springs o of two spring-jacks $p p'$ upon two sections of switchboard $q q'$. The spring-jacks $p p'$ have, in addition to the line-springs o , test-rings o' , as usual. An extension from the side n of the line-circuit includes coils a and b of the individual annunciator r upon the switchboard q' . The test-rings o' of the different jacks $p p'$ are connected together by a conductor and to the arm g of the individual annunciator. The side n' of the line is connected with the contact-anvil l of the annunciator. The connecting outfits at the different switchboards are of the usual character. Each comprises a pair of loop-plugs $s s'$, the like contact-pieces of the two plugs of a pair being connected by conductors $t t'$. Ringing-keys $u u'$ are included in the cord-circuit, each arranged to disconnect the sleeve of one of the loop-plugs from that of the other and to connect the poles $v v'$ of a calling-generator v^2 into circuit with its particular plug. A listening-key w is provided, having its contact-springs connected to the conductors $t t'$ of the cord-circuit and having its contact-points connected with the terminals of the operator's telephone-set w' . A clearing-out annunciator x is permanently included in a bridge connection between the conductors $t t'$. A battery y , grounded at one pole, has its other pole connected to the conductor t , connecting the tips of the different connecting-plugs.

In the operation of the system a subscriber wishing to communicate with another subscriber connected with the same exchange rotates the calling-generator m , the switch m^4 being in its lowest position. The signaling-current finds circuit from one pole of the generator m to earth through the signal-bell and from the other pole over line-wire n to the exchange and therethrough the coils b and a of the individual annunciator r and thence to earth. The signaling-current being of alternating character, polarized annunciator r is operated, attracting the attention of the operator at board q' . The operator at this board then inserts one plug, as s , of a pair into the jack p' of that line at her board and restores the shutter of the individual annunciator to its normal position. The battery y is then provided with a circuit through the retardation-coil to the cord-strand t and thence to the tip of plug s , thence to the line-spring o of jack p' , thence through the individual annunciator r to earth, energizing the annunciator in such manner that the armature thereof is

attracted to the coil b , causing the catch g to enter into further engagement with the shutter and closing the contact-point l' upon the contact-anvil l , thereby connecting the side n' of the line-circuit to the conductor connecting with the test-rings o' of the spring-jacks of that line. The operator at board q' then depresses the plunger of her listening-key w , connecting her telephone-set w' in a loop-circuit with sub-station 1, which may be traced as follows: From the sub-station over line n to line-spring o of jack p' , thence to the tip of plug s , thence by conductor t to listening-key w and the telephone-set w' , thence to the conductor t' , through the ringing-key u to the sleeve of plug s , thence to the test-ring o' of jack p' , to the arm g of the annunciator r , to the contacts $l l'$, and thence by line-wire n' to sub-station. The operator and the subscriber are thus provided with a metallic circuit connecting them. The operator having received the order from subscriber at station 1—say for a connection with station 2—proceeds to test that spring-jack at her board of the line called for to determine whether the line is already in use or not. This she does in the well-known way by applying the tip of the other plug s' of the pair to the test-ring of the jack p^2 of lines to station 2. The plug s^2 of the cord-circuit at board q is shown in the position of testing the jack p^2 of this same line, and the process of testing may be most readily followed in connection with that cord-circuit. If the test-ring of an unconnected line be tested in this manner, the operator making the test, listening at receiver w' , perceives no response in the telephone-receiver when the testing-plug is applied to the test-ring of the jack, since the test-rings are disconnected from all else; but if the line be already in use a battery z in connection between, the middle of the telephone-receiver and earth, will find circuit through one-half the telephone-receiver coil to the conductor t , thence to the tip of the plug s^2 , thence to the test-ring of the jack tested to the line-wire connecting therewith at the individual annunciator, as line-wire n^3 , thence to earth if the line be a grounded line, or returning over the line-wire n^2 to the individual annunciator, and to earth if the line be a metallic-circuit line, and a click will be produced in the receiver w' at each application of the testing-plug to the test-ring of the spring-jack. It is not necessary that the operator should receive any particular characteristic response in her telephone when she applies the tip of her testing-plug to the test-ring of the spring-jack. It is sufficient that she receive any response, since the test-rings are normally—that is, in the unconnected condition of the line—wholly disconnected from the line-circuit and from the earth and will give no test-signal when tested. Suppose the operator at board q' has found the lines to station 2 not in use. She inserts the other plug s' , with which she has

been testing, into the jack p^3 of that line at her board. The battery y is thereby connected with the annunciator r' of that line, energizing it in the proper direction to close the side of line n^3 to the test-rings. The two sub-stations 1 and 2 are thus looped into a continuous metallic circuit, which may be traced, as before, over sub-station 1 as far as conductors $t t'$, from which it is extended by means of plug s' and the corresponding contact-pieces of the jack p^3 to the line-wires $n^2 n^3$, and thence to sub-station 2. The operator then depresses the plunger of calling-key u' , disconnecting one side of the cord-circuit from the connecting-plug and looping the calling-generator v^2 into circuit between the contact-pieces of plug s' , thus sending current to the sub-station 2, which finds circuit through the signal-bell m' thereat to call the subscriber at that station. The operator, having ascertained that the subscribers at stations 1 and 2 are actually in communication, allows the plunger of listening-key w to rise, thus disconnecting her telephone set from the cord-circuit. When the subscribers have completed their conversation, one of them—we will say that one at station 1—sends a signal for disconnection to the exchange by again rotating his generator m , the telephone having been replaced upon the switch-hook m^4 . The signaling-current finds circuit over the metallic circuit $n n'$ to the cord-circuit $t t'$, thence through the clearing-out annunciator x , which is thereby operated, indicating the disconnection-signal to the attendant. A portion of the signaling-current escapes to the earth at sub-station 1 and at the exchange through annunciator r ; but the annunciator is prevented from releasing its shutter by the force of the battery y .

I do not desire to limit myself to the particular arrangement of apparatus herein shown and described. Many modifications of the annunciator r may be found equally effective with the form shown. Moreover, in some instances it may be found desirable to provide a separate electro-magnet to operate the contact-points $l l'$ to connect the line-wire n' to the test-rings of the line to complete the metallic circuit; neither do I desire to limit myself to the particular means described for determining at any switchboard whether the test-rings of the line are connected or disconnected with the line-wire. Various forms of responsive device and various means of producing a difference of potential or altering the electrical condition of the test-rings will readily suggest themselves to those skilled in the art.

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

1. The combination, with a telephone-line circuit, of spring-jacks having contact-pieces normally disconnected from the line-circuit and an electro-magnetic device in the line-

circuit, adapted when energized to connect the contact-pieces of the said spring-jacks with the line-circuit, substantially as described.

2. The combination, with a telephone-line circuit, of spring-jack switches having contact-pieces normally insulated therefrom and an electro-magnetic device included in the line-circuit or in a branch therefrom, adapted when energized to connect the contacts of the spring-jack switches to the line-circuit, and means for energizing the said electro-magnetic device, substantially as described.

3. The combination, with a telephone-line circuit, of spring-jack switches, each having two contact-pieces, one permanently connected with one side of the line-circuit and the other normally insulated, an electro-magnetic device in a grounded branch from the line-circuit, provided with contact-points adapted when actuated to connect the normally-insulated contact-pieces of the spring-jacks to the other side of the line-circuit, a grounded source of electricity at the exchange, and means for connecting the same to the permanently-connected contact-pieces of any spring-jack to energize the electro-magnetic device to complete the connection from the normally-open side of the line-circuit to the normally-insulated contact-pieces of the spring-jacks, substantially as described.

4. The combination, with a telephone-line circuit connected to spring-jacks at an exchange, of normally-insulated contact-pieces upon the spring-jacks, an electro-magnetic device in a branch from one side of the line-circuit to earth, provided with contact-points adapted to be closed together when actuated and when closed to complete a connection from the normally-insulated contact-pieces of the spring-jacks to a conductor adapted to alter the electrical condition of the said test-rings, a grounded source of electricity, and means for connecting the same to the side of the line-circuit containing the said electro-magnetic device when connection is established with the line, substantially as described.

5. The combination, with a telephone-line extending from a sub-station to an exchange, of spring-jacks at the exchange, connected with the line-circuit, each having two contact-pieces, one of which is normally connected to the line-circuit, the remaining contact-pieces of all the jacks being connected together and normally insulated, an electro-magnetic device in a branch to earth from that side of the line-circuit which is permanently connected to the spring-jack contacts, contact-points adapted to be actuated by the electro-magnetic device when energized, connected to the normally-open side of the line-circuit and to the normally-insulated contact-pieces of the spring-jacks respectively, a connecting-plug at the exchange adapted for insertion

into any spring-jack provided with two contact-pieces to make contact with the different contact-points of the spring-jack, and a grounded source of electricity connected to that contact-piece which makes contact with the permanently-connected contact-piece of the spring-jack, whereby the normally-open side of the line is connected to the normally-insulated contact-piece of the spring-jack when the connecting-plug is inserted into any spring-jack of the line, substantially as described.

6. In an individual annunciator, the combination, with two permanently-polarized electro-magnets, of an armature normally retained in an intermediate position between them, indicating mechanism adapted to be actuated by movement of such armature in one direction, and contact-points adapted to be closed by the movement of the armature in the other direction, said indicating mechanism being at the same time prevented from operating, substantially as described.

7. The combination, with the electro-magnets *a* and *b*, of the bar *c*, arranged to produce constant polarity of the electro-magnets *a* and *b*, pivoted armature *f*, adapted to move toward either electro-magnet *a* or *b*, but normally retained in an intermediate or neutral position, the arm *g*, connected with said armature, provided with a catch engaging with an indicator or shutter *k'* and provided with a contact-point *l'*, disposed to be closed upon a contact-anvil *l* when said armature is attracted by one of the magnets, substantially as described.

8. The combination, with a telephone-line extending from a sub-station to an exchange, of an annunciator at the exchange connected with the line-circuit and provided with contact-points adapted to be closed when the annunciator-magnet is energized, spring-jacks, each having two contact-pieces, one of which is permanently connected with one side of the line-circuit, the other side of the line-circuit terminating normally at one of the contact-pieces upon the annunciator, the other contact-piece upon the annunciator being connected with the remaining contact-piece of each of the spring-jacks, a source of electricity, and circuit connections and means for including the source of electricity in circuit with the individual annunciator when desired, whereby the sub-station is connected with the spring-jacks at the exchange in a metallic circuit when the annunciator is energized, substantially as described.

9. The combination, with a telephone-line extending from a sub-station to an exchange, of an individual annunciator at the exchange provided with contact-points adapted to be closed together when the electro-magnet of the annunciator is energized, spring-jack switches connected with the line-circuit at the exchange, and normally-insulated contact-pieces upon the spring-jack switches connected with one

of the contact-pieces upon the annunciator, the other contact-piece thereupon being permanently connected with a conductor adapted to alter the electrical condition of the normally-insulated contact-pieces upon the spring-jacks, substantially as described.

10. The combination, with a telephone-line extending from a sub-station to an exchange, of a polarized individual annunciator in an earth connection from one side of the line-circuit, provided with an indicator adapted to be released by movement of its armature in one direction, two contact-points arranged to be closed by movement of the armature in the other direction, spring-jack switches, each having two contact-pieces, one of which is permanently connected to the grounded side of the line-circuit, the other being normally insulated and connected to one of the contact-points of the annunciator, the remaining contact-point forming the terminal of the normally-open side of the line-circuit, a loop-plug adapted for insertion into any spring-jack of the line, provided with contact-pieces arranged to make contact with the corresponding contact-pieces upon the spring-jack, a source of electricity connected with that contact-piece of the loop-plug arranged to make contact with the contact-piece of the jack which is permanently connected with the line, said source of electricity being of such polarity as to energize the polarized annunciator to close the said contact, and a source of electricity at the sub-station adapted to be connected to the permanently-grounded side of the line-circuit and of such polarity as to actuate the annunciator to operate its indicator when connected with the line-circuit, substantially as described.

11. The combination, with two telephone-lines extending from two sub-stations to an exchange, each being provided with a polarized individual annunciator having an armature adapted to move in either direction, of an indicator arranged to be operated by movement in one direction, and contact-points arranged to be closed by movement of the armature in the other direction, one of said contact-points being permanently connected to a normally-open side of its particular line-circuit, the electro-magnets of each annunciator being included in a permanently-grounded branch from the other side of its particular line, spring-jack switches, each having two contact-pieces, one of which is connected with the grounded side of the line-circuit, the other of which is connected with the remaining contact-piece of its particular annunciator, two loop-plugs inserted one into a spring-jack of each line, having contact-pieces connecting with corresponding contact-pieces of the spring-jacks, like contacts of the two plugs being connected by conductors, and a grounded source of electricity connected with those contact-pieces of both loop-plugs which con-

nect with the permanently-grounded sides of
the two line-circuits and of such polarity as
to energize the annunciator to close together
the contact-points thereupon, and a grounded
5 source of current at each sub-station adapted
to be connected with the grounded side of its
line-circuit, of such polarity as to tend to
actuate the annunciator to release the indi-

cator, but of insufficient strength to effect its
release, substantially as described. 12

In witness whereof I hereunto subscribe my
name this 10th day of March, A. D. 1892.

CHARLES E. SCRIBNER.

Witnesses:

M. JEANE TALLETT,

GEORGE W. MCMAHON.