J. ERICKSON.

TELEPHONE SYSTEM SIGNALING APPARATUS.

APPLICATION FILED FEB. 5, 1910.

1,007,344.

Patented Oct. 31, 1911.

2 SHEETS—SHEET 1.

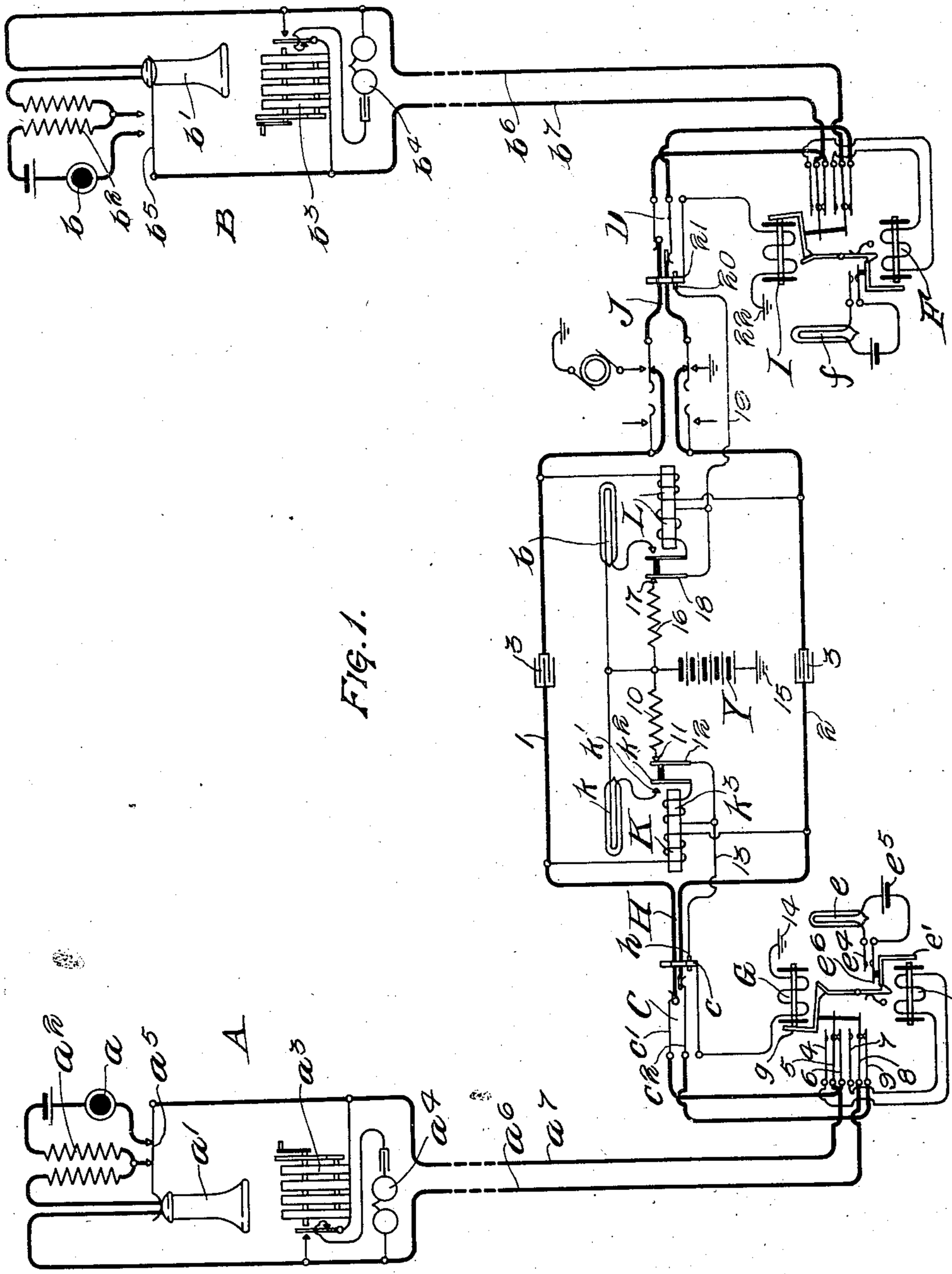


FIG. 1.

WITNESSES
A. Andersen.
A. J. Ray

INVENTOR:
John Erickson
By Bulkley Durand & Dunn
ATTORNEYS,

J. ERICKSON.

TELEPHONE SYSTEM SIGNALING APPARATUS.

APPLICATION FILED FEB. 5, 1910.

1,007,344.

Patented Oct. 31, 1911.

2 SHEETS—SHEET 2.

FIG. 3.

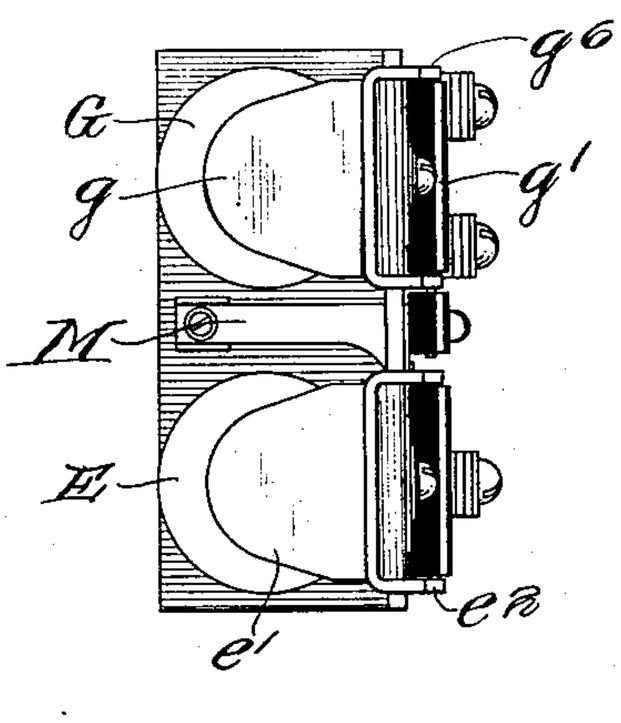


FIG. 2.

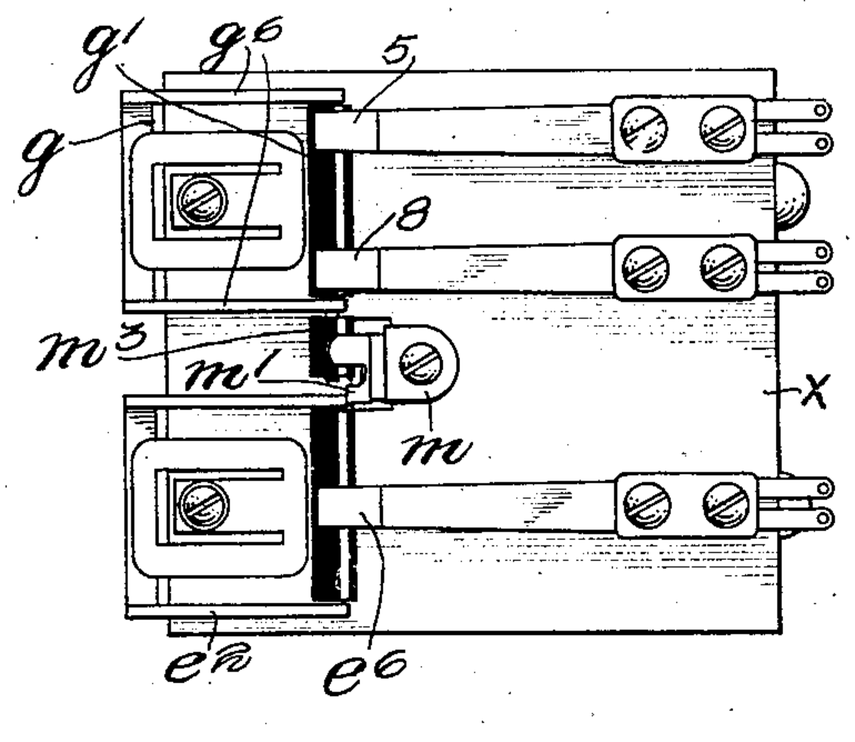


FIG. 5.

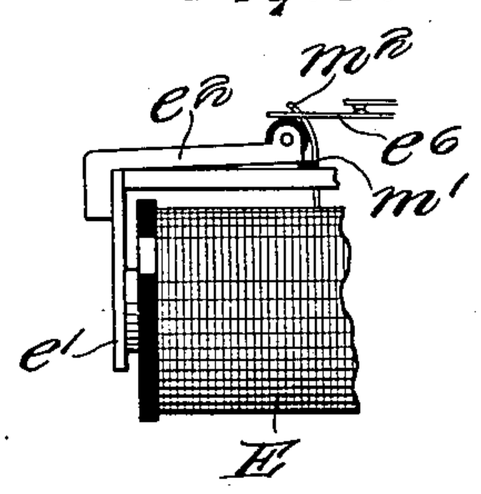
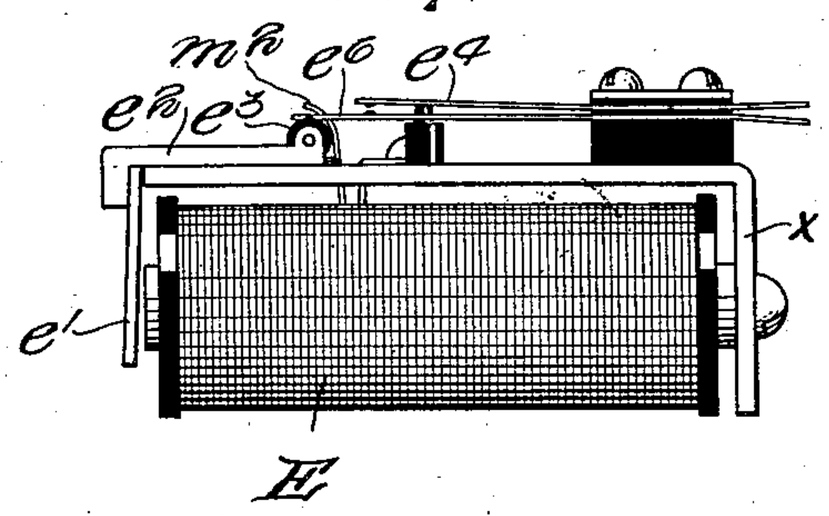


FIG. 4.



WITNESSES

A. Andersen.

A. J. Ray.

INVENTOR:

John Erickson

By Bulkley Durand & Denny

ATTORNEYS.

UNITED STATES PATENT OFFICE.

JOHN ERICKSON, OF CHICAGO, ILLINOIS, ASSIGNOR TO AUTOMATIC ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE-SYSTEM SIGNALING APPARATUS.

1,007,344. Specification of Letters Patent. Patented Oct. 31, 1911.

Application filed February 5, 1910. Serial No. 542,174.

To all whom it may concern:

Be it known that I, JOHN ERICKSON, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Telephone-System Signaling Apparatus, of which the following is a specification.

My invention relates to telephone exchange systems in general, but more particularly to those in which line signals are employed, whereby the calling subscriber attracts the attention of the operator, and especially to those in which cut-off relays are employed for retiring the line signal when the operator answers the call.

My invention contemplates a system of this kind in which the line signal, when operated by the calling subscriber, is automatically locked in such operated condition, and is not released until the cut-off relay is energized by the operator who answers the call. In this way the line signal, when operated by the calling subscriber, remains displayed until the call is answered, even though the calling subscriber should hang up his telephone. Furthermore, and with this arrangement, a line lamp signal can be employed and controlled by a relay which is energized by current transmitted from a magneto at the calling substation. When the calling subscriber operates the magneto to transmit the calling current the line relay is energized, and even though such energizing of the relay be momentary, still the signal remains displayed until the call is answered, because of the fact that the armature of the line relay is locked and cannot be released until the cut-off relay is energized by the insertion of the plug of the operator's cord circuit in the answering jack of the calling line. The nature and advantages of my invention will, however, hereinafter more fully appear.

In the accompanying drawings Figure 1 is a diagram showing a calling subscriber's line connected with a called subscriber's line through the medium of an operator's cord circuit, in a system embodying the principles of my invention. Fig. 2 is a plan view of the line and cut-off relays indicated diagrammatically in Fig. 1. Fig. 3 is a front elevation of the said relays. Fig. 4 is a side elevation of the said relays. Fig. 5 is a fragmentary view of the forward portion of the relay mechanism shown in Fig. 4, showing the armature of the line relay in its attracted position.

As thus illustrated, and referring more particularly to Fig. 1, the system comprises subscribers' substations A and B of any suitable character provided with local battery transmitters a and b, receivers a' and b', transformers or induction coils a^2 and b^2, magnetos a^3 and b^3 and ringers a^4 and b^4, the arrangement being such that the said ringers are normally bridged by condensers across the lines of the said substations. For closing the line circuit of each substation switch-hooks a^5 and b^5 are provided, which are operated by the receivers in the usual and well known manner. When the magneto of either substation is operated the circuit thereof is automatically closed, and at the same time the circuit of the associated ringer is automatically opened in the usual and well known manner. The substation A is provided with a metallic line circuit consisting of parallel line conductors a^6 and a^7, and the substation B is provided with similar line conductors b^6 and b^7. The answering jack C is allotted to the line of substation A, but is normally disconnected therefrom. A similar answering jack D is allotted to the line of substation B and is normally disconnected therefrom. The line relay E is normally in bridge of the line conductors a^6 and a^7 of the substation A, so that it may receive energizing current from the magneto a^3 when the subscriber desires to make a call. The line lamp signal e has a local circuit which is normally open and which is controlled by the said line relay, whereby said signal is displayed when the subscriber calls. A similar line relay F is normally in bridge of the line conductors b^6 and b^7 and is adapted to receive energizing current from the magneto b^3 should the subscriber at this substation desire to make a call. The line lamp signal f has a local circuit that is controlled by said line relay F, it being understood that the line signal equipment of each line is preferably the same. The cut-off relay G is allotted to the line of substation A, and is provided with contacts which control the normally open connection between the line and the jack C, as well as the normally closed connection between said line and the line relay E, whereby the said jack is connected to the line

and the said line relay disconnected therefrom when the operator answers the call, it being understood, as will hereinafter more fully appear, that the said cut-off relay is energized over a local circuit when the operator inserts the plug H in the jack. A similar cut-off relay I is allotted to the line of the substation B, and is similarly controlled by the insertion of the plug J in the jack of the line leading to this substation. The answering plug H is connected with the calling plug J by cord strands 1 and 2 having condensers 3 therein, which condensers are in the talking circuit. The supervisory or clearing-out relays K and L are bridged across the cord circuit at opposite sides of said condensers, the relay K being adapted to receive current from the magneto a^3 when the subscriber at substation A signals for a disconnection, and the relay L being adapted to receive current from the magneto b^3 when the subscriber at substation B signals for a disconnection. The supervisory relay K has a supervisory lamp signal k the local circuit of which is controlled by said relay through the medium of the contacts k' and k^2, which circuit includes the winding k^3 of said relay, whereby the relay, when once energized, remains so until the plug H is withdrawn from the jack C after the subscribers are through talking. It will also be seen that this local locking circuit of the supervisory relay K includes the coil of the cut-off relay G, said circuit being controlled by the engagement of the sleeve h of the plug with the ring or testing thimble c of the jack, as will hereinafter more fully appear. The relay L has a supervisory lamp signal l which is controlled and operated in a similar manner.

It will be understood that the switchboard operator may be equipped with any suitable means for conversing with the subscribers and for testing the lines to ascertain whether they are busy or idle, as well as for signaling the called subscriber.

Referring to Figs. 2 to 5, inclusive, it will be seen that the line relay E and the cut-off relay G are mounted side by side upon the bracket plate or mounting X, which is simply a flat plate with a downwardly bent rear end portion x to which the rear ends of the magnets are secured. The line relay E is provided at its forward end with an armature e' which is mounted upon the frame X in any suitable manner. This armature has its upper end provided with a rearwardly projecting arm e^2 which carries a bushing e^3 of insulation. The normally open springs e^4 and e^6, which control the circuit of the line lamp e, are operated by the said bushing, and are closed together when the said armature is attracted. The cut-off relay G is provided with a similar armature g which has a bushing g' for operating two sets of springs, one set for each side of the line circuit. Referring to Fig. 1, it will be seen that one of said sets of springs consists of two springs 4 and 5 which are normally in electrical contact with each other, and which serve to normally connect one terminal of the line relay coil with the line conductor a^7, and another spring 6 that is normally out of engagement with the spring 5, but which is adapted to engage the latter to connect the line conductor a^7 with the tip contact c' of the jack. The other set of springs consists of a pair of springs 7 and 8 which are normally closed to connect the other terminal of the line relay coil with the line conductor a^6, and a spring 9 which is normally out of engagement with the spring 8, but which is adapted to engage the latter to connect the line conductor a^6 with the contact c^2 of the jack. The armature g is normally held away from its magnet by the springs 5 and 8, and the armature e' is normally held away from its magnet by the spring e^6. These springs press down on the bushing at the ends of the arms g^6 and e^2 to normally force the armatures away from their magnets. A locking spring M is secured at its lower end to a bracket m, which latter is secured to the plate X by a screw or other fastening device. This spring M is provided at its upper end with a shoulder or engaging portion m', which latter is normally in engagement with the end of the arm e^2, as shown in Fig. 4. When the armature e' is attracted the shoulder or engaging portion m' springs under the end of the arm e^2, as shown in Fig. 5, thereby locking the said armature in its attracted position. The spring M is also provided with an upwardly projecting and inclined engaging portion m^2 which is adapted to be engaged by the roller m^3 that is carried by the arm of the armature G, as shown more clearly in Fig. 2. When the cut-off relay is energized and its armature attracted the roller m^3 engages the portion m^2, forcing the spring M backward and thus disengaging the portion m' from the arm e^2, thereby allowing the armature e' to be restored to normal position. Thus the line relay, when energized, is locked in energized position, and is not released or unlocked until the cut-off relay is energized.

The operation is as follows: Assuming the subscriber at substation A desires to call the subscriber at substation B, the subscriber at substation A removes the receiver a' from the switch hook a^5, thereby closing the local circuit of the transmitter a, and also the line circuit through the said receiver. Then the subscriber at substation A operates the magneto a^3 to transmit signaling current over the line to the exchange or central station.

This signaling current is received by the line relay E, with the result that its armature e' is attracted, the springs e^4 and e^6 are pressed together and the circuit of the lamp signal e is closed to give the lamp current from the battery e^5. The armature e' is locked in its attracted position by the spring M in the manner already described, with the result that the lamp signal e remains displayed until the operator answers the call. When the operator inserts the plug H in the jack C a local circuit is closed from the main battery Y through the resistance 10, through the contact 11 and the armature 12 to the conductor 13, to the contact h, through the testing contact c of the jack, through the coil of the relay G, and through the ground connections 14 and 15 to the other pole of said battery. The cut-off relay G is thus energized, with the result that the line relay is unlocked, causing the line signal to be retired. The energizing of the cut-off relay also serves to disconnect the line relay E from the line and connect the said line of the calling subscriber with the jack C, whereby the operator's cord circuit is then connected with the line of the calling subscriber. Having thus answered the call the operator communicates with the calling subscriber in the usual manner to ascertain the number of the called subscriber. Learning that the subscriber A desires to converse with the subscriber B, the operator then inserts the calling plug J in the jack D, with the result that the cut-off relay I is energized over the following circuit: from battery Y through the resistance 16, contacts 17 and 18, conductor 19, the plug contact 20 and the jack contact 21, through the coil of the relay I, and through the ground connections 22 and 15 to the other pole of said battery. The energizing of this cut-off relay I serves to connect the line conductors b^6 and b^7 with their respective contacts in the jack D, and to disconnect from said line conductors the line relay F, in the manner shown and as described in connection with the calling line. The operator's cord circuit being thus connected with the line of the called subscriber, suitable calling mechanism can then be operated to transmit calling current to the substation of the calling subscriber, thereby operating the ringer b^4 to attract the attention of the called subscriber. The called subscriber then removes the receiver b' from the switch-hook b^5, thereby closing the line circuit, as well as the local battery circuit of the transmitter b, thus placing the substation equipment in condition for conversation with the calling subscriber.

When the subscribers are through talking each subscriber operates his magneto, and thus the relays K and L are energized over metallic line circuits. The energizing of the relay K causes it to attract its armature and to thereby operate the contacts 11 and 12, at the same time closing the contacts k' and k^2, whereby the lamp signal k is substituted for the resistance 10, thus keeping the said lamp signal displayed by the current flowing through the winding of the cut-off relay G until the operator withdraws the plug H from the jack of the calling line. When this is done the circuit through the lamp and cut-off relay is broken, and the jack is again disconnected from the line, the cut-off relay mechanism being restored to its normal condition. It will also be seen that the energizing of the relay K, as previously explained, brings the winding k^3 thereof into the circuit through the lamp K and cut-off relay, so that current from the battery Y continues to flow through this winding of the supervisory relay, and thereby keeps the said relay energized until the operator withdraws the plug from the jack of the calling line. If the called subscriber, after hanging up his receiver, operates the magneto b^3, current is thereby transmitted over the line circuit to the relay L, and the operation is then the same for this end of the cord circuit as for the other end. Both subscribers having signaled for a disconnection, and the plugs having been withdrawn from the jacks of the respective lines, the entire apparatus brought into use in connecting the two lines is thereby restored to normal condition.

From the foregoing it will be seen that I provide a combined line relay and cut-off relay mechanism which is of a unitary form or nature, and which is allotted to the subscriber's line. It will also be seen that this relay mechanism is provided with means for locking the line relay in its energized position for the purpose of keeping the line lamp signal displayed until the call is answered. Thus the subscriber can make a call by operating his magneto, and the line signal does not remain displayed for only a moment—that is to say, does not continue to remain displayed only as long as the subscriber continues to operate his magneto, but to the contrary remains displayed until the subscriber answers the call. In this way a subscriber cannot make a call and then hang up his receiver without the operator knowing that such a call was sent in. Other advantages will be obvious to those skilled in the art.

What I claim as my invention is:—

1. In a telephone system, a line, a line relay therefor, a line lamp signal controlled by said relay, means for energizing said relay over the line, and mechanical means for locking the relay in energized position.

2. In a telephone system, a line, a line relay therefor, means for energizing the relay over the line, a line signal controlled by

said relay, mechanical means for locking the said relay in energized position, a cut-off relay, a local circuit for energizing said cut-off relay, and means operated by the cut-off relay to unlock the line relay.

3. In a telephone system, a line, a line relay therefor, a magneto for energizing said relay over the line, a line lamp signal controlled by said line relay, mechanical means for locking the said relay in energized position, a cut-off relay, a local circuit for energizing said cut-off relay, and means operated by the cut-off relay to unlock the line relay.

4. In a telephone system, a line relay, a spring catch to lock the line relay in energized position, a cut-off relay associated with said line relay, and means operated by said cut-off relay to unlock the line relay.

5. In a telephone system, a line relay provided with an armature having an arm, circuit springs operated by said arm, a spring catch provided with means for engaging said arm to automatically lock the armature in attracted position, a cut-off relay arranged at one side of said line relay, an armature for said cut-off relay, circuit springs operated by the armatures of the cut-off relay, and means carried by the armature of the cut-off relay for engaging the said spring catch to unlock the line relay.

6. In a telephone system, a line, a line relay therefor, a lamp signal controlled by said line relay, a magneto for energizing the relay over the line, a spring catch for locking the line relay in energized position, a cut-off relay disposed at one side of said line relay, means for energizing said cut-off relay when the call is answered, means operated by the said cut-off relay for retiring the line signal when the call is answered, and means operated by the cut-off relay for actuating said spring catch to unlock the line relay.

Signed by me at Chicago, Cook county, Illinois, this 24 day of January, 1910.

JOHN ERICKSON.

Witnesses:

EDWARD D. FALES,

ARTHUR J. RAY.