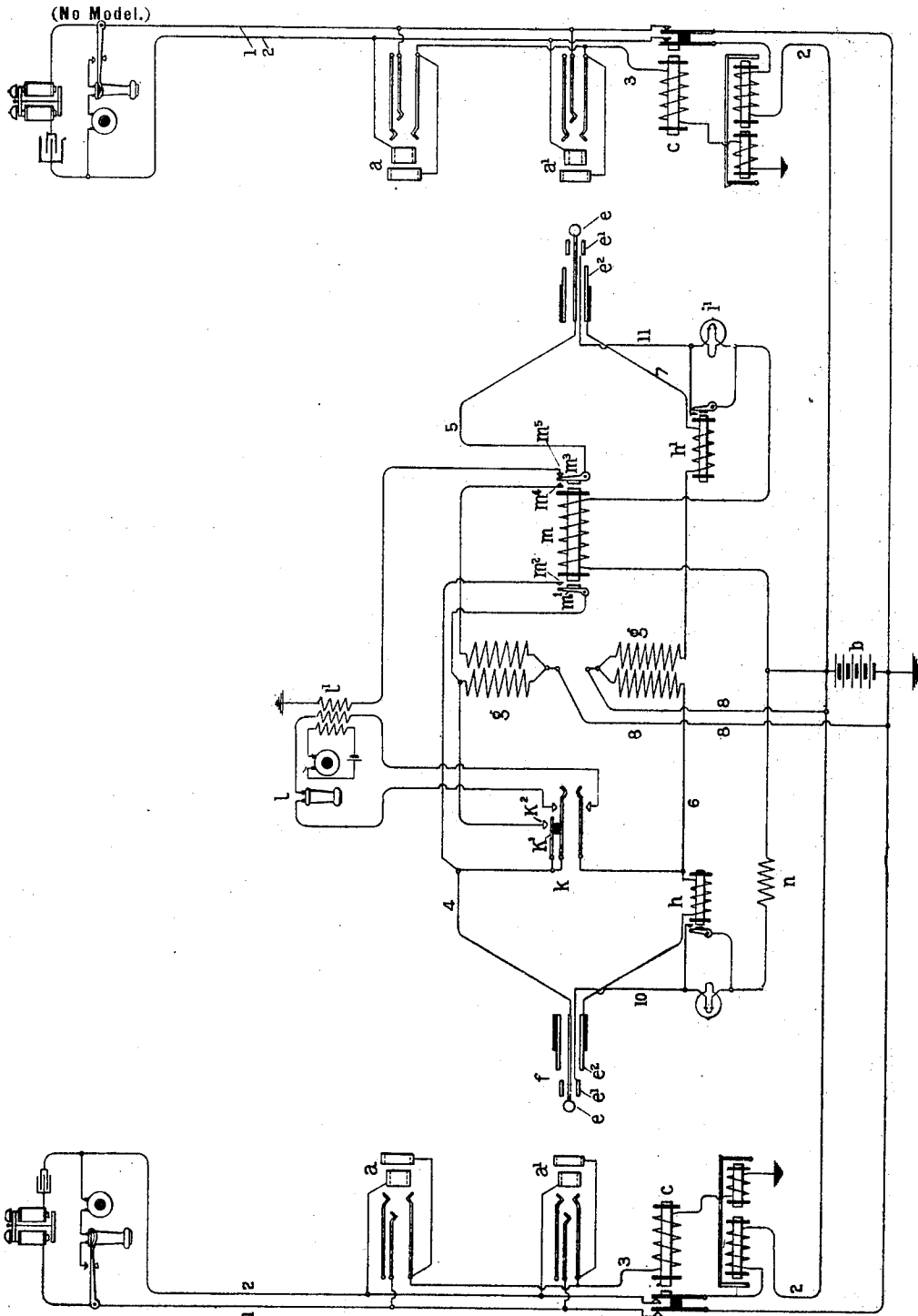


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SWITCHBOARD FOR TELEPHONE LINES.

(Application filed Dec. 28, 1899.)



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# UNITED STATES PATENT OFFICE.

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## SWITCHBOARD FOR TELEPHONE-LINES.

SPECIFICATION forming part of Letters Patent No. 681,743, dated September 3, 1901.

Application filed December 26, 1899. Serial No. 741,564. (No model.)

*To all whom it may concern:*

Be it known that we, CHARLES E. SCRIBNER, residing at Chicago, and FRANK R. McBERTY, residing at Evanston, in the county of Cook and State of Illinois, citizens of the United States, have invented a certain new and useful Improvement in Switchboards for Telephone-Lines, (Cases 481-80,) of which the following is a full, clear, concise, and exact description.

This invention consists in switching apparatus for uniting telephone-lines in a telephone-switchboard and for applying to the lines so united current for automatically operating signals associated with the lines and for supplying the transmitting-telephones at the substations of the lines; and it consists in certain automatic appliances for preventing impulses of current in the lines arising from accidental contacts between parts of the plugs and spring-jacks used in making the connection, such as would produce troublesome noises in the telephones at the substations.

Switchboards adapted for the automatic control of signals and for the supply of current from a central source to the telephones at the substations are commonly provided with normal branches from the lines leading to the central source of current, including the respective individual line-signals, with electromagnetic switches for severing these branches when connections are made with the lines, and have temporarily associated with the lines, through the medium of the cord-circuits uniting them in pairs, supervisory signals which serve to indicate the closed or open condition of the lines at the substations, the circuit of the plugs being connected with a source of current suitable for operating both the signals and the substation transmitting-telephones. The spring-jacks constituting the terminals in the switchboard have two contact-pieces for the two line conductors and one or more local contact-pieces for local circuits concerned in operating the electromagnetic switches and the supervisory signals, and the plugs for use in these jacks have corresponding contact-pieces arranged in different positions along the axis of the plug, which form the terminals of line and local-battery

circuits, respectively, and which thus tend to apply to the various contact-pieces of the spring-jack as the plug is inserted into the jack currents of abnormal amount or direction, which affect the telephone of the listening subscriber. The present invention for avoiding these abnormal currents consists in an electromagnetic switch controlling the connection of the source of current with the plug-circuit and means for exciting the switch, the means consisting, first, in a local circuit closed in registering contact-pieces of the calling-plug and the multiple-jack, and, second, in switch-contacts in the operator's listening-key which are closed when the telephone is connected with the plug-circuit, whereby the common source of current for exciting the station-transmitters and controlling the signals may be applied through a plug-circuit temporarily by the operator in manipulating her listening-key and is applied permanently during a connection automatically in the completion of the connection.

The invention is illustrated in the attached drawing, which represents diagrammatically two telephone-lines entering a telephone-switchboard equipped with our improvement.

The arrangement of apparatus at the substation is that which is well known in telephone sets adapted for the automatic control of signals. The line-circuit is adapted for closure serially through the receiving and transmitting telephones; but the circuit through these instruments is normally broken at the telephone-switch, while the call-bell is interposed in a permanent bridge of the line, together with a condenser, which prevents the passage through this bridge of current from the central battery. The line conductors 1 and 2 from this telephone equipment are led to the line-terminals of spring-jacks *a* and *a'* in a telephone-switchboard, and they are further extended to the poles of a central calling-battery *b*. The actuating-magnet of a self-restoring line-annunciator is connected in the extension of line conductor 2. The continuity of both extensions is controlled by an electromagnetic switch or cut-off relay *c*, the actuating-magnet of which is located in a portion 3 of a local circuit of battery, which lo-

cal conductor includes also the restoring-magnet of the line-annunciator. The spring-jacks and the plugs adapted for use with them may be of the type described in Patent No. 563,333, dated July 7, 1896, while the line-annunciator may be that commonly known as the "self-restoring drop," used with branch terminal switchboards. The plugs adapted for use with these spring-jacks have, as described in the patent before mentioned, three contact-pieces—a tip, a short ring, and a sleeve—these being designated in the drawing  $e$ ,  $e'$ , and  $e^2$ , respectively. The contact-pieces  $e$  of two plugs  $f$  and  $f'$ , which constitute a pair for uniting two lines, are connected together by conductors 4 and 5, each of which includes a winding of the repeating-coil  $g$ . Similarly contact-sleeves  $e^2$  are united by other conductors 6 and 7, which traverse other windings of the same repeating-coil. At the points of junction of conductors 4 5 and 6 7 of the plug-circuit the terminals of a bridge-wire 8 are applied. This bridge-wire includes the common source of battery for exciting the substation-transmitters, which may in practice be the battery  $b$ . Supervisory relays  $h$  and  $h'$  are interposed in conductors 6 and 7, these relays being adapted to control secondary supervisory signals  $i$  and  $i'$ . An operator's listening-key  $k$  is provided for connecting the operator's telephone  $l$  into a bridge of the plug-circuit. The conductor 4 of the plug-circuit is divided into two branches, each of which is normally interrupted. One of the branches is controlled by auxiliary switch-contacts  $k'$   $k^2$  of the operator's listening-key. The other is controlled by switch-contacts  $m'$   $m^2$  of a special relay  $m$ . Conductor 5, leading to the tip of plug  $f'$ , is likewise normally interrupted at other open switch-contacts  $m^3$   $m^4$  of the relay  $m$ ; but the portion leading to the plug is connected through a resting contact  $m^5$ , forming the terminal of a tertiary winding of the operator's induction-coil  $l'$ , which winding is of high resistance. Contact-rings  $e'$  of the plugs  $f$  and  $f'$  form the respective terminals of two conductors 10 and 11, leading to the battery  $b$ , which are designed to be brought into association with the conductors 3 in the spring-jacks to form complete circuits therewith. Each of the conductors 10 and 11 includes one of the signal-lamps  $i$  and  $i'$ , and conductor 10 includes a resistance-coil  $n$ . A supervisory signal associated with each supervisory relay  $h$  or  $h'$  is controlled by this relay by means of a shunt about the signal traversing the switch-contacts of the relay. Taking the telephone from its switch for use at a substation automatically initiates the call, liberating the target of the line-signal, and thus calling the attention of the operator. The attendant responds to the call by inserting an answering-plug  $f$  into a spring-jack  $a'$  of the line. As the plug is thrust into the jack the tip makes contact successively with the thimble of the spring-

jack, with the local contact-spring in the jack, and finally with the short line-spring connected with line conductor 1; but none of these contacts produces any sound in the telephone of the calling subscriber, since the circuit terminating in the plug is open at the switch-contacts of relay  $m$ , both at the listening-key  $k$  and at the relay  $m$ . The ring-contact  $e'$  of a plug also connects momentarily with the thimble of the spring-jack, but does not alter the potential of this part, since both contact-pieces are connected with the same pole of battery  $b$ . Finally the sleeve  $e^2$  makes connection with the thimble at the same moment that the tip  $e$  registers with the short line-spring, whereby the line-circuit is completed. The ring-contact  $e'$  also comes to rest under the local contact-spring of the jack, closing the local circuit 3 10. The last-mentioned condition results in the excitement of the cut-off relay  $c$ , which therefore severs the normal extensions of the line, leaving the line disconnected from the battery. The restoring-magnet of the line-annunciator is also energized and resets the indicator of the annunciator. The operator now depresses her listening-key, whereby the conductor 4 of the plug-circuit is completed and the battery  $b$  is applied to the line-circuit for exciting the substation-transmitter. Having learned the order of the calling party for the line called for, the operator tests the line called for in the usual way, obtaining, if the line be busy, a click in the telephone, due to the formation of current from the test-ring through the tertiary winding of the induction-coil  $l'$ . Finding the line free, however, the operator thrusts the plug into the spring-jack tested. In its progress into the jack the tip of the plug makes contact successively with the thimble, the local spring, and the line-spring; but since the tip is disconnected from the portion of the plug-circuit leading to the telephone of the calling subscriber the latter is not disturbed by any unnecessary impulses of current. When the plug reaches its place in the spring-jack, the conductor 7, which is permanently connected with the battery  $b$ , is applied to the line conductor 2. At the same moment the ring  $e'$  makes connection with the local spring of the jack, and so effects both the disconnection of the normal extensions of the line through the agency of the cut-off relay of the line and the completion of conductor 5 of the plug-circuit by means of the relay  $m$ . The movement of the switches of the relay  $m$  also closes the bridge in the conductor 4, leading to plug  $f$ , in multiple with the circuit closed in the operator's listening-key. The operator now disconnects her telephone, breaking the branch of conductor 4, controlled by the telephone-key; but this act is not attended with any disturbance in the current traversing the line to the calling subscriber. The listening subscriber hears during the preliminary work of switching only the single click in the telephone pro-

duced by applying a current for exciting the substation-transmitter when the operator's listening-key is closed. After the completion of the connection and the calling of the party  
 5 wanted the response of the latter closes the line-circuit at the substation called. After connection is thus established between lines supervision is effected by means of signals *i* and *i'* in the usual way, the lines being dis-  
 10 connected when both signals indicate the replacement of the telephones on the switches at the substations.

We claim as new and desire to secure by Letters Patent—

15 1. The combination with a telephone-line and the transmitting-telephone thereof adapted for excitement by current supplied through the line, a spring-jack for the line, and a plug and plug-circuit for making connection there-  
 20 with, of an operator's telephone, a listening-key for connecting the operator's telephone with the plug-circuit, and switch-contacts associated with said listening-key, controlling the application of said source of current to  
 25 the line; said switch-contacts being actuated in connecting the operator's telephone to the

plug-circuit, and adapted simultaneously to apply to plug-circuit current for exciting the substation transmitting-telephone, substantially as described.

2. The combination with telephone-lines, 30  
 spring-jacks thereof, and an answering and a calling plug with their associated plug-circuits for uniting lines, of a source of current in a bridge of the plug-circuit, an electromag- 35  
 netic switch having a pair of switch-contacts interposed in the plug-circuit at each side of the said bridge containing the source of cur-  
 rent, a local circuit closed in registering con- 40  
 tacts of the calling-plug and line-jack including the actuating-magnet of said switch, an  
 operator's listening-key and auxiliary con-  
 tacts thereof adapted to effect the closure of  
 the break in the plug-circuit toward the an- 45  
 swering-plug, substantially as described.

In witness whereof we hereunto subscribe  
 our names this 2d day of October, A. D. 1899.

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Witnesses:

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