(No Model.) 2 Sheets—Sheet 1.

C. E. SCRIBNER.

SPRING JACK FOR TELEPHONE SWITCHBOARDS.

No. 533,148. Patented Jan. 29, 1895.

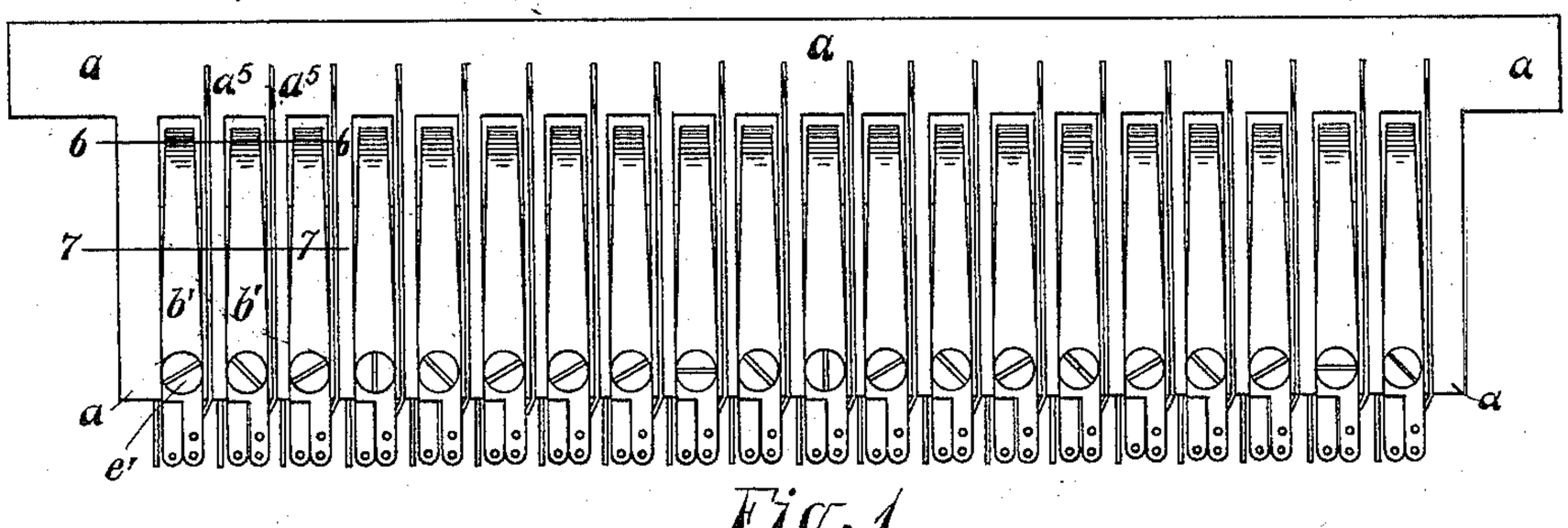

Fig. 1

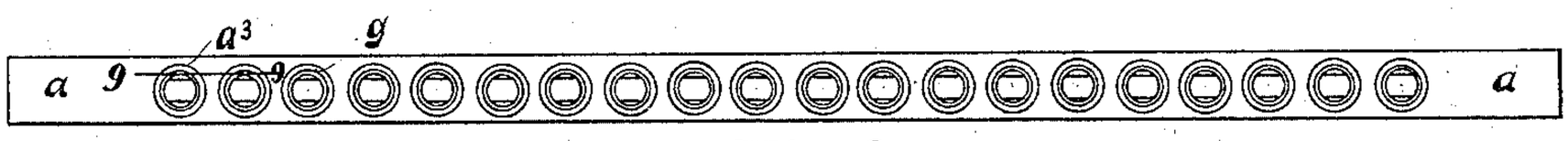

Fig. 2

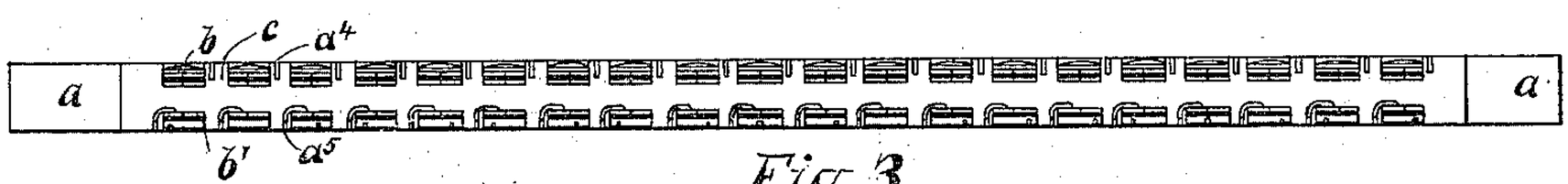

Fig. 3

Fig. 7

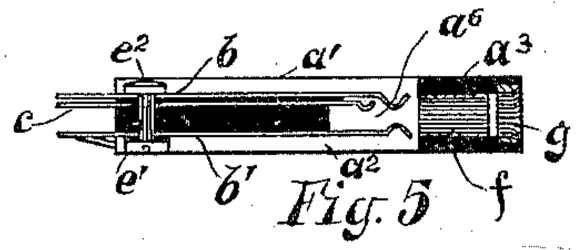

Fig. 5

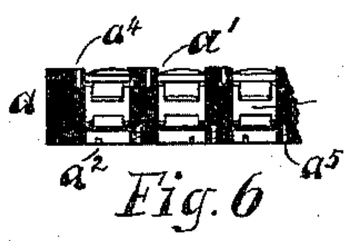

Fig. 6

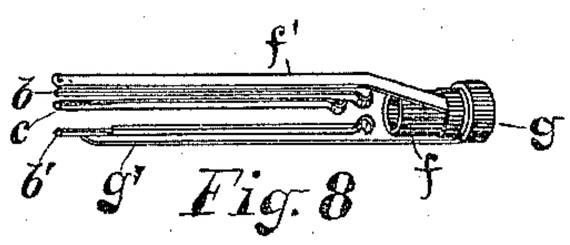

Fig. 8

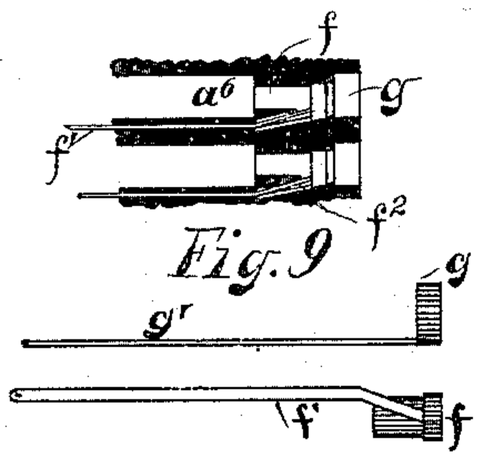

Fig. 9

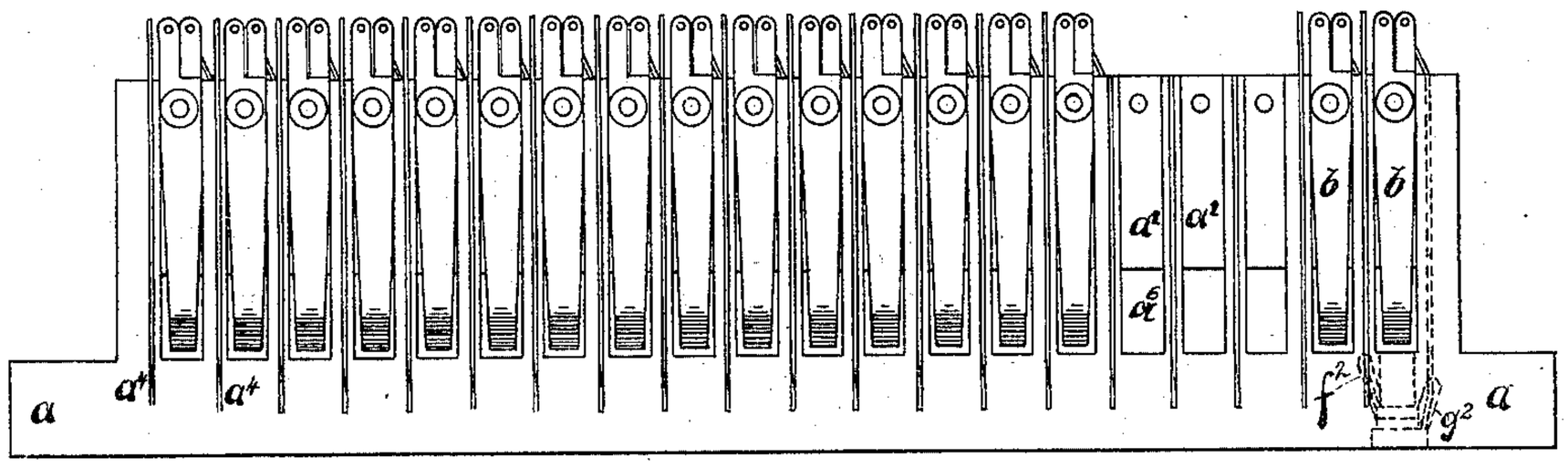

Fig. 4

WITNESSES
George P. Barton
DeLancey N. Cameron.

INVENTOR
Charles E. Scribner
BY F. R. McBerty ATTY.

(No Model.) 2 Sheets—Sheet 2.

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SPRING JACK FOR TELEPHONE SWITCHBOARDS.

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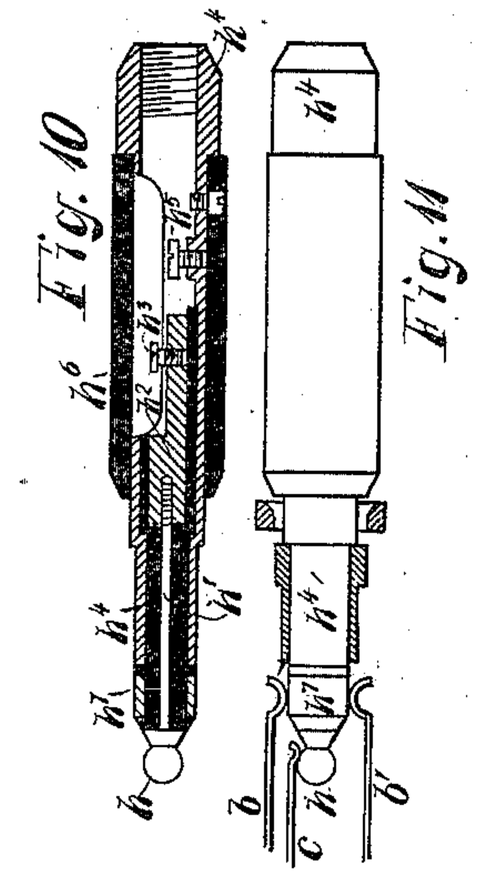

Fig. 10

Fig. 11

Fig. 12

WITNESSES

George R. Barton

DeLoures A. Cameron

INVENTOR

Charles E. Scribner

BY F. R. McBerty ATTY.

UNITED STATES PATENT OFFICE.

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

SPRING-JACK FOR TELEPHONE-SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 533,148, dated January 29, 1895.

Application filed May 23, 1892. Serial No. 434,068. (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 Spring-Jacks for Telephone-Switchboards, (Case No. 309,) 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 apparatus for switchboards of telephone exchanges,—more particularly, to that class of telephone switchboards in which the spring jacks or line terminals and the annunciator of a line are connected permanently therewith. Its object is to simplify the construction and to increase the durability and reliability of the apparatus of such switchboards.

Heretofore in certain multiple switchboard systems the spring jacks upon the different switchboards have been connected in parallel with the line, the annunciator has been permanently connected in a bridge between the different sides of the line circuit, and a separate normally open local circuit has been provided having terminals upon each of the spring jacks adapted to be crossed together when a connection is made with the line, and including a separate electro magnet or coil upon the individual annunciator of the same line adapted to prevent the operation of the individual annunciator when said coil is energized.

My invention relates specifically to apparatus of this class of multiple switchboards, and consists in certain details of construction of the spring jacks and connecting plugs for use therewith and circuits appropriate thereto which will be described hereinafter and will be particularly indicated in the claims.

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

I will designate parts in the figures by letters of reference, like parts being indicated by similar reference letters throughout the different figures.

Figure 1, Sheet 1, is a plan view of a strip or plate carrying twenty spring jacks. Fig. 2 is a front elevation of the same strip. Fig. 3 is a rear elevation thereof. Fig. 4 shows the same strip of spring jacks in a view from below, some of the springs and other parts being shown removed from their places in the strip and disposed above the strip of spring jacks. Fig. 5 is a transverse sectional view of the strip taken on the center of one of the spring jacks. Fig. 6 is a longitudinal section of a portion of the strip of spring jacks, the section being made on the line 6—6 of Fig. 1. Fig. 7 is a similar section on the line 7—7 of Fig. 1. Fig. 8 is a perspective view of the metallic contact portions of one spring jack arranged in their proper relative positions. Fig. 9 is a section of a small portion of the strip of spring jacks taken on the line 9—9 of Fig. 2, showing the method of leading the insulated connecting strip from one of the contact pieces at the front of the jack to the rear of the strip for connection. Fig. 10, Sheet 2, is a longitudinal central section of a connecting plug for use with my improved spring jacks. Fig. 11 is a side elevation of the same. Fig. 12 is a diagram showing the connecting apparatus at the exchange, and the spring jacks and annunciators of two telephone lines which extend to substations, whereat the apparatus is also shown.

Referring to Fig. 1, Sheet 1, a is a strip or plate of hard rubber or other suitable insulating material having projections at its opposite extremities by which to secure it in place in the switchboard. In this strip a a are milled transverse grooves a' a' extending nearly across the strip, upon the upper side, and similar grooves a^2 a^2 upon its lower side, as is best shown in Figs. 4 and 6. Perforations are drilled from the front of the strip of spring jacks, one perforation to each pair of grooves, having its axis centrally located and parallel with respect to the grooves. A small portion of the insulating material is removed from between the grooves so as to leave a rectangular opening a^6 through the strip connecting the two grooves at those ends which are nearer the front of the jack. In the grooves a' upon the upper surface of the rubber strip a are mounted springs b and c. These are most clearly shown in Figs. 4 and 5. The spring b is the longer of the two so that its curved extremity is presented close to the

end of the perforation through the front portion of the strip a. The springs are insulated from each other by a strip or tongue d of hard rubber or other suitable insulating mater il placed between them, thin and flexible enough so as not to impede the flexion of the two springs. In the under groove, a^2, is mounted another spring b' similar to spring b and of equal length.

The three springs b, c, and b' are firmly secured to the strip a by a bolt e passing through the different springs and the body of strip a, having a head e' bearing upon the spring b' and a nut e^2 screwed down upon the springs b and c. The bolt is insulated from the springs b' and c by suitable rubber washers and bushings in the usual way. In the perforations a^3 in the front of the strip are inserted short tubes f of metal, which are secured therein by any suitable means. The metal tube or thimble f is provided with a shoulder which bears against a corresponding ledge in the perforation a^3, so as to prevent the tube f from being thrust backward toward the rear of the jack. The thimble f is provided with an extension f' connected with it, designed to afford electrical connection to the strip from the rear of the jack. This strip f' extends through an oblique duct f^2,—shown in dotted lines in Fig. 4,—and thence through a transverse slot or saw cut a^4 in the strip a to the rear of the strip.

In assembling the strip of spring jacks, the thimble f is inserted over a suitable mandrel, and the extension f' is inserted into the oblique duct. The thimble f is then forced into the perforation in the strip a by pressure upon the mandrel, the somewhat flexible extension f' following the oblique duct into the transverse saw cut and thence to the rear of the jack.

In front of the thimbles f in the perforations a^3 are placed additional rings or very short tubes of metal g. These are forced into place against other ledges in the perforation a^3 and are secured in place by suitable means. The ring g is also provided with an extension g' designed to project to the rear of the strip of spring jacks for connection thereat. This extension g' may be a thin wire if desired. The wire g' is lead through another duct g^2 in the front portion of the strip a into a saw cut a^5, thence to the rear of the strip, where, for the circuit herein shown, it is connected with the spring b', preferably by being soldered thereto.

Referring now to Sheet 2, I will describe the connecting plug designed for use with this spring jack, shown in Figs. 10 and 11. This plug is constructed similarly to the two part or "double" plug in ordinary use and hence need not be described in great detail. It consists of a tip h secured to the end of a rod h' which extends along the axis of the plug and terminates in a block h^2 of metal, provided with a binding screw h^3 adapted to receive one strand of a two part cord to make connection therewith. The central rod h' and block h^2 are surrounded by suitable insulation. Concentric with the rod and block is a sleeve h^4 of suitable size for insertion into the thimble f of the spring jack and of such length that when the plug is fully inserted, the end of the sleeve will be flush with the inner end of the thimble. The sleeve is, however, not sufficiently large to touch the ring g when the plug is fully inserted into the spring jack, in order that the insulation between the thimble f and the ring g may be maintained. A continuation of the sleeve h^4 forms the tubular body of the plug. On the inside of the tube is provided another binding screw h^5 adapted to receive and retain the other strand of the connecting cord. A shell h^6 of insulating material surrounds the metallic body h^4 for a portion of its length to prevent the deterioration of insulation by handling. Between the tip h of the plug and the forward end of the sleeve h^4 is placed an insulated ring h^7 slipped on over the insulation and properly secured in place. It is this additional ring h^7 upon the plug that forms the novel feature of the plug. The plug is so constrncted that the tip h projects sufficiently far into the spring jack to enter under and make contact with the shorter spring c of the jack. The ring h^7 is so placed as to enter between the springs b and b' when the plug is fully inserted into the jack and thus made to cross them together. The sleeve h^4 makes electrical contact with the thimble f of the jack. The different contact pieces of the spring jack are shown bearing upon their corresponding contact pieces of the plug in Fig. 11.

Referring now to Fig. 12, I will describe the circuits therein depicted in detail and will trace the various operations involved in establishing connection between two telephone lines by means of the system shown.

The apparatus at the substation is of the usual character. That at station 1, for example, comprises a calling generator i and signal bell i' in a branch from one side k of the line circuit, a telephone receiver i^2 and transmitter i^3 in another branch from the same side of the line circuit and a telephone hook switch i^4 connected with the other side k' of the line circuit and adapted to connect the telephone apparatus or the signaling apparatus alternately into the line circuit. The line $k\,k'$ extends to the exchange, whereat the different sides of the circuit are connected with the thimbles f and the shorter springs c respectively of two spring jacks $l\,l'$, one upon each of two sections $m\,m'$ of multiple switch board. An individual annunciator n is placed near the spring jack l' upon the section m' of switchboard. This annunciator may be of the construction shown in my application, (Case No. 252,) filed February 4, 1892, Serial No. 420,310. The operating coil n' of the annunciator is permanently connected in a bridge or cross connection between the different sides

$k\,k'$ of the line circuit. The springs b of all the spring jacks are connected directly to earth. The springs b' of the different spring jacks of one line are connected together and by a branch through the restoring coil n^2 of the annunciator n of the same line and a battery o to earth. The apparatus at substation 2, and the spring jacks, annunciator and circuit connections thereof at the exchange, are of similar character. The spring jacks l^2 l^3 are placed one upon each of the sections m and m' of switchboard. The individual annunciator n^3 of the line is, however, placed upon a section m of switchboard near the jack l^2 of the same line, so as to be under the care of another attending operator. Two pairs of connecting plugs and other accessory appliances are shown complete, one at each section of switchboard. The plugs p p' are of construction shown in Figs. 10 and 11 and described in connection therewith. The like contact pieces of the two plugs of the pair are connected together by flexible conductors q q' and other circuit connections. Included in circuit between the two plugs are two calling keys r and r', each adapted to disconnect both contact pieces of one of the plugs from those of the other and to connect them to wires s s' which form the terminals of the calling generator t. A listening key u is provided, having contact points or anvils connected with the different sides q q' of the cord circuit and having its contact springs u' and u^2 connected with the terminals of the telephone w. Thus when the plunger of the listening key u is allowed to rise, as shown in the upper cord circuit, the telephone w is connected in a bridge or branch connection between the different sides of the cord circuit. A branch is connected in the middle of the telephone coil to earth for testing purposes, in the well known manner. An additional spring u^3 is provided upon the listening key, insulated from the other parts of the key but adapted to be raised when the plunger is depressed so as to be separated from a contact anvil u^4 connected to earth.

A clearing-out annunciator x similar in construction to the individual annunciators, is provided in connection with each cord circuit, having its operating coil permanently connected in another bridge between the different sides of the cord circuit. The restoring coil x^2 is connected in a normally open local circuit including the contact spring u^3 and its anvil u^4 and a source of electricity. By this device the clearing-out annunciator x is automatically reset or restored to its normal position whenever the telephone of the operator is brought into the circuit.

I will now briefly describe the operation of establishing connection between two subscribers' lines.

Suppose, for example, that subscriber at station 1 desires to communicate with subscriber at station 2. His switch hook being in its lowest position, he rotates his calling generator i, thus sending signaling current over the circuit $k\,k'$ to the exchange, where the current finds circuit through the operating coil n' of the individual annunciator n thereat. The armature of magnet n' is attracted, releasing the shutter of the annunciator and indicating the signal to the operator attending at board m'. The operator then inserts one plug p of a pair into the spring jack l' of that line at her board. The line circuit is thus extended through the contact pieces c and f of the spring jack to the corresponding contact pieces h and h^4 of the plug, thence through the conductors q q' of the cord circuit, to the listening key u belonging to that cord circuit. This key being in its normal position,—that shown in the upper cord circuit, the circuit is continued from conductors q and q' through the contact points of the listening key to the operator's telephone w whereby she is enabled to communicate with the subscriber at station 1. When the plug p was inserted into the spring jack, the plug besides connecting the line contacts of the spring jack with the corresponding contact pieces of the plug, at the same time crossed together the two local springs b and b' through the ring h^7 upon the plug, thereby completing the local circuit including the battery o and the restoring coil n^2 of the individual annunciator. The electro-magnet n^2 was thereby energized, attracting the shutter of the annunciator and restoring the same to its normal position, in which position it is retained as long as the plug remains inserted in the spring jack. Having received the order from subscriber at station 1, say for connection with subscriber at station 2, the operator at board m' proceeds to test the line called for to determine whether it is already in use or not. This she does by the well known process of applying the tip of the remaining plug p' of the pair to the test ring g of the spring jack at her board belonging to that line. The plug p^3 of the upper pair of cords at board m is shown in position of making such a test of the spring jack l^2 of line to station 2. In the normal or idle condition of the line circuit, the test ring g is electrified to a difference of potential from the earth by the battery o, which finds circuit through the restoring coil of the individual annunciator of the line to the different test rings thereof. If, when the line is in that condition, the tip of a plug, as p^3, be applied to the test ring, the circuit will be completed from the test ring touched, to the operator's telephone, thence through one-half of the telephone coil to earth; and at each application of the tip of the plug to the test ring, a click will be produced in the operator's telephone set indicating to her the idle condition of the line. When, however, the line is put into use by inserting a plug into a spring jack thereof, the springs b b' are crossed together directly, whereby the test rings are connected directly to earth through a short circuit, and thereafter possess no dif-

ference of potential from the earth. Hence no response will be produced in the telephone when the test plug is applied to the spring jack. Assume that the operator at board m',—having tested line to station 2,—found the line to be unoccupied. She then inserts the plug p' with which she has been making the test into the spring jack l^3 of that line, whereby the two substations are joined into a continuous loop circuit including the line circuits of both substations, the contact pieces of the spring jacks at which the connections are made, corresponding contact pieces of the connecting plugs, and the conductors q q' of the cord circuit. The subscribers are thus enabled to communicate with each other. When they have finished their conversation, one of them, as for example subscriber at station 1, may send a clearing-out signal or signal for disconnection to the exchange by replacing his telephone upon the switch hook and again rotating his generator i. A portion of the current thus sent over the lines k k' finds circuit through the individual annunciator n as before but fails to operate the same because the shutter of the annunciator is retained in its normal position by the continued energization of the magnet n^2. Another portion of the current finds circuit through the contact pieces of the plug to the cord circuit and thence through the operating coil of the clearing-out annunciator x. The operator at board m' had previously disconnected her telephone from the line circuit after having found the subscribers in communication, and hence the clearing-out annunciator x is free to respond to the signal for disconnection, its magnet x^2 being unenergized. The operator who made the connection is thus notified that the subscribers have completed their conversation. Whenever she introduces her telephone set into that cord circuit again, as to answer a call, by allowing the plunger of the listening key to rise, the local circuit containing the restoring coil of the clearing-out annunciator is closed and the clearing-out annunciator is reset.

I do not desire to claim broadly the circuits which I have herein described, but only such modifications of these circuits as are required in connection with my improved apparatus.

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

1. The combination with a spring jack having an insulated thimble and three insulated contact springs, two of said springs being of equal length, of a connecting plug in said jack having three insulated contact pieces, one of which makes contact with the thimble of the jack, another of which makes contact with both of said springs of equal length, and the remaining contact piece of which makes contact with the remaining spring, substantially as specified.

2. In a spring jack, the combination with a tube or thimble, of a narrow test ring in front of said thimble and insulated therefrom, the opening of said test ring being larger than the opening in said tube, substantially as described.

3. The spring jack having thimble f and the spring contacts b, b', and c, in combination with the plug having tip h, making contact with spring c, sleeve h^4 making contact with thimble f, and ring h^7 making contact with both springs b and b'.

4. The spring jack having test ring g, thimble f, and spring contacts b, b', and c, in combination with the plug having tip h making contact with spring c, the sleeve h^4 making contact with thimble f, and the ring h^7 making contact with both springs b and b', as described.

5. The combination with the block a of insulating material formed with the grooves a' and a^2, and the cylindrical apertures a^3 therein and the rectangular perforations a^6 therethrough, of the test rings g and the thimbles f in said apertures, the springs b and c in said grooves a', and the springs b' in said grooves a^2, substantially as described.

6. The block a of insulating material, formed with the grooves a' and a^2, the cylindrical apertures a^3, the saw cuts a^4 and a^5, and the ducts g^2 and f^2 leading from different points in said apertures a^3 into the sawcuts a^5 and a^4 respectively, in combination with the springs b' mounted in the grooves a^2, the springs b and c mounted in the grooves a', the test rings g in front of said perforations a^3 having the extensions g' extending through the ducts g^2 and saw cuts a^5, and thimbles f in another portion of said apertures a^3, having extensions f' extending through ducts f^2 and saw cuts a^4 to the rear of the spring jacks, substantially as described.

7. The combination with the contact spring b', of the test ring g electrically connected therewith, substantially as specified.

In witness whereof I hereunto subscribe my name this 5th day of May A. D. 1892.

CHARLES E. SCRIBNER.

Witnesses:
F. R. McBERTY,
DE LANCEY A. CAMERON.