(No Model.) 3 Sheets—Sheet 1.

# C. E. SCRIBNER.

## MULTIPLE SWITCHBOARD APPARATUS.

No. 496,904. Patented May 9, 1893.

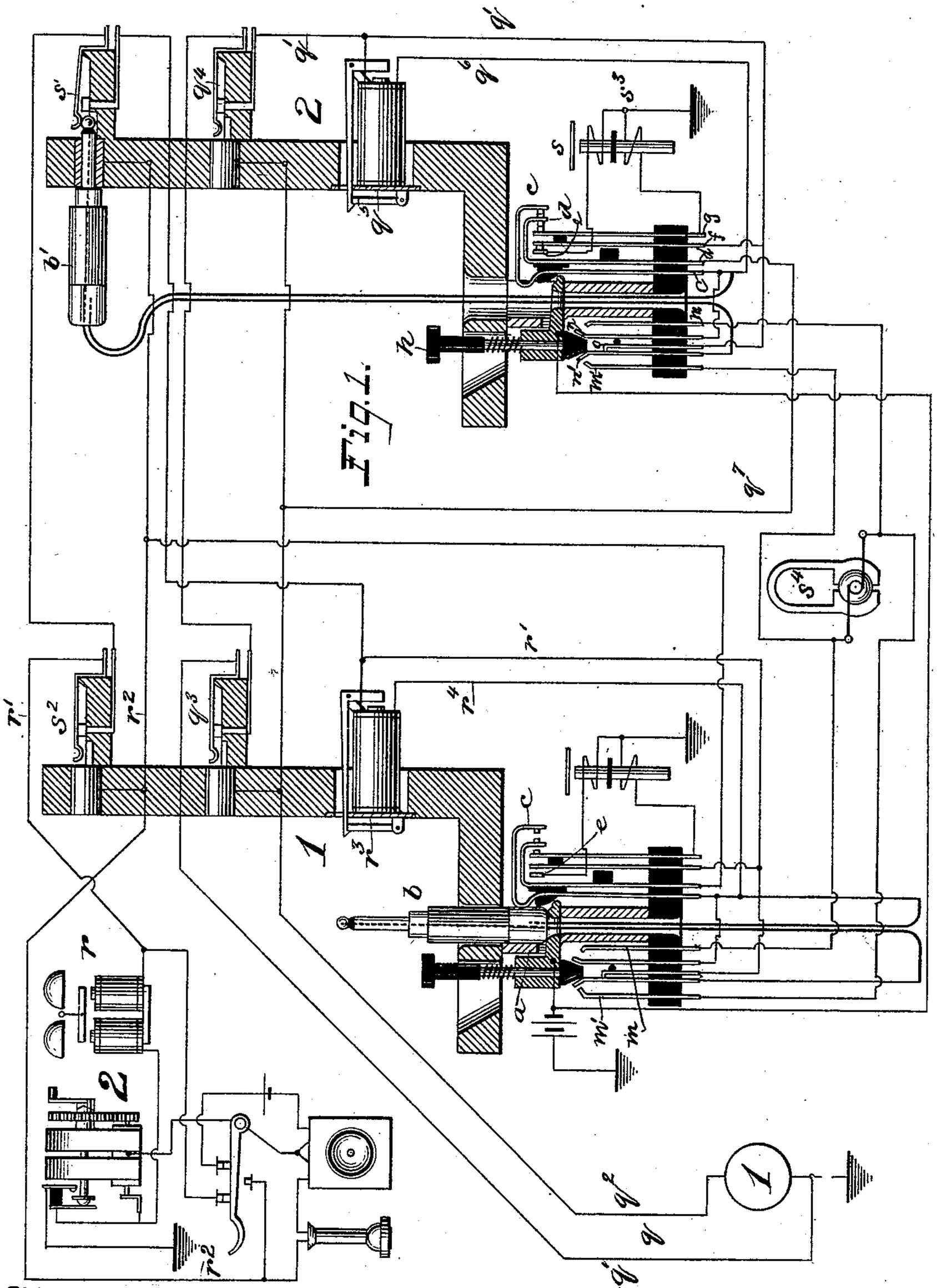

Fig. 1.

Witnesses.
Charles G. Hawley.
F. A. Boynton

Inventor.
Charles E. Scribner.
By George P. Barton
Attorney.

(No Model.) 3 Sheets—Sheet 2.

# C. E. SCRIBNER.

## MULTIPLE SWITCHBOARD APPARATUS.

No. 496,904. Patented May 9, 1893.

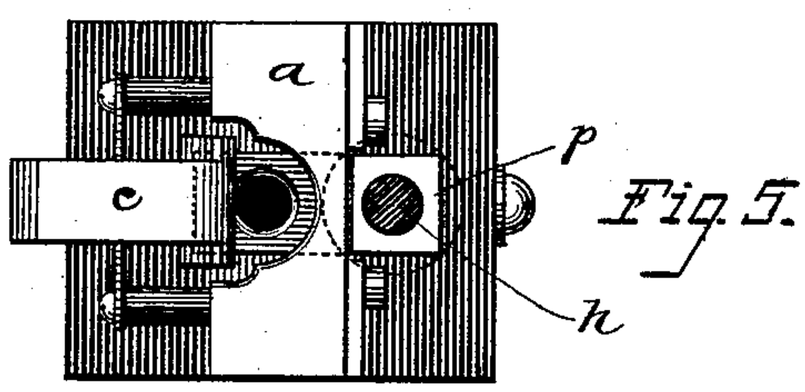


Fig. 5.

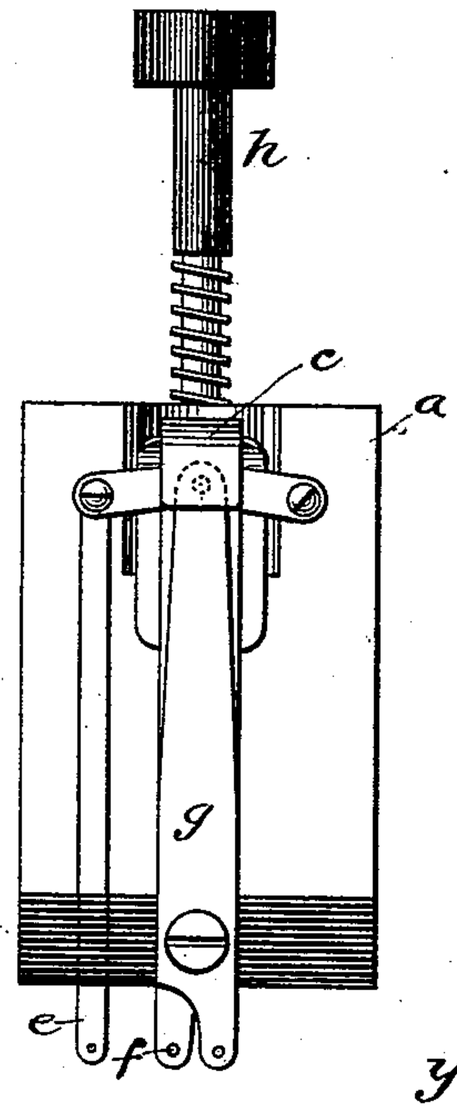


Fig. 2.

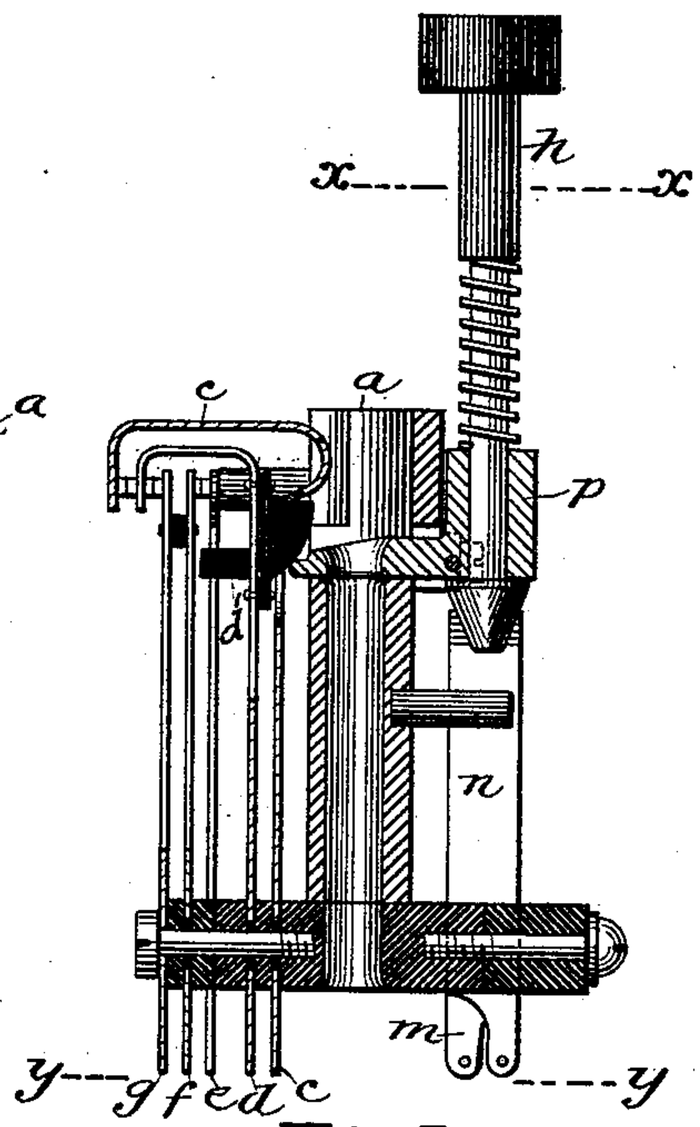


Fig. 3.

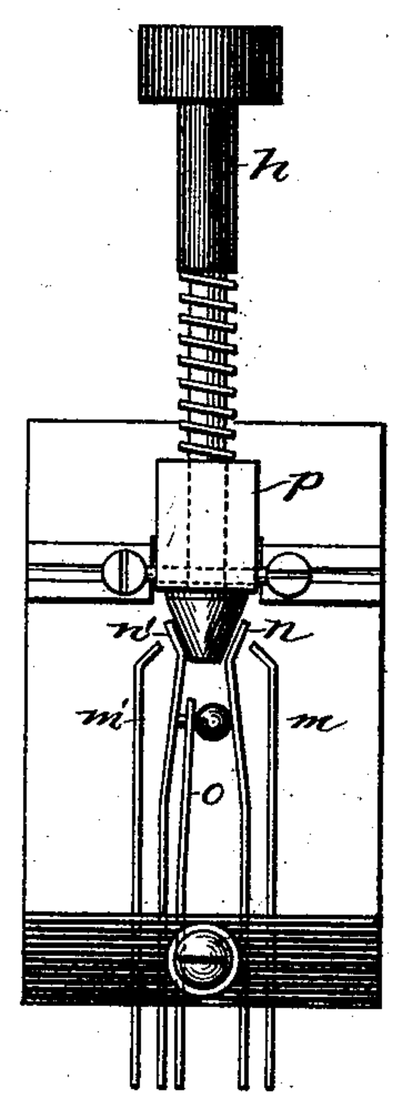


Fig. 4.

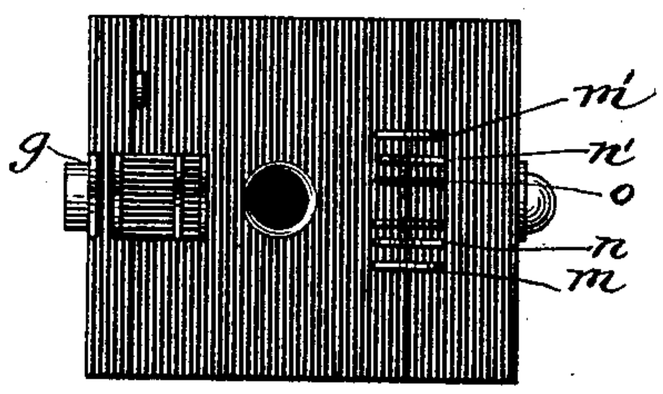


Fig. 6.

Witnesses.
Charles G. Hawley.
F. A. Boynton

Inventor.
Charles E. Scribner.
By George P. Barton
Attorney.

(No Model.) C. E. SCRIBNER. 3 Sheets—Sheet 3.

MULTIPLE SWITCHBOARD APPARATUS.

No. 496,904. Patented May 9, 1893.

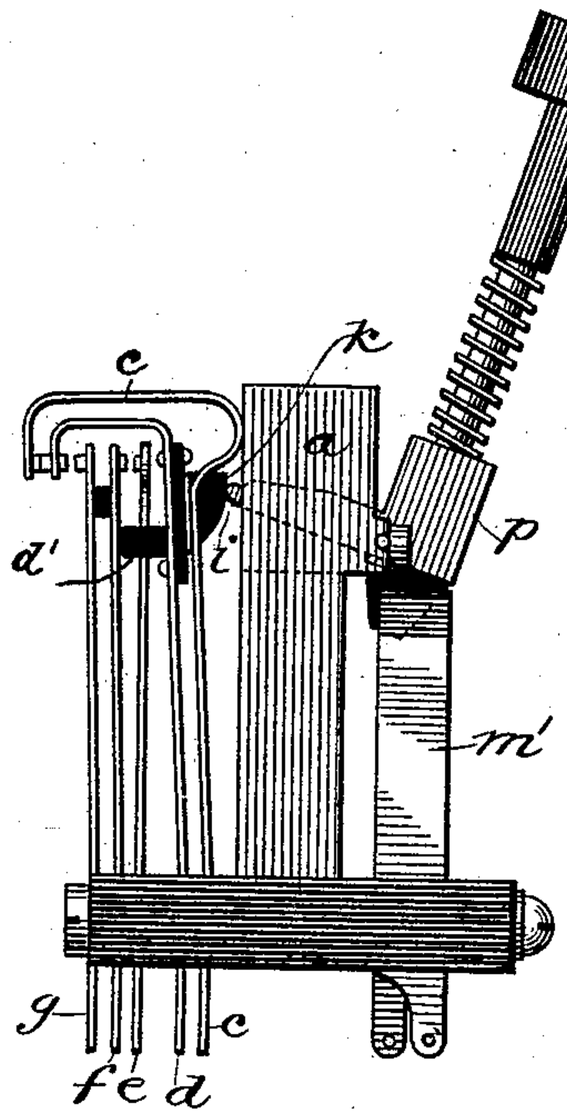


Fig. 9.

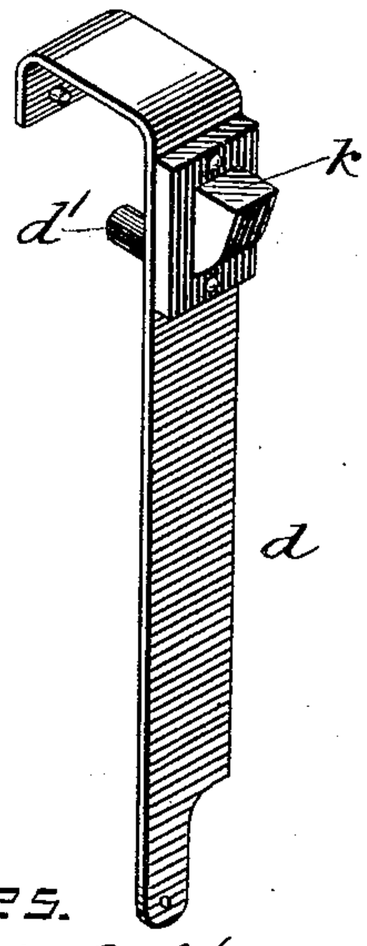


Fig. 7.

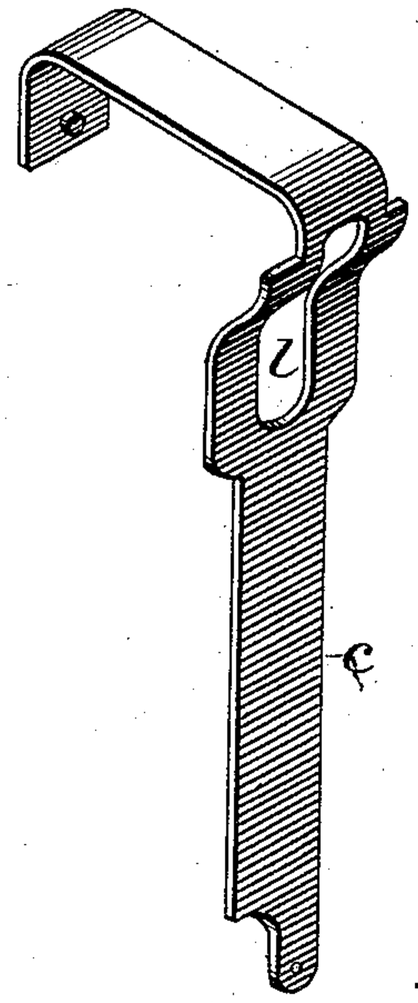


Fig. 8.

Witnesses.
Charles G. Hawley.
F. A. Boynton.

Inventor.
Charles E. Scribner.
By Livingston Burton
Attorney.

# UNITED STATES PATENT OFFICE.

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

## MULTIPLE-SWITCHBOARD APPARATUS.

SPECIFICATION forming part of Letters Patent No. 496,904, dated May 9, 1893.

Application filed February 7, 1890. Serial No. 339,597. (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 Apparatus, (Case No. 225,) 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 the circuits and switch board apparatus of multiple switch board systems and its object is to provide a listening, ringing and grounding key and test circuits whereby the work of the operators in receiving and answering the calls and connecting and disconnecting the lines may be facilitated.

My invention will be described in connection with metallic circuit systems, each line being provided with a generator, bell and telephone set at the subscriber's station and being connected each with a different switch on the different switch boards and with one of my listening, ringing and grounding keys. The subscriber's generator when operated is brought automatically into a circuit formed by grounding one limb of the metallic circuit at the subscriber's station, the limb thus grounded being connected through the subscriber's annunciator and battery to ground at the central office, the other limb of said metallic circuit being normally open at the central office and being connected with the test pieces of the switches of the line and being branched to a normally open contact spring of the grounding switch. The subscriber's generator when not in active use is shunted in the ordinary manner to remove its resistance from the circuit; the ground branch at the subscriber's station also being open. The combined calling, listening and grounding switch I have termed the cord switch; this cord switch is of such construction that when the plug is lifted the operator's telephone and the individual annunciator are bridged across the strands of the cord of the loop plug, the normally open contact spring to which the branch of the normally open limb of the metallic circuit is connected being closed when the plug is thus lifted. By forcing down a plunger to change the position of certain of the springs of the key the generator at the central office is brought into circuit and current sent in the proper direction to ring up the subscriber wanted, the calling subscriber's line being at the same time opened. By throwing this plunger forward an arm carried thereon is brought against one of the springs to disconnect the operator's telephone while maintaining the annunciator in a bridge across the metallic circuit formed by the two lines. The construction of the cord switch is such that the operator's work in calling, answering, testing and making the connections and disconnections is greatly facilitated, the changes in the circuits by means of this cord switch being accomplished simply by lifting the plug and manipulating a single handle or knob. The call having been received by the operator and the plug having been lifted the subscriber speaks to the operator, giving the operator the number of the subscriber wanted. The operator now tests the line called for by means of the terminal loop plug of the calling subscriber which was lifted when the annunciator of the calling subscriber was first thrown down. The test consists in simply touching this plug to the test piece of the switch of the line called for. If she hears no click in her telephone she will know that the line is busy, but if a click is heard indicating that there is battery present on the line tested she will know that the line is free. As before stated one limb of each circuit at the central office passes to ground through a battery; now if the plug of that line be lifted this battery will be taken off. Moreover, if a plug be inserted in a switch of any line the same battery will be disconnected from the line at the contact of the switch which is open by the insertion of the plug, and hence as will be seen upon examination of the circuits the operator testing will get no battery current when a line is busy, that is, if its plug has been lifted or if a plug has been inserted in any spring jack of the line tested upon either of the switch boards; hence no click in the telephone indicates that

the line is busy and a sound in the telephone indicating the presence of battery current indicates that the line is free.

My invention is more especially designed for metallic circuit systems of telephone exchanges.

My invention will be readily understood by reference to the accompanying drawings, in which—

Figure 1 is a diagram illustrative of two metallic circuit telephone lines connected with multiple switch boards, upon which boards are provided calling and ringing keys and test circuits embodying my invention. Fig. 2 is a rear elevation of the operator's cord switch. Fig. 3 is a side elevation thereof, partly in section. Fig. 4 is a front elevation thereof. Fig. 5 is a plan view on line *x*—*x* of Fig. 3. Fig. 6 is a view from below upon line *y*—*y* of Fig. 3. Fig. 7 is a detailed perspective view of the spring which may be connected with the test portion of a metallic circuit. Fig. 8 is a detailed perspective view of the spring adapted to be operated by the heel of the plug. Fig. 9 is a side elevation of the listening, ringing and grounding switch, the knob or plunger being thrown forward in position to disconnect the operator's telephone and leave the metallic circuit of the telephone line complete.

Like parts are indicated by similar letters and figures of reference throughout the different figures.

I will first describe the cord switch or general switching device which I have referred to as the listening, ringing and grounding key. This instrument is illustrated in Fig. 2 to 9 inclusive without the plug; the plug, however, is shown resting in the socket of this cord switch at board 1 of Fig. 1, and the position of the switch thus shown may be considered as the normal position thereof, and as shown at board 1, Fig. 1, the metallic socket *a* of the cord switch is connected to ground through a battery, the metallic heel of the plug *b* forming a medium for connecting spring *c* with said socket *a* and hence with the ground. It will be observed, as shown for example in Fig. 9 in side elevation, that the metallic frame through which the cord passes is mounted on a base of insulating material. The guide piece of the plunger, as hereinafter more fully explained, is pivoted to this frame. The springs *c d f g* assume different relations to one another accordingly as the plug *b* is in the socket or removed from the same, and according to whether the knob or handle *h* is upright or drawn forward to the position shown in Fig. 9. Thus as shown in Fig. 1 the springs *c d*, the contact piece *e* and the springs *f g* will be separated from one another. When the plug is removed and the handle of the plunger *h* upright as in Fig. 3 the springs *c d* and *g* will be brought into contact with one another and at the same time the spring *f* will close upon contact piece *e*. The tension of the springs is such that such changes in the electrical connections will take place simply on removing the plug *b* from the socket. This results from the fact that the contact piece *e* forms, as it were, a stop for the springs *c d g f*, the tension of these springs being so adjusted that their free ends normally press in the same direction, that is to say, toward the contact stop *e;* therefore the electrical connections formed will be certain since all the springs press together in the same direction. Now it may be desirable to again separate these contacts except the contact between springs *c d*, that is to say, it may be desirable to separate spring *g* from contact with the springs *c d* and to separate the spring *f* from contact *e* without separating or disconnecting the springs *c d*. Such a result is accomplished as shown in Fig. 9 by forcing spring *d* over away from spring *g*. By means of the rubber stud *d'* between spring *d* and spring *f*, spring *f* is carried away from contact *e* at the same time spring *d* is carried away from spring *g;* thus two of the three pairs of contacts are opened and one pair permitted to remain closed, that is to say, springs *c d* when spring *d* is thus forced over in the proper direction. This is accomplished by throwing the handle *h* forward so as to bring the arm *i* against the inclined plane or beveled block *k* provided upon said spring *d*.

As shown in Figs. 7 and 8 the spring *c* is provided with an opening or slot *l* through which the block *k* protrudes, thus affording an inclined bearing surface upon spring *d*, which surface the arm *i* takes when the plunger or handle *h* is thrown over to the position shown in Fig. 9. The function of this cord switch as a grounding jack is quite simple as before indicated; that is to say, the spring *c* when resting against a metallic piece, as the heel of plug *b* inserted in the socket, serves to connect said spring *c* with the ground through the medium of the heel of the plug and the metal frame of the grounding switch, which metal frame as before stated is connected to ground through a test battery.

As used in multiple switch board systems it will be understood that each subscriber's terminal cord and plug will be provided with a cord switch and each operator will have a certain number of lines whose initial calls she will answer. Now in such case the contacts *e* of all the cord switches of the lines assigned to her will be common, that is, connected together, and also that the springs *g* of all these cord switches will be common, the contacts *e* being connected with one side of her telephone and the springs *g* with the other side thereof, in order that she may readily connect her telephone as occasion may require with any one of the lines assigned to her. The feature of this cord switch relating to calling or signaling will be best understood by reference to Fig. 4. The outer springs *m m'* may be considered as connected with the two sides of the generator or source of electricity. The springs *n n'* may be con-

sidered as connected with the different strands of the cord of a loop plug inserted in the switch of a line into which it is desired to loop the calling generator. Spring *o* may be considered as connecting with the line of the subscriber who has called and over whose line it is desirable to prevent the signaling current from being sent. Now it will be observed that the end of the plunger is in such relation to the springs *n n'* that when the plunger is forced down spring *n'* will be separated from spring *o* and closed to spring *m'* while spring *n* will at the same time be closed to spring *m;* thus the generator if connected with springs *m m'* will be looped into the cords, that is to say, into the metallic circuit of the line wanted. It will be observed that the plunger *h* is supported in a pivoted guide piece *p*, this guide piece having the extension or arm *i*. Now it matters not in what position this guide piece *p* may be, that is, whether in the position shown in Fig. 9 tilted to bear against the block *k* on spring *d*, or whether upright as shown for example in Fig. 3. In either of these positions the plunger *h* may be forced down to operate the springs *n n'* for any purpose desired. The set of springs placed under the plunger *h* is operated by forcing the plunger down. The other set of springs is operated by using the plunger *h* as a handle, and turning the piece *p* upon its pivot so as to bring the arm *i* thereof against the bearing surface *k*, as illustrated in Fig. 9. When thus used the pivoted guide acts as a shifting lever. I find it most convenient to provide this shifting lever with an opening corresponding with the opening in the metallic frame so that the cord may pass through the same.

I will now describe in detail the circuits illustrated in diagram in Fig. 1 in connection with one of these cord switches at each of the two switch boards.

Telephone line *q* extends in two limbs or branches *q' q²* from station 1 to the central office, the limb *q'* being connected through a switch *q³* on the first board and thence through a switch *q⁴* on the second board, and thence to spring *o* of the calling portion of the switch, thence to spring *n'* thereof and thence to the strand of the cord of plug *b* connecting with the tip thereof. The annunciator *q⁵* is included in a branch *q⁶* extending from limb *q'* through said annunciator to spring *c* of the cord switch. Now when plug *b'* is resting in its socket the contact between spring *c* and spring *d* of the switch at board 2 will be open and spring *c* will be connected to ground through battery. This limb *q'* is therefore normally closed to ground through battery at the central office, the branch or bridge *q⁶* including the annunciator *q⁵* forming a part of this grounded circuit. In other words limb *q'* branches in one direction through the annunciator and in the other direction to contact *o*, spring *n'* and one strand of the double cord which strand is connected with the tip of the plug, and tracing from the point at which limb *q'* branched through the annunciator, through the annunciator *q⁵*, the branch is continued by wire *q⁶* to a point connecting with the other strand of the cord, which strand is connected with the sleeve of the plug, and the same point connecting with spring *c* of the cord switch; thus the branch including the annunciator forms a bridge across the two strands of the cord. The other limb *q²* extends to the test pieces of switches *q³ q⁴* and is also provided with a branch *q⁷* which is connected with spring *d* of the switch; therefore normally the limb *q²* is open at the central office, that is to say, the test pieces of *q³ q⁴* are normally open and the branch *q⁷* is normally open because normally contact springs *c d* are separated by the heel of the plug *b'* resting in the socket forcing the spring *c* away from contact with spring *d*. It should be observed that the spring *c* has a connection to the strand of the cord connecting with the sleeve and heel thereof, and hence when springs *c d* are in contact the circuit of limb *q²* may be traced by limb *q⁷* to spring *d*, thence to spring *c* and thence to the sleeve of plug *b'*.

At station 2 I have shown the subscriber's outfit somewhat in detail. The metallic circuit of the line *r* of station 2 extends in branches *r'* and *r²* to the central office and is connected with switching devices after the manner described with respect to line *q;* normally the telephone rests upon the switch lever. In this position on turning the generator current will be sent from ground at station 2 over limb *r'* through annunciator *r³* included in the branch or bridge *r⁴* to spring *c* at board 1 through the heel of plug *b* of socket *a* and thence through the battery to ground. The shutter *r³* being thrown down the operator will pick up the plug *b* to answer the call. The generator at subscriber's station 2 is of well known construction. The wire leading from the center of the generator armature to the telephone switch is connected with the open limb *r²* of the circuit when the telephone is hung upon the switch. This connection will therefore be simply an open branch when the generator is operated to close the ground contact with the metallic frame of the generator. In this instance, I have shown the driving shaft passing through a sleeve, and a V-shaped bearing surface between the hub of the crank and the sleeve so that the shaft will be automatically moved longitudinally to open the shunt and close the ground contact. There are other well known mechanical constructions for accomplishing the same result.

Now in describing the manner of making the connections I will assume that the subscriber of station 1 has called throwing down the shutter *q⁵*, and that the operator at board 2 has simply lifted the plug *b'* from its socket. The operator's telephone *s* will thus be looped into the circuit of line *q* as will be seen by

the position of the switch; that is to say the limb $q'$ may be traced to spring $f$ and thence to contact $e$ through the telephone and back to spring $g$ and thence to spring $d$ with which branch $q^7$ leading to limb $q^2$ is connected. The telephone is thus looped into the metallic circuit and the subscriber taking down his telephone informs the operator listening at telephone $s$ what connection is desired. The operator, we will say, is informed that line $r$ is wanted. She must now test to see whether or not this line $r$ may not be already connected at some other section of the switch board, for example at board 1. This test is made by simply touching the tip of plug $b'$ to the test piece of switch $s'$. Now if the line is free the battery connected with branch $r^4$ at spring $c$ of cord switch of board 1 will find circuit through the plug. The circuit which is thus formed may be traced from ground at board 1 through the battery to socket $a$, thence through heel of plug $b$ to spring $c$, thence over branch $r^4$ to limb $r'$ through the contact and spring of switch $s'$ and thence through the switch $s^2$ upon the first board and thence through the station 2 to limb $r^2$, and thence as shown to the test piece of switch $s'$ to which the tip of plug $b'$ is applied. Now from the tip of plug $b'$ the circuit may be traced, we will say, to springs $n'$ $o$, thence to spring $f$ and contact $e$ in contact therewith, and thence through half of the winding of the telephone to ground, the ground connection of the telephone being at the middle $s^3$ of the coil of the telephone. Thus it will be seen that the test battery has found circuit as traced over line $r$ and a strand of the cord of plug $b'$ through a portion of the winding of the operator's telephone $s$ to ground.

It should be observed that if the sleeve of the plug should be connected with the test piece of the switch $s'$ we should have a circuit complete through the telephone, the circuit being from the sleeve through the strand of the cord connected therewith to spring $c$ and thence by spring $g$ to common point $s^3$ and to ground. Assuming then that the line $r$ being thus tested is found free, that is, that battery current was found present at the test piece of switch $s'$ the operator will complete the connection by inserting plug $b'$ as shown into the spring jack switch $s'$, thus looping the two lines $q$ $r$ together in metallic circuit. After being thus looped together the operator will ring up station 2 by depressing knob $h$ of the plunger, thus looping the generator $s^4$ into the circuit of line $r$ as before described; the bell at station 2 will thus be rung. The operator will now in order to disconnect her telephone bring knob $h$ forward as shown in Fig. 9.

It will be understood that the springs $m$ $m'$ $n$ $n'$ and $o$ are in Fig. 1 indicated in the best position for showing the circuits, that the preferable construction is as shown in the detailed drawings, these springs being in planes at right angles to the planes of the springs $c$ $d$ $f$ $g$ so that in tilting the knob or plunger $h$ forward the lower end thereof may be moved without coming against spring $n$ as would appear from the position of the springs in Fig. 1. The operator's telephone is thus disconnected from the circuit and the subscriber wanted called, the individual annunciator $q^5$ of the calling subscriber being left, however, in the branch $q^6$, that is to say, the individual annunciator $q^5$ is left to serve as a clearing out annunciator in a bridge closed across the two sides of the metallic circuit formed by uniting the two telephone lines $q$ $r$. We will now suppose that when line $r$ was thus tested the plug $b$ had been lifted; in such case it is evident that the heel of plug $b$ being removed from between the spring $c$ and the socket $a$ the battery in the ground connection of socket $a$ would be cut off and no sound would be heard in telephone $s$ since there would be no battery current present and no sound would indicate that the line was busy. Suppose again that the line $r$ was busy on account of a connection at switch $s^2$ of another board; now the insertion of the plug in switch $s^2$ would open the branch or limb $r'$ at contact of switch $s^2$ and hence the test battery would be cut off at said contact of switch $s^2$; that is to say, the circuit of the test battery might be traced to socket $a$ through the heel of plug $b$ to spring $c$, thence to the contact of switch $s'$ and the spring thereof and thence to the contact of switch $s^2$, but at this contact of switch $s^2$ the circuit would be interrupted because the spring of the switch $s^2$ would be lifted from its contact; hence there would be no current sent through the telephone $s$ when the test was made; therefore lifting of the terminal plug as $b$ of a line makes the line test busy and inserting a plug in any switch of any line makes the line test busy at all other switches.

It should be observed that the operation of making a disconnection in response to a clearing out signal is facilitated, the only motion necessary being to withdraw the plug, as for example plug $b'$, and replacing it in its socket, the act of replacing it in its socket automatically moving the pivoted guide piece $p$ into place.

My invention admits of various modifications which would readily suggest themselves to those skilled in the art and I therefore do not limit myself to the precise details of construction shown.

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

1. The cord switch having the metallic frame thereof connected with ground through a battery, the springs $c$ $d$ $g$ $f$ having a tension in the same direction toward the stop or contact $e$ and a metallic piece or plug adapted to be inserted in said metallic frame to bear against spring $c$ to wedge the free end thereof away from its contact with springs $d$ and $g$ and to permit spring $f$ to separate from the

contact *e* while a ground connection is maintained with spring *c*, substantially as and for the purpose specified.

2. In a cord switch the combination with the frame provided with the plug socket and opening for the cord, of the pivoted arm or lever provided with an opening corresponding to the opening in the frame and the springs *c d*, spring *d* being provided with a block of insulating material having a curved or inclined bearing surface projecting through the spring *c* in the path of said pivoted arm when tilted, together with the plug and cord passing through said opening, whereby the free end of spring *d* may be forced into contact with spring *c* by the movement of said arm against the inclined surface of the said block, while on restoring said plug to its socket the pivoted arm is carried back to its normal position and said springs *c d* separated.

3. A plunger mounted upon a pivoted guide having a projecting arm, a set of springs or contacts operated by forcing down the plunger and a second set of springs operated by tilting the pivoted guide to cause the said arm to act upon said second set of springs, substantially as and for the purpose specified.

4. A telephone line normally extending in two limbs to the central office from the subscriber's station thereof, one of said limbs including the springs and contacts of the switches of the line, and being connected normally through the individual annunciator, and thence by a spring of the cord switch to the metallic heel of the terminal plug of said line, and thence through battery to ground, the other limb of said circuit being connected with the test pieces of said switches, which test pieces are normally extended by a branch to another spring of the cord switch, which spring is normally open, and the subscriber's generator adapted to close a connection to ground at the subscriber's station when operated combined, substantially as described.

5. A metallic circuit extending from the subscriber's station in two limbs, one limb being connected through the springs and contacts of spring jack switches on different switch boards and to the tip of the terminal plug of the line, the other limb being connected to the test pieces of said switches and by a branch to the sleeve of said loop plug, a telephone and a switch adapted upon lifting the plug to bridge the telephone into the circuit, substantially as and for the purpose specified.

6. Two telephone lines in metallic circuit connected together by the terminal loop plug of one of said lines inserted in the spring jack switch of the other line, switching apparatus operated by lifting said plug from its socket, each of said lines having a normal test battery connection, the test battery connection of one line being cut off automatically by lifting the terminal plug thereof from its socket and the battery connection of the other line being cut off by inserting said plug into said spring jack switch to lift the spring or lever thereof, whereby both of said lines are caused to test busy when in use, substantially as and for the purpose specified.

7. The combination with multiple switch boards of telephone lines each connected therewith in metallic circuit and each being provided with a terminal loop plug and cord, the terminal plug of one line being adapted to be inserted in the switch of any other line upon the board where said plug is placed, and a cord switch and test battery in connection with each line, substantially as and for the purpose specified.

8. The combination in a cord switch of a slotted spring, a spring adjacent to said slotted spring carrying a block *k* protruding through the slotted spring, a plug adapted to move the slotted spring, a shifting lever adapted to bear against the insulating block to move the spring upon which said block is mounted, whereby the contact between the springs may be maintained closed or open accordingly as the plug is lifted from or placed in the switch.

9. The combination in a cord switch, of a frame for carrying the contact pieces of the switch, a set of springs mounted on said frame, a shifting lever to move said set of springs, a second set of springs and a plunger mounted in a pivoted guide to move the second set, as and for the purpose specified.

10. The combination in a cord switch, of a frame for carrying the contact pieces of the switch, a set of springs mounted an said frame, a shifting lever to move said set of springs, a second set of springs and a plunger mounted in a pivoted guide to move the second set, and a plug adapted to alternate with the lever in operating the first set of springs, as and for the purpose specified.

11. In a telephone switch board a circuit from ground through a test battery, thence to springs and contacts of the different switches of a telephone exchange, thence through a metallic circuit including a subscriber's station, thence to the rings or test pieces of the switches and thence to a contact of a cord switch, in combination with a cord switch, plug and cord, whereby the operation of the cord switch by the plug may remove the ground and connect the branch from the test rings to the cord, substantially as and for the purpose specified.

12. The combination in a telephone switch board system, of a cord switch, a plug and a plunger for controlling the springs of said cord switch, a metallic circuit connected with said cord switch, one branch of said metallic circuit being grounded through a battery, and the other branch of said metallic circuit being left open in said cord switch when the plug is inserted in said cord switch, and a telephone circuit connected to contacts of the cord switch, substantially as and for the purpose specified.

13. A metallic circuit extending from the telephone exchange to the subscriber's station,

one limb of said metallic circuit being connected through an annunciator and thence through a switching device adapted to be closed by the metallic heel of said plug to ground when the plug is in its socket, the other limb being normally open at the central office, in combination with the subscriber's calling generator, a ground contact connected with said generator and adapted to be closed automatically thereby when the generator is operated, substantially as and for the purpose specified.

14. The combination in a telephone exchange, of a double plug and two stranded cord connected therewith, an annunciator bridged across the circuit of the two stranded cord, a metallic circuit, one limb of which is connected to one strand of the cord, a ground circuit connected with the other strand of the cord and a cord switch whereby the said annunciator may be included in a grounded circuit or in a bridge circuit accordingly as the cord switch is in one position or another.

15. In a telephone exchange system a metallic circuit including a subscriber's station a double plug and two stranded cord connected therewith and to the metallic circuit, a telephone bridged across the metallic circuit thus formed, said telephone being grounded at or near the middle portion of its winding, in combination with a subscriber's metallic circuit, one limb of which is grounded through a battery and the other limb of which is normally open and connected to the test pieces of spring jack switches of the line, whereby application of the plug to one of said test pieces will form a ground circuit including the operator's telephone, substantially as and for the purpose specified.

16. In a telephone exchange a subscriber's metallic circuit whose normal connection is through a battery, a contact upon a cord switch, the contacts of the several spring jack switches and the subscriber's station to the test pieces of the spring jacks, the plug normally resting in the cord switch, whereby lifting the said plug or inserting a plug in either of the several spring jacks will disconnect the battery from the said test pieces to make the line test busy, substantially as and for the purpose specified.

17. In a cord switch a frame, movable contact springs, a plug to move the said springs, a lever adapted to move the said springs to make a different combination of connections from that given the springs by the plug, said plug adapted to rest upon and shift the said lever to its normal position when the plug is replaced in the socket, substantially as described.

18. The cord switch having two sets of springs or contacts on opposite sides of the frame thereof, in combination with a plunger mounted on a pivoted guide, said plunger when depressed acting against one set of springs to change the contacts thereof and when tilted being brought against the other set of springs to change the connections thereof, substantially as described.

19. The combination, with a telephone line circuit extending from a substation to a central station and having its two sides connected to the tip and to the sleeve respectively, of a terminal plug at the central station, a cord switch in connection with the socket of said plug, having two contact springs connected to the different sides of the line circuit respectively, two contact pieces adapted to engage with said contact springs when said plug is removed from the socket, and a telephone set connected in a circuit of which said contact pieces form terminals, whereby said telephone set is connected in a bridge between the two sides of said telephone line when the terminal plug thereof is removed from its socket, substantially as described.

20. Telephone lines connected in metallic circuit from the subscriber's stations thereon to the central office each circuit being provided with a different switch on each of two or more switch boards, in combination with generators one at each station in a normally open ground branch adapted to be closed automatically by the operation of the generator and an individual annunciator for each line at the central office included in a branch normally connected through the cord switch, the said cord switch and telephone connected therewith to ground, a metallic piece or part of the terminal plug of each line being interposed normally in the annunciator branch thereof when said plug is resting in its normal position in its socket, whereby current may be sent over any line to operate the individual annunciator thereof while the branch containing the annunciator may be opened on the removal of the terminal plug of the line from its socket to bring the operator's telephone into circuit.

21. A telephone line provided with a terminal loop plug at the central office and a branch at the central office containing an annunciator, in combination with the switch of a similar telephone line into which the loop plug is adapted to be inserted, a cord switch having a socket for said plug and contacts operated by the lifting of the plug from its socket to bring the operator's telephone into the circuit of the line and a pivoted arm or lever adapted to be tilted to disconnect the telephone and close directly the branch from the line which contains the annunciator thereof, substantially as and for the purpose specified.

In witness whereof I hereunto subscribe my name this 1st day of February, A. D. 1890.

CHARLES E. SCRIBNER.

Witnesses:

GEORGE P. BARTON,

C. G. HAWLEY.