

(No Model.)

S. J. LARNED & F. A. PICKERNELL.
STATION APPARATUS FOR TELEPHONE CIRCUITS.

No. 501,086.

Patented July 11, 1893.

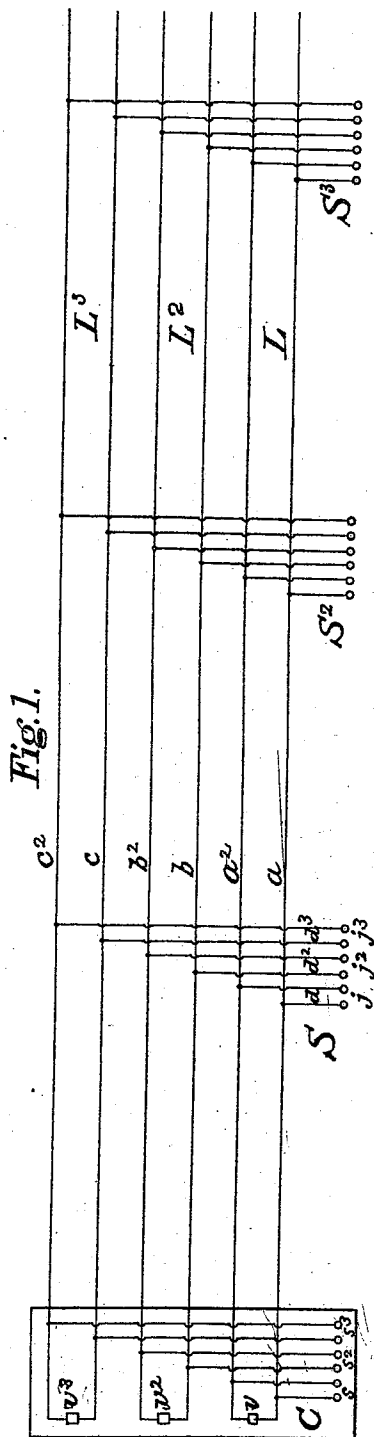


Fig. 1.

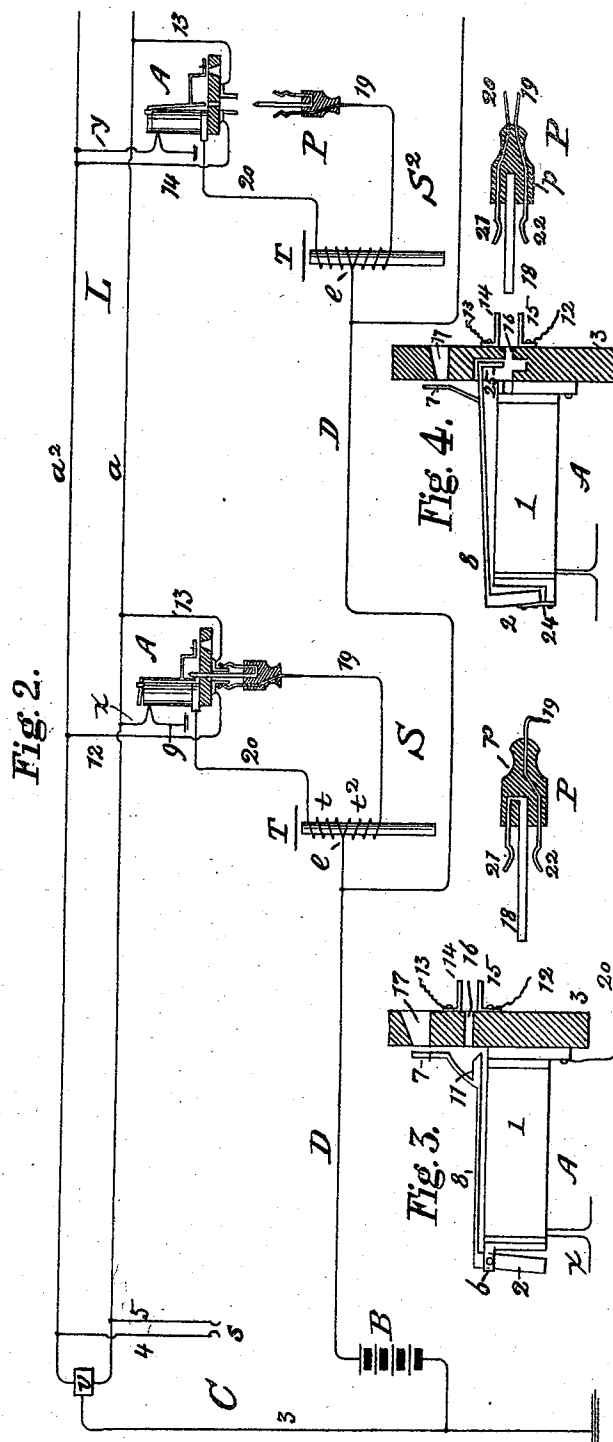


Fig. 2.

Fig. 4.

Fig. 3.

Witnesses.

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UNITED STATES PATENT OFFICE.

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STATION APPARATUS FOR TELEPHONE-CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 501,086, dated July 11, 1893.

Application filed March 20, 1893. Serial No. 466,868. (No model.)

To all whom it may concern:

Be it known that we, SHERWOOD J. LARNED, residing at Evanston, in the county of Cook and State of Illinois, and FRANK A. PICKER-
NELL, residing at Newark, in the county of Essex and State of New Jersey, have invented certain Improvements in Station Apparatus for Telephone-Circuits, of which the following is a specification.

10 This invention relates to that class of telephone exchange systems in which a series of stations are served by a smaller number of main circuits, which however are common to and accessible by all stations of the series,
15 and which all extend from all substations to a central station. In such an exchange there is great economy in the main line conductors; while by reason of the fact that each substation has a number of main lines leading to the central office, there is a reasonable expectation, though each line is capable of being
20 used by any substation in the system, that each substation desiring communication, will always find a conductor free and at its disposal. In two other applications, filed of even
25 date herewith, respectively by Frank A. Pickernell, and by ourselves are described and claimed, in the first apparatus and circuit arrangements whereby in such a system, the
30 substation may at any time send a call signal to the central office indicating that communication is desired, and whereby the said substation, or its correspondent, may be enabled at the close of said communication to apprise
35 the central station of the fact and thus indicate the necessity of disconnection; and in the second apparatus and circuits whereby in such a system as has been outlined, the substation may be able to distinguish among the
40 lines accessible thereto, the lines in use from the free lines or the lines not in use, and thus to prevent the connection of any second telephone to a line already in use.

This invention relates to apparatus and circuits embodying the essential features shown
45 in the two applications referred to, and has special reference to a secrecy device connected in each main line at the several substations, by means of which, when any main line is con-
50 nected for use at any substation, it is impos-

sible for any other substation to connect with the same main line, thus insuring absolute secrecy to the connecting substation. We also combine the "line in use" or "busy" visual signal, forming the subject matter of
55 the second application referred to, with the secrecy device in such a way that they are operated simultaneously *i. e.* when the plugs are up, or a connection is made at any substation by the insertion of the connecting plug
60 into the jack of a main line, the line in use signal is shown at the same time the secrecy device is operated, so that at all the other substations a line in use annunciator is displayed; and such a change is effected in the apparatus
65 that it is impossible for any other substation to connect with the said main line as their line terminal sockets are rendered inoperative.

In carrying out the invention, suitable call sending and receiving appliances are provided
70 to be operated in conjunction with any member of a series of metallic circuits and associated therewith are disconnecting signals. The metallic or double conductor main circuit extending between a central station and
75 a substation or a number of substations or in fact between any two stations is provided with suitable means for effecting the secrecy of the main lines when connected at any substation, and means in combination therewith
80 for indicating the lines which are in use or busy and those that are not; and with said main circuit or any number of such main circuits is associated a common source of electric current, for example a primary or storage
85 battery which can be located either at the central station or at any suitable and convenient place. One of the poles of this source of electrical energy may be connected to earth, and the other is extended by a supply con-
90 ductor to the several substations, entering these by branches which, when applied, unite with the center of the telephone coil or helix. The main circuit is normally open at the sub-
95 stations, but has plug socket or spring jack branch terminals adapted to receive looping and connecting plugs which are respectively the terminals of the telephone loop extending from its coil, and which, when thrust into their sockets, thereby close the said circuit
100

through the telephone helix; the telephone is thus included in the main circuits operatively and in such a way as to be fully responsive to currents circulating therein.

5 While there are many ways which we could employ to effect the secrecy of a main line telephone conductor, we prefer to employ electro-magnetic apparatus in an earth branch from each main line at each substation connected to the said main line; the electro magnet has an armature, connected to which is an arm having upon its end a terminal piece, which is located just inside of a plug hole so that upon its insertion the plug will pass over
10 the said terminal piece and prevent it from rising, at the same time making electric contact therewith. At the outside of the plug socket are two pins, one on each side thereof, forming branch terminals from either side of
20 the main metallic circuit. The frame of the electro-magnet is connected to one side of the coil of the substation telephone, while the other side of the coil ends in a spring on the line connecting plug. The plug is composed of a body of insulating material into
25 which a metal spindle is inserted centrally at one end, and on either side thereof are inserted springs, one of which is connected to the central spindle, the other being connected, as aforesaid, by a wire loop to one side of the telephone coil, the center of which is connected to the supply conductor. The same source of electric current, used to call the central office, operates these electro magnets,
35 and when a line is in use, *i. e.* when the connecting plug at any substation is in a socket, thus closing the circuit at that point of any main line, all the electro-magnets legged or branched onto the line at any substation through which it passes have their armatures attracted (excepting the electro magnet at the substation where the plug is inserted, its armature is held from moving by the spindle of the plug) and the terminal ends of their
45 levers are brought to a position to prevent a line plug at any other such substation being inserted in a jack branching from this main line; or the levers are brought to such a position that if the plug is inserted, it cannot
50 make the electrical contact or continuity with the armature lever, necessary to close the circuit through the metal frame of the electro-magnet.

We combine the "line in use" or "busy" indicator with the secrecy apparatus, and preferably attach to the armature lever of the electro magnets an arm, bearing on its end a target which is divided into two parts, by different colored paints or otherwise; opposite the target is an opening in the frame of the box or case which incloses the apparatus, as described in the second application hereinbefore referred to. When the line is in use at any substation and the armature lever is attracted to block the line at all other
65 substations simultaneously therewith the "line in use" target is displayed. If the line

is free, the circuit is open and the source of electricity cut off, the armatures of the electro-magnets are unattracted and consequently none of the sockets are blocked and the line "not in use" target is displayed. The main circuit is a double conductor or metallic circuit and at the central station has a branch to earth including an electro-magnetic call annunciator common to all of the substations connected to the said main circuit.

Figure 1 is a diagram of a general system with which the invention may be associated. Fig. 2 is a diagram of one main circuit illustrating the invention. Fig. 3 is a side view partly in section of the combined electro-magnetic and secrecy apparatus shown connected in circuit in Fig. 2 with a connecting plug, and Fig. 4 is an alternative device, with its
85 connecting plug.

In Fig. 1 is shown the general arrangement of a combination line system in association with which the invention may be conveniently operated. C represents a central or end station for a number of metallic or double conductor circuits L, L², and L³. S, S², and S³ represent out, or substations into which the said circuits enter by paired branches *d*, *d*², *d*³; the several pairs terminating respectively in springjack or other plug sockets *j*, *j*² and *j*³. Thus the two conductors *a*, *a*²; *b*, *b*² and *c*, *c*² of the several main circuits L, L², and L³ lead into all of the substations normally connected with such circuits by multiple arc or parallel branches, which, so far as this invention is concerned, are normally open or discontinuous, while at the end station C the two conductors of each main circuit are joined through the coils of suitable call receiving devices *v*, *v*² and *v*³, and are furthermore provided with springjack connections *s*, *s*², *s*³ whereby central station appliances may be connected by the use of intermediate or linking conducting devices of any ordinary or well known character.

Fig. 2 indicates the mode in which our invention will be preferably carried out. L represents one of the double conductor circuits, and *a* and *a*² are the direct and return conductors thereof, provided at the central or end station C with connecting branches 4 and 5, leading to contacts in spring jacks *s*. A differentially wound annunciator drop *v* is connected between the two main conductors and the earth branch 3; and at the station S it is assumed that the telephone T has been connected with the circuit and that the metallic circuit by such a connection has been closed through the telephone coils or helices *t*, *t*². A source of electricity, shown as a battery B, is located at the central station C, or at any other suitable and convenient place, and has one of its poles earthed, while the other connects with a call current supply conductor D which may form an extra member of the group of line conductors and passes to the several substations of the system, a branch being led from it into each, which branch is

permanently united to the telephone helix at a point *e* at the center thereof; or if the said telephones have two distinct helices, is serially connected at a point between them.

5 A at substations S and S² represents the electro-magnetic secrecy device or apparatus, legged or branched from one side of the main circuit L by wires *x* and *y* respectively to ground. Its construction is more clearly
10 shown in Fig. 3. 1, is the helix or coil of the electro-magnet, 2 is the armature therefor pivoted at points 6; attached to the armature is a lever 8 extending to the opposite end of the helix and having a terminal end inclined
15 as shown. 3 is a block of insulating material forming a side of a case to the back of which the helix 1 is secured; 16 is a hole through the block 3, the lower side of which is on a level or a little below the upper surface of the
20 armature lever terminal 11; on either side of the hole are metal pins 15 and 14 secured to the block 3. These are terminals of branches 12 and 13 from the respective sides *a* and *a*² of the main line L. The plug P is composed
25 of an insulating base or handle *p*. Projecting from its center at one end is a metal spindle 18; and on either side thereof inserted in said handle, are metal springs 21 and 22, one of which 21 is connected to the spindle 18. The
30 said supply circuit D is normally open, and the armatures 2 of the several electro magnets are normally retracted; but, when the plug P is inserted, as shown at substation S, the circuit is closed and the telephone there
35 is connected with the main circuit; the armatures 2 are attracted at all of the substations, except the one at which the plug is inserted and the lever terminals 11 at said substations block the holes 16 to prevent a plug from being
40 inserted; or prevent the plug from making electrical contact with the said terminals, and the said terminal sockets are rendered inoperative. When a plug is so inserted, its
45 spindle 18 enters the hole 16 and strikes the end or terminal 11 of the armature lever 2, and passes in over the terminal, making an electrical contact and continuity therewith. The springs 21 and 22 slide onto and make
50 contact with the pins 14 and 15 respectively; thus closing a circuit from earth at central station battery B, supply and independent conductor D, to the point *e* in the telephone
55 coils where it divides, branching through wire 20 to the metal frame of the electro magnet, and by armature lever 8, its terminal 11 to spindle 18 of the plug P, and thence to its
60 connected spring 21, pin 14, branch 13 to one side, *a*, of main line L; the other branch from the telephone is by wire 19 to spring 22 of plug P, pin 15, branch 12, to other side *a*² of
65 main line L, both sides of which unite at the central station through the call annunciator *v* and branch wire 3 to the other pole of battery B or to earth. A portion of the current
leaks by legs or branches *x*, *y* to earth through the helices of the electro magnets A at each substation, operating their armatures, as de-

scribed. We have shown the electro-magnets of the secrecy devices as in a branch from side *a* of the main circuit at substation S, and
70 in a branch from *a*² of the said circuit at substation S², in alternation, to properly balance the circuit.

Fig. 4 shows a modification of the electro magnetic secrecy device; in this case the ar-
75 mature is hung by a flat spring so that normally it is away from the pole of the electro magnet, and the terminal end of its lever raised from the plug hole 16 to allow the plug
80 spindle to enter; in case the line is in use at any of the substations the armature would be attracted and the lever terminal brought down to block the plug hole 16, so that the plug
85 could not be inserted sufficiently to connect its springs 21 and 22 with their pins 14 and 15. The plug shown here is of a simple character each spring connects directly to either
90 side of the telephone terminals, and there is no circuit through the metal parts of the electro magnet when it is in the socket.

We combine the line in use indicator or annunciator with the electro magnetic secrecy
95 apparatus, in the following way. In both of the devices, shown in Figs. 3 and 4, are shown an arm attached to the armature lever near
its end brought out so as to come opposite an orifice 17 in the block 3; upon the end of the
100 arm is a target 7 divided into two parts by different colored paint, or by any other suitable manner. When in its normal position,
105 shown in Figs. 3 and 4, the upper part of the target 7 shows at the orifice 17, indicating that the line is not in use; while in the position shown at substation S², Fig. 2, the lower part
110 of the target is displayed at the opening 17 indicating that the line is in use. When the circuit is closed, as described, by the insertion
115 of the plug P into a socket, the line in use annunciator is set or indicated simultaneously with the blocking of the plug hole or socket, and by the same act; and simultaneously
120 therewith the calling annunciator *v* at the central station which is common to all the substations in the main line, is caused to indicate that a call has been made. And, while
125 the telephone loop is thus connected by its plug terminal with the armature lever terminal, the electro magnetic secrecy apparatus, acts as a line continuity controlling device in that the said lever terminal not only is caused
130 to press against the spindle of the plug and maintain the line intact while it is inserted, but at the same time the operation of the said device, as aforesaid, at the other substations renders it impossible for a looping plug to be
inserted in any of the line sockets there, to effect a connection.

Having now fully described the invention, we claim—

1. The combination of a main double con-
130 ductor telephone circuit extending between an end or central station and a series of substations and provided at the said substations with plug socket terminals; a secrecy device

or apparatus connected with said circuit at each substation; a suitably located battery or equivalent source of electricity; an earth branch conductor including the said source of current, provided with connecting plug terminals adapted to be inserted in the said plug sockets, and thereby to simultaneously close the said main circuit, and the earth branch circuit including the source of electricity and to operate the said secrecy device, substantially as described.

2. The combination of a main double conductor telephone circuit extending between an end or central station and a series of substations and provided at the said substations with plug socket terminals; a secrecy device or apparatus, and a line in use indicator, connected with said circuit at each substation; a suitably located battery or equivalent source of electricity; an earth branch conductor including the said source of current, provided with connecting plug terminals adapted to be inserted in the said plug sockets, and thereby to simultaneously close the said main circuit and the earth branch circuit including the source of electricity for the purposes described.

3. The combination of a main double conductor telephone circuit extending between an end or central station and a series of substations and provided at the said substations with plug socket terminals; a secrecy device or apparatus, and a line in use indicator, connected with said circuit at each substation; an annunciator at the central station included in an earth branch of said main circuit; a suitably located battery or equivalent source of electricity; an earth branch conductor including the said source of current, provided with connecting plug terminals adapted to be inserted in the said plug sockets and thereby to simultaneously close the said main circuit, and the earth branch circuit including the source of electricity, for the purpose described.

4. The combination of a main double conductor telephone circuit, extending from a terminal station to two substations and provided at the said substations with plug socket terminals; a secrecy device or apparatus included in an earth branch of said circuit at each of said substations; a telephone at the substations; a suitably located battery or equivalent source of current; an earth branch conductor extending from the said terminal station to the substations including the source of current, and branching to the helices of the said telephones; and connecting plug terminals for the helices of the said telephones adapted to be inserted in the said plug sockets and thereby to simultaneously close the main circuit and the earth branch circuit for the purposes described.

5. The combination of a main double conductor telephone circuit extending between a terminal and two or more substations; a secrecy device or apparatus connected with said circuit or branches thereof at all of said sub-

stations; an independent earth branch extending from said terminal station to all of said substations, normally disconnected from said main circuit, and including an electrical generator; and means for closing the earth branch and thereby the generator circuit through the double conductor circuit whereby the closure of the generator circuit is enabled to block or render inoperative the line terminal sockets of the said main circuit, at all of the other substations, substantially as described.

6. The combination of a main double conductor telephone circuit extending from a central station to a number of substations and provided at each substation with plug socket branch terminals united respectively to the conductors of said circuit, secrecy devices or apparatus connected with said circuit, one at each substation; an electric generator such as a battery, common to all of the substations located at any desired point; an earth branch conductor including the said source of current, extending to each substation and provided with connecting plug terminals branched to each substation, adapted to be inserted in either of the plug sockets thereof, and thereby to simultaneously close the main circuit, and the earth branch circuit including the source of current, and also to simultaneously render inoperative the line terminal sockets at all of the other substations, substantially as described.

7. The combination of a main telephone circuit extending between an end or central station and a series of substations and provided at the said substations with plug socket terminals; a combined secrecy device and line in use annunciator connected with said main circuit at each substation; a suitably located battery or equivalent source of electricity; an earth branch conductor including the said source of current, provided with connecting terminals adapted to make connection with the said plug sockets and thereby to simultaneously close the said main circuit and the earth branch circuit including the source of electricity and to simultaneously actuate the said secrecy devices and the line in use annunciators to respectively render inoperative the line terminal sockets, and to indicate "line in use" at the said substations.

8. The combination of a double wire telephone circuit extending between a central station and a series of substations, provided at each station with branch terminal connection devices, and with earth branches including electro-magnets; with a telephone loop at each station, having plug terminals to fit said connection devices, and thereupon to close said circuit through the telephone; a supply conductor extending from earth through a source of electricity and connected to the center of said loop whereby current may be directed over both conductors of the main circuit and their respective earth branches; and a continuity controlling device associated with each

connection device and itself controlled by the electro-magnet in the earth branch, adapted to become operative at any substation when the said electro-magnet is excited by the insertion of a plug at any other substation, and the consequent flow of current through its containing earth branch and to thereby prevent the establishment of a connection between the main circuit and the telephone loop at any station during the pendency of a similar connection at any other station.

9. The combination of a double wire telephone main circuit extending between a central station and a series of substations, provided at each substation with branch terminal connection plug sockets, and with an earth branch including an electromagnet; a telephone loop with plug terminals at each substation, said plugs being adapted to fit said sockets and to close said main circuit through the telephone included in said loop; a current supply conductor extending from earth through a source of electrical energy to a permanent connection at the center of said telephone loop, and adapted to close the circuit of said source through both conductors of said main circuit and their earth branches and to excite the magnets thereof; a circuit controlling device and a line condition indicating device at each substation, both controlled by the earth branch electro-magnets of said substation and adapted to become operative upon the establishment of a connection between the telephone loop and main circuit at any other substation, and thereupon to indicate such connection, and prevent the establishment of a second with the same main circuit, substantially as described.

10. The combination of a double wire telephone main circuit extending between a central station and a series of substations, provided at each substation with branch terminal

plug sockets, and an earth branch including an electro-magnet, and at the central station with a permanent earth branch, and an annunciator included therein; a telephone loop with plug terminals at each substation, said plugs being adapted to fit said sockets and to close said main circuit through the telephone included in said loop; a current supply conductor extending from earth through a source of electrical energy to a permanent connection with said loop at the center of the helix of said telephone; and arranged to close the circuit of said source through both conductors of said main circuit, and their substation and central station earth branches and to excite the magnets thereof; and independent circuit controlling and line condition indicating devices at each substation controlled by the earth branch electromagnet of said substation, adapted to become operative upon the establishment of a connection between the telephone loop and main circuit at any other substation, and thereupon to indicate such connection, and prevent interruptions thereof, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 25th day of February, 1893.

SHERWOOD J. LARNED.

Witnesses:

FRED GERLACK,

ALBERTA ADAMICK.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 6th day of March, 1893.

FRANK A. PICKERNELL.

Witnesses:

R. J. MORGAN,

CHARLES D. M. COLE.