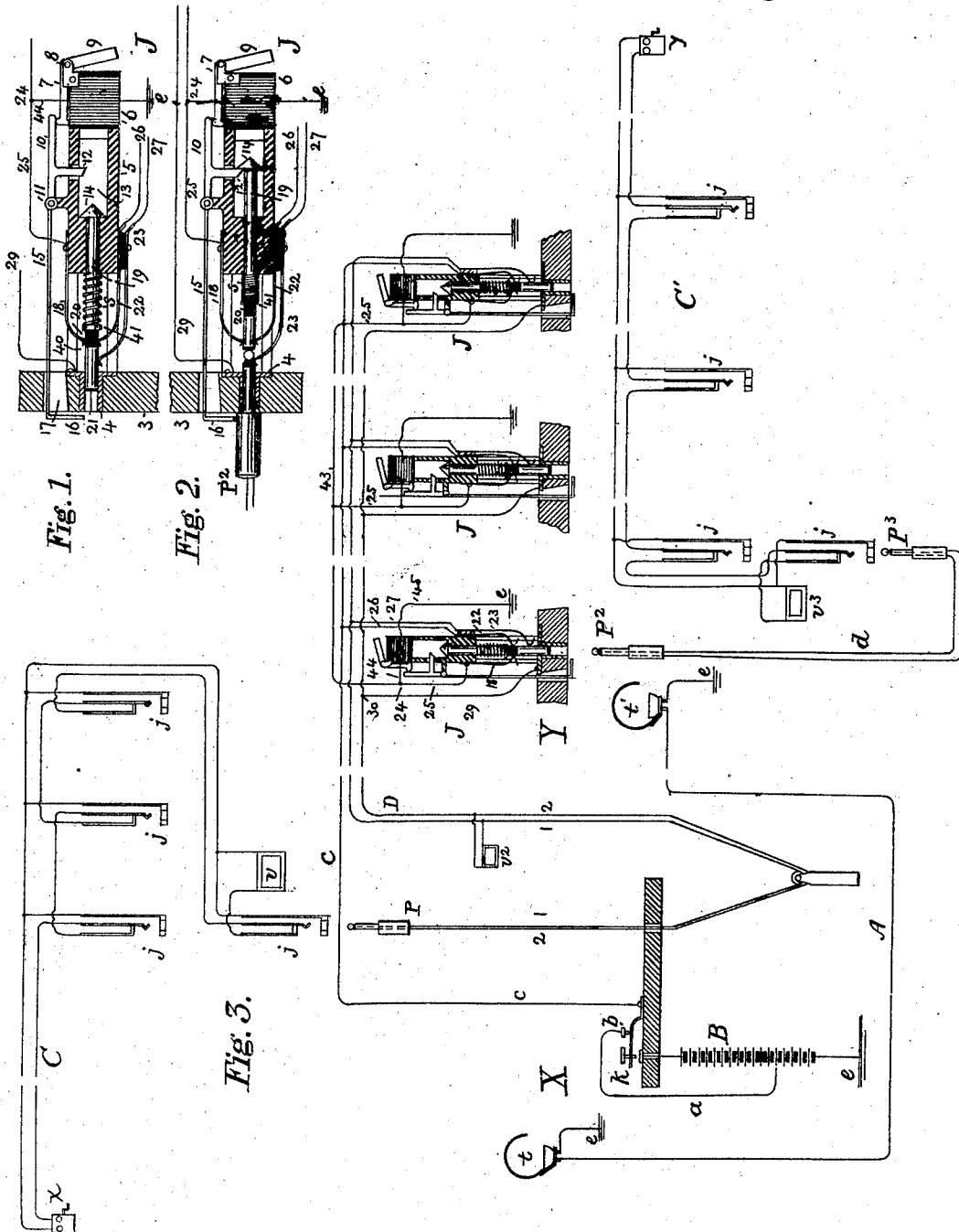


(No Model.)

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ONE CIRCUIT AND APPARATUS.

No. 502,466.

Patented Aug. 1, 1893.



*Attest.*

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# UNITED STATES PATENT OFFICE.

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## TELEPHONE CIRCUIT AND APPARATUS.

SPECIFICATION forming part of Letters Patent No. 502,466, dated August 1, 1893.

Application filed May 25, 1893. Serial No. 475,449. (No model.)

### *To all whom it may concern:*

Be it known that I, JAMES L. MCQUARRIE, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Telephone Circuits and Apparatus, of which the following is a specification.

This invention relates to telephone central office or exchange switchboard circuits and apparatus, and especially to the trunk lines which are employed as links between two distant points, or terminals, which may be located on separate switchboards in the same room or building, or may be in the telephone exchanges of two widely separated towns or cities.

Owing to the increased use of the telephone and the consequent multiplication of substations connected with exchanges, it has been found desirable and necessary to increase the number of such central stations, and as the subscribers of the several central stations wish to converse with one another, trunk conductors are extended between the several exchanges, which thus serve as links between the respective switchboards over which signaling and conversation may be carried on between the substations associated therewith. At one or both of the terminals of such trunk lines there are usually some means provided to indicate to the operator there that the substations which have been connected for conversational purposes, have finished, such means being denominated "clearing out annunciators," or "visual signals;" or sometimes such an indication is conveyed by speech from one operator to the other. In all such means or devices more or less time is taken up in the notification and frequently an operator is too busy to make the disconnection required, and consequently a trunk line forming part of a line of communication on which a conversation lately in progress has been completed is thought to be still in active employment, and consequently remains idle and useless, when its employment may be required by other operators at other sections of the switchboard.

My invention relates to a trunk line which extends between distant terminals, each terminal being located upon a switchboard. At

one of said switchboards the said line terminates in a clearing out annunciator and plug, while at the other switchboard the line extends through the several sections thereof, having looped in at each section a "clearing out" spring jack, which constitutes a new feature in such circuits. The "clearing out" jack performs the usual functions of a connecting jack upon multiple switchboards, and serves the additional purposes of, first: an automatic disconnecter of the trunk line with a substation line, and, second, when the trunk line is connected with a substation line at one terminal, of visually indicating at all the other sections of the switchboard the fact that the line is in use, and also of interposing an obstacle whereby the operators are prevented from inserting a connecting plug therein.

In carrying out my invention I associate an additional conductor with the trunk line, which extends with it and at the plug terminal thereof has connected therein normally through the back contact of an interposed key the minor portion of a main battery which is grounded at one pole; at the opposite terminal the said conductor is branched to a normally open spring in each clearing out jack. I also provide between each of said terminals an operator's instruction circuit of any suitable character. Each clearing out jack consists preferably of a body of insulating material supporting an electro magnet and suitable connecting springs and is provided with a plug orifice in which there is located a self retracting longitudinally movable circuit controller, by means of which, when the looping or connecting plug is inserted in said orifice, the circuit connections are made and the circuit controller is operated and locked, and the minor portion of said battery or source of electricity at the other terminal is closed to earth through the electro magnets of all the clearing out jacks at the several switchboard sections, and "line in use" indicators are operated. Upon the termination of conversation between two substations connected by means of such a linking trunk line, the clearing out annunciator at the plug terminal end thereof is operated when either of said substations ring off, whereupon the operator there noticing its fall withdraws the connecting

plug and presses the key in the battery line, thereby closing the whole battery current through the electromagnet of the clearing out jack at the other terminal in which the connecting plug of the other substation is inserted, energizing the same, and operates the locking device of the self retracting circuit controller, unlocking the same, whereupon the connecting plug of the said substation line is forcibly ejected from the jack, thereby automatically disconnecting the line, and the plug falls to its normal position upon the operator's table; at the same time the line in use indicators of the several clearing out jacks upon the several sections of the switchboard are caused to indicate that the line is not in use; all of which I will now proceed to describe in detail, and to point out in the appended claims.

In the drawings forming a part of this specification Figures 1 and 2 are sectional views of my improved clearing out jack, the first in its unused position and the second with a plug inserted, and Figure 3 is a diagrammatic representation of circuits, illustrating the connection of two substations by means of a trunk line extending between two central stations, to which the substations are respectively connected.

In Figs. 1 and 2, 3 represents the front or face of a switchboard to the rear of which the clearing out jacks are attached, or it may represent a rubber strip to which a number of other connecting jacks are attached.

4 is a metal thimble to which the jack is directly attached.

The body 5 of the jack, is of hard rubber, and bears upon its outer end an electro magnet 6, which has an armature 9 pivoted at 8. Upon its end, the armature is provided with a lever 7, which extends over its top, the end of which is under the outer end of the lever 10, pivoted at 11.

13 is a chamber hollowed out in the end of the body 5, into which projects an arm 12 from the lever 10, the end of which is inclined as shown.

15 is a prolongation of the lever 10, in the form of a flat steel spring. It projects through an opening 17 in the rubber strip 3, and is bent downward to form a shield 16.

19 is a spindle located in the center of the body 5, one end of which bears a cone shaped head 14, which projects into the chamber 13. Its other end rests in the thimble 4.

41 is a ring abutment on the spindle and a spiral spring pressing against it and the rear end of the slot 40 cut through the body 5.

18 and 22 are flat springs secured to opposite sides of the body 5, their free ends extending into the slot 40 and pressing upon the insulating section 20 of the spindle 19.

23 is a flat spring secured over but insulated from the spring 22; its free end resting upon the spindle 19.

In Fig. 2 a connecting plug  $P^2$  is inserted in the thimble 4 and jack J. The spindle 19 is

forced inwardly against the pressure of its spring  $s$  and is locked by its cone shaped head being held by the lever arm 12. The two springs 18 and 22 form a connection through the spindle 19 and the spring 23 forms a connection with the tip of the plug whose body forms a connection with the thimble 4. The tip of the plug is prevented from connecting electrically with the spindle by reason of the insulation 21 upon its end.

In Fig. 3 I have shown the automatic disconnecting jack J associated with a metallic trunk line circuit D which extends between two distant exchanges X and Y and provided at the former exchange with a clearing out annunciator  $v^2$  and a terminal connecting plug P, and at the other exchange with automatic disconnecting or clearing out jacks J one on each section of the said switchboard. One side 1 of the circuit D is branched by wires 27 to the spring 23 of each jack J at the terminal Y and the other side 2 thereof is branched by wires 29 to the thimbles 4 of each jack. A local circuit is formed by wire 43 branching to the springs 18 of each jack from which branch there extends legs 44 through the electromagnets 6 to earth  $e$ .

$c$  is a conductor extending parallel with the trunk circuit D provided at terminal X with a source of electricity B the circuit being from line to key  $k$ , back to contact  $b$  wire  $a$ , to ground  $e$ , through a minor portion of the battery B; and at the terminal Y it is branched to the spring 22 of each jack J by the wire 26.

C represents a line extending from substation  $x$  to the switchboard at exchange X, and  $C'$  represents a similar line extending from substation  $y$  to the switchboard at exchange Y. Each of these lines is provided with jacks  $j$  for each operator's section of the switchboard, and with line annunciators  $v$  in a manner well understood.

A is an instruction circuit provided with operators' telephones  $t$  at each exchange, and with such other appliances as is usual.

$d$  represents the operator's interconnecting apparatus, of which only the connecting plugs and looping cords are shown.

To illustrate the operation of my invention, let us suppose that a call is sent in from substation  $x$ , which operates its annunciator  $v$ . The number of the substation wanted having been ascertained in the usual manner by the operator, the plug P of the trunk line D is inserted in the jack  $j$  of the line C, and the operator at exchange Y is informed through the instruction circuit A of the substation wanted, who then inserts one of the plugs  $P^2$  of the loop  $d$  into the special trunk line jack J upon her switchboard section, and inserts the other plug  $P^3$  into the jack  $j$  of the substation line wanted, and calls up the subscriber there, switching out all of the keyboard apparatus and leaving in simply the plugs and cords when the connection has been made. When the operator at exchange Y inserted the plug  $P^2$  into the jack J, it forced the spindle circuit

controller 19 inwardly, its cone shaped head 14 striking the lever arm 12 pushing it upward against the resiliency of the spring 15, (whose shield 16 finds an abutment against the plug) which springs back and locks the spindle, as shown in Fig. 2. A circuit is now closed from ground *e* at exchange X, through a portion of battery B over conductor *c*, branch 26, through spindle 19, spring 18, wire 25, to point 24, where a portion goes through the electro magnet 6 of the jack to ground at *e*. The remainder of the current passes by the local wire 43 and its branches 25, through the electro magnets of the other jacks J, to ground, and is of sufficient strength to operate their several armatures 9, and thereby elevate the levers 10, and depress the shields 16 to cover the orifices or plug holes of the jacks, thus indicating that the line is in use, and also interposing an obstacle to prevent the jack being used. The current is not however strong enough to attract the armature of the connected jack J against the resiliency of the spring 15, and consequently the spindle 19 remains locked. When conversation between the substations has terminated, a ringing off signal is sent in from either or both substations, which operates the clearing out annunciator *v*<sup>2</sup> at exchange X, giving notice to the operator there of the fact, who thereupon withdraws the plug P, and instead of calling the operator at exchange X to disconnect there, she presses the key *k* to make contact with its anvil, thus opening the shunt wire *a* and including the whole or major part of current of the battery in the line *c*, which is of sufficient strength to operate the armature 9 of the connected jack J, and elevate the lever 10 against the force of the spring 15, and thereby pull the arm 12 from the head of the spindle 19 and unlock it; the spring *s* on the spindle is thus brought into action, and forcibly propels the spindle and the plug P<sup>2</sup> outward until the head 14 is stopped by its abutment, but the plug is ejected from the jack entirely and the line C is disconnected, the plug falling to its place upon the table; at the same time the springs 18 and 22 resume their places upon the insulation 20, and all current is cut off from battery B. consequently the shields of the several jacks J move to uncover the jack holes, and thus indicate that the line is not in use.

Having now fully described my invention, I claim—

1. In a trunk line extending between two telephone switchboards, the combination of a circuit provided at one terminal with a clearing out annunciator and a connecting plug, and at its other terminal with one or more spring jacks, each having a movable circuit controller in its plug orifice, and an electro magnetic locking and tripping device; with an associated normally open circuit provided with a source of electricity; and a key or circuit switch at one terminal; whereby the said

source of electricity is included in said circuit when either of said spring jacks are looped to a substation line, for the purpose set forth.

2. In a trunk line extending between two telephone switch boards, the combination of a metallic circuit provided at one terminal with a clearing out annunciator and a connecting plug and at its other terminal with a spring jack having a movable circuit controller in its plug orifice and an electro magnetic locking and tripping device; with an associated circuit grounded through a circuit switch and a source of electricity at one end and connected by a normally open branch to the said spring jack; whereby when a substation line is looped to said spring jack its connecting plug may be automatically disconnected as set forth.

3. In a trunk line extending between two telephone switch boards, the combination of a metallic circuit provided at one terminal with a clearing out annunciator and a connecting plug, and at its other terminal with one or more spring jacks each having a movable circuit controller in its plug orifice and an electro magnetic "line-in-use" indicating device; with an associated circuit grounded through a source of electricity at one end and connected by normally open branches to the said spring jacks; whereby when a substation line is looped to one of said spring jacks, the said circuit controller closes the said source of electricity to ground and operates the said line-in-use indicating devices, as set forth.

4. The combination with a trunk line extending between two telephone switchboards, consisting of a metallic conversation and signaling circuit, provided at one terminal with a clearing out annunciator and a connecting plug, and at its other terminal with one or more springjacks, each having a longitudinally movable circuit controller in its plug orifice, and provided with electro magnetic locking, tripping, and line-in-use indicating devices; with an associated circuit grounded through a circuit switch and a minor portion of a source of electricity at one end, and connected by normally open branches to the said springjacks: whereby when a substation line is looped at one of the said springjacks, the said circuit controller closes the said minor source of electricity to ground and operates the said line-in-use indicating device; and whereby when the said circuit switch is operated to include the major portion of the said source of electricity, the said substation line is disconnected and the said line-in-use indicators are restored to their normal condition, as set forth.

5. In a trunk line, extending between two telephone switch boards, the combination of a metallic circuit provided at one terminal with a clearing out annunciator and a connecting plug, and at its other terminal with one or more springjacks, each having a mov-

able circuit controller in its plug orifice; with  
an associated circuit, provided at one end  
with a shunt-branch grounded through a cir-  
cuit switch, and a normally open branch in-  
5 cluding a source of electricity, and connected  
at its other end by normally open branches  
to the said spring jacks; whereby when a sub-  
station line is looped to one of said spring-  
jacks, its connecting jack will be ejected from  
10 said spring jack upon the closure of said cir-

cuit switch with the said branch including  
the source of electricity.

In testimony whereof I have signed my  
name to this specification, in the presence of  
two subscribing witnesses, this 16th day of 13  
May, 1893.

JAMES L. McQUARRIE.

Witnesses:

GEO. WILLIS PIERCE,  
JOSEPH A. GATELY.