No. 750,704. PATENTED JAN. 26, 1904.

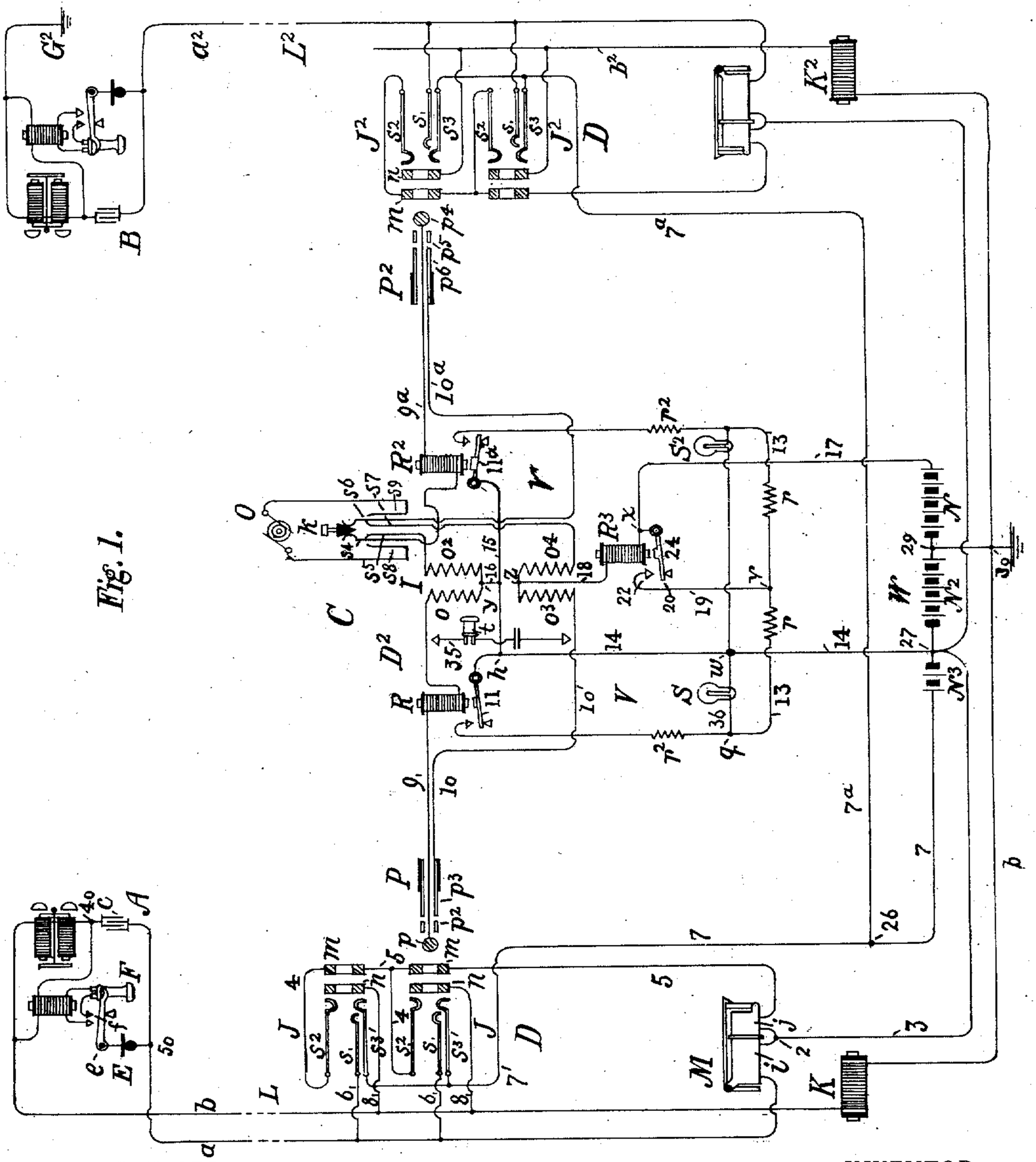
M. C. RORTY.

TELEPHONE SWITCHING AND SIGNALING APPARATUS.

APPLICATION FILED JAN. 3, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



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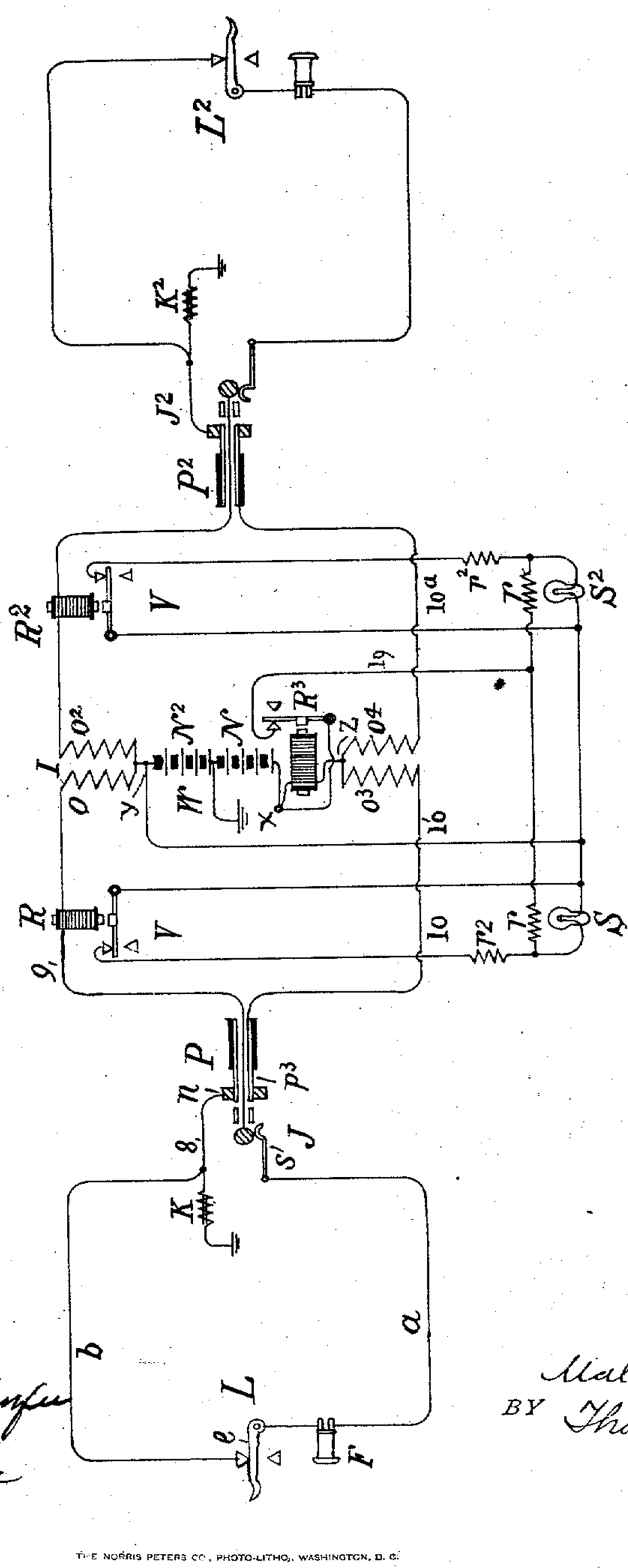
NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.



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No. 750,704. Patented January 26, 1904.

UNITED STATES PATENT OFFICE.

MALCOLM C. RORTY, OF DEDHAM, MASSACHUSETTS, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

TELEPHONE SWITCHING AND SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 750,704, dated January 26, 1904.

Application filed January 3, 1902. Serial No. 88,315. (No model.)

To all whom it may concern:

Be it known that I, MALCOLM C. RORTY, residing at Dedham, in the county of Norfolk and State of Massachusetts, have invented certain Improvements in Telephone Switching and Signaling Apparatus, of which the following is a specification.

Prior to the introduction into telephone-exchanges of the central and universal battery system of current-supply and the "relay-switchboard" now operated in association therewith the most approved central-station switching apparatus was the so-called "branch-terminal switchboard," the same being provided with a central-station annunciator which, though constantly connected with the circuit even when the said circuit was switched for intercommunication, was prevented from operating in response to clearing-out signals transmitted from the substations by means of a subsidiary retaining magnetizing-coil surrounding its core and connected in a local circuit established through contacts in the plug-and-socket switch of the line and acting to lock the annunciator-shutter in its non-operative position. The substation apparatus employed in connection with the branch-terminal switchboard comprised the ordinary and formerly usual polarized call-bell and magneto-generator.

The advantages of a system of telephone-exchange work having for its characteristic feature a central and common or universal source of current-supply, furnishing current for signaling from the substations to the central station and also for talking, are many and obvious, and there is consequently a constantly-increasing demand for this system.

In cases where it is possible, convenient, or expedient to coincidently install the common battery system and a new switchboard no special difficulty now attends the introduction of the former, since the relay-switchboard was designed to harmonize with the said system of current-supply and is especially adapted thereto. There are, however, many cases wherein branch-terminal switchboards which have been installed are comparatively new and unworn, and it is highly desirable on the score of economy that the introduction of the common battery service in these cases shall not necessitate the discarding of such switchboards. Attempts have been made to so reorganize these branch-terminal boards as to render them capable of being operated in association with the central and common battery system; but so far as I am aware such attempts have uniformly sought to utilize the three-conductor switch-cord circuit of the relay-switchboard or one closely similar thereto, wherein the switch-plug is provided in a well-understood manner with tip and ring contact-surfaces for its main-circuit conductors adapted to register with spring-contacts representing line conductors in the switch-sockets of the line concerned and with a sleeve-contact nearer the handle of the plug for its local busy-test and supervisory signal circuit conductor, this being adapted to register with the test-ring or socket-frame of the switch-socket wherein it may be placed; but the use of this type of switchcord not only necessitates the remodeling of the branch-terminal-switchboard socket connections, but also introduces a marked tendency to the production of a false busy-test signal indicating that lines called for are busy when they are not, which comes about because in applying the tip of the switch-plug to the test-ring of a switch-socket of the line called for the operator is liable to bring the said conducting-tip and also the conducting-ring immediately behind it into simultaneous contact with the said test-ring and to conductively unite them through its substance, and since the working battery is looped between these tip and ring contacts with the operator's testing-telephone bridged across such loop it follows that the sound indicating the busy condition of the line tested is under these circumstances heard in the receiver, and thus a line which is at liberty is liable to be reported as engaged.

My invention addresses itself, therefore, to means for adapting branch-terminal switch-

boards now in use to the universal and central battery system of construction and operation; and, generally stated, its objects are to increase the efficiency of such switchboards and to enable them to be satisfactorily operated without liability to error in conjunction with a central and common source of current supply.

In my invention a branch-terminal multiple switchboad and its busy-test system are associated with the substation-telephone apparatus and instrument arrangement of the central-battery system and at the central station with the signaling devices and the central source of current appropriate to such system, and means are provided whereby the said source normally connected with the several lines to supply current for incoming call-signals may be brought into the necessary relation to supply current for the substation-transmitter of any line switched for conversation and for the central-station-signaling devices concerned in such switch connection and also for the control of the current of such signaling devices, partly by the connection-establishing switchboard apparatus and partly by the telephone-switch at the substation.

It consists also in combining the fixed portions generally of a branch-terminal switchboard and in particular the switch-socket devices representing the substation-circuits centering therein with a switch-cord circuit having two conductors only, both arranged to serve as main-circuit link conductors, one uniting the tip-contacts and the other the sleeve-contacts of the associated switch-plugs, the intermediate or ring contact of the said plugs being unconnected with either or any cord conductor and adapted to serve when the plug is placed in a jack or socket merely as a medium for uniting two of the contact-springs of said jack, and with a central and common battery in a bridge between said cord-conductors, also in combining with each switchboard-circuit and with the system as a whole a governing-relay in a branch circuit formed in part of the said battery-bridge organized and arranged to control the connection between the supervisory signals and the battery furnishing current for their operation, the said relay being in a circuit closed when either of the switchboard-plugs is inserted in a switch-socket.

In carrying out the invention both metallic circuit and grounded return substation-circuits are provided for. The apparatus at the substations is entirely changed, the automatic calling and the telephone circuits adapted for the common battery type being substituted for the magneto-generator and the local battery and circuit, and at the central station while the multiple switch-sockets, the self-resetting electromagnetic line-signals, and the switch-plugs remain unaltered the cord-ciruit is rearranged. The central battery furnishing current for talking and signaling is split into two sections by the attachment of a ground connection at its middle, which sections under certain conditions, as when double and single conductor-circuits are united, serve as separate batteries, both sections being in the metallic circuit and one only in the grounded circuit.

In the drawings which accompany and illustrate this specification, Figure 1 is a diagram of two substation-circuits and their central-station switch and signal devices, the switch-cord, supervisory-signal connections, busy-test-circuit arrangements, and substation appliances being changed to conform with the principles of my present invention; and Fig. 2 is a simple diagram indicating conventionally two telephone-circuits united by a switch cord and plugs to form a compound circuit for through communication, the switch-cord circuit and supervisory-signal circuits and apparatus being arranged in accordance with the invention.

Referring to the drawings, A and B are substations, C a central station, and L and L^2 main telephone-circuits converging to the said central station from the said substations, respectively, L being a metallic circuit having two main conductors *a* and *b*, while L^2 is an earth return-circuit having a single complete main conductor a^2. At the substations the usual telephone and signal apparatus of the universal central-battery system is connected in the standard manner. The secondary coil of the transmitter inductorium is included in a branch of the line with an ordinary gravity-switch *e* normally maintaining such branch open, but acting to close the same and permit a flow of current from the central battery in the line when the telephone-receiver is taken from the switch-hook for use. The call-bell and a condenser *c* are similarly connected in a second branch of the line, and the telephone-transmitter E, receiver F, and the primary of the induction-coil are in a local transmitter-circuit set off from the two main conductors and extending from a point 50 on conductor *a* to a point 40 between the bell and condenser. The said local thus contains the condenser *c* and though normally open is also controlled by the switch *e*, being closed through contact *f* thereof on the removal of the receiver. The call-bell is in a manner well understood responsive to alternating currents sent from the central-station generator, but by reason of its association with the condenser is not affected by steady currents.

At the central station the switchboard apparatus consists of a fixed portion D, comprising the switch-sockets J of the several lines, and a flexible or movable portion comprising any appropriate number of switch-cords D^2, each being fitted with an answering-plug P and a companion plug P^2.

M is the line-signal or annunciator having a main-circuit-actuating coil *i* and a local-circuit restoring or locking coil *j*.

K is an impedance coil.

W is the central and universal battery comprising two sections N N², one of them serving alone as a source of signaling-current for both main circuits and also furnishing talking-current for grounded circuits, while the two serve together as a source of transmitter-current for metallic circuits. There is also a battery N³, smaller than the said sections of main battery, to supply current for the busy test and for the locking or resetting coil *j* of the line-signals. The said smaller battery N³ is shown as being connected at one pole with section N² of the larger battery, and by such connection I am enabled to utilize the conductor 14 and the plug-tips and their associated conductors as portions of the circuit of both batteries. A ground connection is attached to a point 29 between the battery-sections N and N².

Conductor *a* of substation-circuit L, reaching the central station, includes the actuating-winding *i* of the signal-magnet M, and continues to a connection with the battery W at point 27 or at the ungrounded pole of section N², while main conductor *b* of said circuit connects with battery W at point 29 between the sections N and N² thereof and includes in its circuit the impedance-coil K. Circuit L therefore normally includes section N² of said battery, and its conductors are respectively united to the two poles thereof, conductor *b* being also grounded.

The switch-sockets J have branches 6 and 8 from the conductors *a* and *b*, respectively, to the shorter contact-springs *s* and interior socket-rings *n*, and a conductor 5 unites the exterior socket-rings or test-rings *m* of the several switch-sockets J of each line. In each socket, also, there are two other switch-springs s^2 and s^3, the springs s^2 being united by conductors 4 to conductor 5, which joins the test-rings *m*, and the springs s^3 branching from a conductor 7, extending from the free pole of the smaller battery N³. The said conductor 5, which unites the test-rings, is extended through the locking or resetting coil *j* of the line-signal device M to a connection at 27 with the other pole of the said smaller battery N³, utilizing, if desired, for such connection the continuation-conductor 3 of the main conductor *a*, with which, as shown, it forms a junction at 2.

The switchboard connections of the grounded circuit L² are substantially identical in character with those of the circuit L, as described above, a special switchboard-conductor b^2 taking the place of main conductor *b* and extending through the impedance-coil K² to the ground or (what is the same thing) to the grounded pole of the battery-section N² at 29. The inner socket-rings *n* of the jacks J² of line L² are branched to this special conductor, and the jack-springs s^3 connect by conductor 7^a with any point 26 on the local-circuit conductor 7, and so to the free pole of the small battery-section N³. It is to be understood that any number of substation-circuits may be similarly connected with the same main and test circuit batteries.

D² represents one of the group of switch-cords with which each section of the switch-board is supplied. It contains two conductors or strands only and with its plugs, circuit arrangements, and associated apparatus constitutes an important feature of my invention.

The answering switch-plug P has the usual tip-contact *p*, ring-contact p^2, and sleeve-contact p^3, and the companion plug also has like contacts p^4, p^5, and p^6. When the plug is inserted in the socket, the said tip connects with the short-line spring *s*, and thereby with main conductor *a*. The sleeve registers with the inner and outer socket-rings *n* and *m*, thereby establishing connection with the other main conductor *b* and by the conductive union of said rings through the metallic substance of the said sleeve, closing the test-circuit, and the intermediate or ring contacts register with and unite the two socket-springs s^2 and s^3. It will be noted that the ring-contacts have no conductors attached to them and no connections in the cord-circuit, and their sole function is to establish conductive connection between the said two contact-springs, and as the said intermediate or ring contact is now wholly disconnected from any circuit or source of current and has no conductive relation with the tip conductor there is of course no longer any liability to produce false busy signals. The tip and sleeve contacts of each plug are, however, united by link conductors with the corresponding contacts of its companion plug, so that any two lines may be switched together by inserting the plugs of a pair into the respective switch-sockets of such lines. The cord conductor uniting the tips of the two plugs is formed of two portions 9 9^a and contains the half-windings *o* o^2 of the two helices of the induction-coil I, while the other conducting-strand uniting the sleeve-contacts of the said two plugs and similarly constituted of two portions 10 10^a includes the remaining half-windings o^3 o^4 of the said coil, the central battery W being, as most clearly shown in Fig. 2, placed in a bridge connection of the said cord conductors extending from a point *y* on one conductor between the two induction-coil half-windings thereof to a similarly-placed point *z* on the other for the purpose of supplying current to the substation-transmitters.

S and S² are the usual supervisory signals associated with the two plugs, respectively, each being provided in its direct circuit with a suitable reducing and regulating resistance *r*, and V V are shunt-circuits for the control

of said lamps, these also having like resistances r^2.

R and R^2 are relays connected in the plug-tip conductor portions 9 and 9^a and in the main circuit when the plugs are placed in switch-sockets. They control the shunt-circuits of the signals S S^2, acting when excited by the flow of current in the main circuit to close the said shunts, thus withdrawing current from the signals to prevent their display, but opening the shunts to permit the display of the signal as soon as the main-line current ceases to flow.

R^3 is a governing-relay or electromagnetic switch placed in a local circuit formed in part of a portion of the battery-bridge and leading through conductors 17 and 18 between point z and the free pole of the battery-section N and controlling the connection of said battery to the supervisory signals. By means of this relay-switch so placed the supply-current connection for the said signals is maintained until both stations which have been engaged in a communication have replaced their receivers on their respective switch-hooks and until pursuant to such replacement the plugs have been withdrawn from the switch-sockets.

The operator's telephone t is in a loop 35, which by any suitable key or switch is bridged between or disconnected from the cord conductors.

O is the call-generator, and k a signaling-key controlling the terminals s^4 and s^5 of the severed conductor portion 9^a and s^6 s^7 of the conductor portion 10^a of plug P^2, and the terminals s^8 and s^9 of the said generator. These terminals are so disposed that when the key k is depressed the conductor-terminals are separated and the generator is connected with the plug P^2 for the transmission of call-currents in the direction of the said plug and the main circuit connected therewith.

The main-circuit arrangement when two metallic circuit-lines are united at the central station by means of my two-conductor cord and the central source, together with the supervisory-signal and shunt circuits, is most clearly and simply shown in Fig. 2, wherein the entire substation-telephone apparatus is symbolized by the hand-telephone F. The battery-current is separate in each of the two component circuits; but the circuit arrangement being the same for both it is sufficient to trace circuit L. Starting from the plus-pole of the battery W the circuit may be traced through the windings of relay R^3 by point z, winding o^3, cord conductor 10, sleeve-contact p^3 of the switch-plug, the inner socket-ring n, branch 8, line conductor b, the substation-switch e, and telephones F, line conductor a, socket-spring s, tip-contact of the plug, cord conductor 9, including relay-magnet R, winding o, and point y, to the minus pole of the entire battery. If, however, one of the substation-circuits l^2 has a ground-return, one section only of the battery is needed, the main-line resistance being less. In Fig. 1 the section N^2 is shown as being alone employed, and in that case the circuit from the ground G^2 at substation B extends through the telephone apparatus by line conductor a^2 and at the central station through socket-spring s, the tip-contact of the plug, conductor 9^a, relay R^2, the ringing-key k, winding o^2, point y, conductors 15 and 14 to point 27 and the battery-section N^2, and thence to point 29 and the central-station ground. The current variations set up by the operation of the substation-transmitter E in either line propagate themselves in the other through the cord-circuit induction-coil I. The relays R and R^2 being in the said two battery-circuits are responsive to the closure and opening of such circuits as the gravity-switch at the substations is operated, and in the same way the actuating-coil of the line-signal M, which is in the normal circuit of each line with the battery-section N^2, is also responsive to the operation of the said switch when the receiver is lifted therefrom. The circuit of the signals S and S^2 extends from one pole of battery W through conductor 17, point x, armature 24 of relay R^3, contacts 20 and 22, conductor 19, point v, resistance r, conductor 13, point q, conductor 36, signal S or S^2, point w, conductor 14, and point 27 to the other pole of the complete battery. This circuit is open at the armature-contacts of the relay R^3, so that no current for the operation of the signals can flow therein until the said relay is operated and its armature attracted. When this occurs, the signal-circuit is closed, current is permitted to flow, and the signals subject to control of the supervisory relays R and R^2 may operate.

The circuit of the governing-relay R^3 will now be traced. This also extends from the plus pole of the battery W by conductor 17, but diverges from the path of the signal-circuits at the point X. From thence it proceeds through the helices of the relay R^3 by conductor 18 to the point z, where it splits, completing itself through the sleeve-contacts of both plugs. It is, however, sufficient to trace it through the plug P alone, since its path by way of the other one is substantially identical. From point z the circuit continues to the minus pole of section N of the battery W by way of induction-coil winding o^3, conductor 10, sleeve-contact p^3 of plug P, the interior socket-ring n, branch 8, main conductor b, including impedance-coil K and points 30 and 29.

The circuits of relay R^3 are composed in part of portions of the battery and the bridge connection thereof; but having its own special circuits just described it is not responsive to the changes of the substation-switches, and having once become energized it continues to maintain the attraction of its armature, and thus to furnish current to the supervisory-signal circuits until both plugs shall have been

withdrawn and the connection taken down. The control of the said supervisory signal S or S^2 of the two lines concerned is exercised through the relays R and R^2, associated with the tip-strands of the two plugs, respectively. When current flows over the main circuits by reason of the plugs being in their sockets and the substation-receivers taken up from their switch-hooks, these relays are excited and by the local contacts of their armatures 11 and 11^a close the shunt-circuits V of their respective supervisory signals S S^2. These signals at such time are not manifested; but when either subscriber hangs up his receiver the appropriate relay acts to open the shunt, and the corresponding signal is displayed until in response thereto the plug is withdrawn.

The smaller battery N^3 is alone concerned with the busy-test and annunciator-locking circuit. The latter circuit is as follows: from the plus pole of said battery through conductor 7 to switch-socket spring s^3, thence when a plug is in such socket through the ring-contact p^2 thereof to spring s^2, continuing by conductor 4, external socket-ring *m*, conductor 5, locking-coil *j* of annunciator M, conductor 3, and point 27 to the minus pole of the small battery N^3. The busy-test circuit can of course be completed only when such locking-circuit having been established for a given line by the insertion of a plug in a socket thereof and an abnormal potential having thereby been imparted to the test-rings *m* of other sockets of the same line the tip of some other switch-plug is applied to some one of the said other sockets. This circuit therefore is the same as the last as far as the test-ring *m* and continues thence by the tip of the testing-plug—say P^2—over cord conductor 9^a and through one winding o^2 of the induction-coil to point *y*, conductor 16, conductor 15, point *h*, and conductor 14 to the minus pole of the test-battery N^3. The operator's receiver *t* is at this moment bridged with its condenser between the cord conductors, and should the tested line be busy a definite sound-signal or click will be heard therein, owing to the variation of charge in the condenser and through the instrument, which occurs by reason of the differing potential of the test-ring and plug-tip. If, however, the tested line be disengaged, there is no such difference of potential and the "busy" click will not be heard in the telephone.

Briefly describing the operation of the invention, let it be assumed that station A of line L wishes to communicate with station B of line L^2. The subscriber at A takes his telephone from the hook-switch, which closes the main circuit, causing current from battery-section N^2 to flow therein, so that the annunciator M operates to give the call-signal. In response the operator inserts the plug P in the answering-socket and receives the order in the receiver *t*. The insertion of the plug connects the whole battery W with the main circuit, closes a local circuit of one section of said battery through the controlling-relay R^3 and plug-and-socket contacts, this being followed by the supply of current to supervisory signal S, which, however, is not displayed, because the main circuit being closed at the substation it is at once shunted by the action of the supervisory relay R and also closes the locking-circuit of annunciator M through plug-and-socket contacts and through the self setting and locking coil *j*, restoring the annunciator, and sets the busy test for the circuit. The order being received the operator takes up the companion plug P^2 and tests the line wanted by applying the tip of said plug to test-ring *m* of the socket thereof. If the said line is busy, a sound indicative of such condition is heard in the receiver and the calling subscriber is informed of the fact; but if no such sound be heard the plug P^2 is inserted into the proper socket and the call-signal is sent by operating the call-key *k*. As soon as the plug P^2 is inserted signal S^2 is displayed, because circuit L^2 being as yet open at the substation no current flows therein and relay R^2 is not excited and because also the circuits of the relay R^3 and signal S^2 are closed; but as soon as the subscriber B takes his receiver from the hook to answer the call signal S^2 is no longer displayed, being shunted by relay R^2, which is now energized, and by the disappearance of said signal the operator may infer that the subscriber wanted has answered the call. When the communication is ended, the two subscribers replace the receivers and both main circuits are reopened by the reintroduction of the condensers. The relays R R^2, no longer excited, suffer their armatures to fall away and disestablish the shunt-circuits V. The signals S S^2 are accordingly displayed and indicate an order to disconnect, the relay R^3 still being energized and maintaining contact between its local points for the supply of current to said signals. The operator now withdraws the plugs, the display of each signal ceasing as the plug with which it is associated is withdrawn. All of the connection circuits are now opened and the normal condition of the main lines is restored.

Having thus described my invention and its operation, I claim—

1. In a telephone-exchange apparatus, the combination of a number of substation-circuits; substation telephone apparatus at the substation of each circuit including a switch to open and close the said circuit; branch-terminal multiple switchboard apparatus at a central station to which said substation-circuits converge, said apparatus comprising a switchboard-circuit having two conductors only, a common source for supplying current for talking and the transmission of incoming signals, central-station annunciators through which

each substation-circuit is permanently connected to the common source of current, a local locking and resetting circuit for each annunciator connected to the common source of current, an appropriate busy-test system for the switchboard, supervisory signals representing the substations of any two circuits united at said switchboard, means for connecting the common source of current with any pair of lines united at said switchboard and with the said signals, and means responsive to the substation-switches for controlling the display of said signals.

2. The combination in a branch-terminal multiple switchboard, of a plurality of switch-sockets for each main-line circuit converging to said switchboard; a number of two-conductor switchboards each provided at both ends with a switch-plug adapted to enter and cooperate with the said sockets; an annunciator locking and resetting local circuit for each series of main-circuit switch-sockets; and a busy test associated with each and adapted to be set when said local circuit is closed; a supervisory relay associated with each switch-plug and connected in the main cord conductor extending between the tip-contacts of said plugs; a central source of current bridged between the two conductors of the said cords; a governing-relay in a local circuit containing a section of said source; and two supervisory signals in local circuits receiving current from said source through the local points of said governing-relay, each signal being provided with a shunt leading through the local points of the corresponding supervisory relay; the switchboard-circuits including said supervisory relays, the controlling-relay local circuit, and the annunciator-locking circuit, being all established through registering contacts of switch-sockets of their respective lines and switch-plugs inserted in said sockets, substantially as set forth.

3. The combination with a switchboard having terminal plugs provided with a plurality of switch-contacts, and containing two conductors electrically uniting corresponding contacts of said plugs; a source of current in a bridge between said conductors; and two signal devices associated with said plugs respectively; of a relay in said bridge controlling the current supplied to said signal devices; and two relays in circuit with the said cord conductors one on either side of the said bridge, said relays controlling shunts of the said signals respectively, and thereby determining the display or withdrawal of said signals, substantially as set forth.

4. In the switchboard apparatus of a telephone system, and in combination with a circuit-controlling switch at a substation; a switch-socket; and a two-conductor switch-cord having switch-plugs adapted for insertion in said sockets; of a source of current at the central station in a bridge between said cord conductors; a signal device in a local circuit of said source associated with a plug of said cord; a governing-relay in a branch circuit of said source controlling the supply of current to said signal devices; and a supervisory relay in the circuit of said cord conductor, and thereby (when said plug is inserted in a switch-socket) in the line or substation circuit represented by said socket, said relay controlling a shunt of said signal device to determine the display and withdrawal thereof; the said supervisory relay being responsive to the operation of both the substation-switch and to the plug-and-socket switch, and the said governing-relay being responsive to the operation of the plug-and-socket switch only, substantially as described.

5. In the switchboard apparatus of a telephone system; and in combination with circuit-controlling switches at two substations; switch-sockets; and a two-conductor switch-cord having switch-plugs adapted for insertion in said sockets; of a source of current at the central station in a bridge between said cord conductors; two signal devices such as glow-lamps in different local circuits of said source associated with the said plugs respectively; a governing-relay in a branch circuit of said source formed in part of said bridge, controlling the current supplied to the local circuits of said signal devices; and two supervisory relays in circuit with the said cord conductors on either side of the connection therewith of said bridge, and thereby (when the said plugs are in the appropriate switch-sockets) also in circuit with the substation-switches respectively of the lines represented by said sockets, the said relays controlling shunts of the said signal devices respectively to determine the display and withdrawal thereof; the said supervisory relays being each responsive to the operation of both the substation-switch and the plug-and-socket switch on its own side of said bridge, and the said governing-relay being responsive to the operation alone of the plug-and-socket switches on both sides of said bridge.

6. In a telephone-exchange the combination of branch-terminal switchboard apparatus comprising the self-setting annunciator having actuating and locking helices, and switch-socket devices representing the substation-circuits centering in said switchboard, and containing switch-contacts of the several associated main and local circuits; with a switch-cord circuit having but two conductors both arranged to form main-circuit link conductors, and switch-plugs at its ends adapted to be inserted in said sockets, and each having tip, ring and sleeve contacts arranged to register with the corresponding contacts in said sockets; the tip and sleeve contacts of each plug being united by said cord conductors with the corresponding contacts of the other, and the intermediate or ring contacts of both plugs

being unconnected with either or any cord conductor and adapted to serve when the plug is in a socket as a medium for uniting spring-contacts of said socket; a local central-station circuit including the locking-helix of the annunciator and said spring-contacts and adapted to be closed by the ring-contact of a plug; and a central and common battery in a bridge between said cord conductors as a source of transmitter-current and connected with the actuating-helix of the annunciator as a source of incoming signal-current; substantially as set forth.

7. In a branch-terminal switchboard, organized for operation in connection with a system of central and universal current-supply, a switch-cord circuit extending between two switch-plugs having each tip, ring, and sleeve switch-contacts, and comprising two conductors uniting the tip and sleeve contacts respectively of said plugs, the ring-contacts of said plugs being unconnected with either or any cord conductor; the central source of current in a bridge between the said cord conductors; an induction-coil interposed in said cord conductors having half of both of its windings in each, one of the said half-windings on each side of the point of bridge connection; two supervisory relays in said main conductors associated with the said two plugs respectively; and a governing-relay in a branch circuit of said source of current formed in part of a portion of said bridge; combined with two supervisory signals in local circuits external to said switch cord conductors, and a controlling shunt-circuit for each signal, the said local circuits being extended through the local points of said governing-relay, and their shunt-circuits through the local points of the supervisory relays respectively.

8. The combination with a switchboard having terminal plugs provided with a plurality of switch-contacts, and containing two conductors electrically uniting corresponding contacts of said plugs, a source of current in a bridge between said conductors, and two signal devices associated with said plugs respectively, of relay mechanism in the circuits of said conductors and source of current controlling the current supplied to said signal devices, two relays in circuit with the said cord conductors one on either side of the said bridge, and shunt-circuits controlling said signals and controlled by said two relays, thereby determining the display or withdrawal of said signals, substantially as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 31st day of December, 1901.

MALCOLM C. RORTY.

Witnesses:
GEO. WILLIS PIERCE,
FRANK C. LOCKWOOD.

Corrections in Letters Patent No. 750,704.

It is hereby certified that in Letters Patent No. 750,704, granted January 26, 1904, upon the application of Malcolm C. Rorty, of Dedham, Massachusetts, for an improvement in "Telephone Switching and Signaling Apparatus," errors appear in the printed specification requiring correction, as follows: On page 5, lines 126–127, the word "switchboard" should read *switchcord;* on page 6, line 18, the word "switchboards" should read *switchcords*, and in lines 37 and 44, same page, the word "switchboard" should read *switchcord*, and on page 7, line 41, the word "switchboard" should read *switchcord;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23d day of February, A. D., 1904.

[SEAL.]

F. I. ALLEN,
Commissioner of Patents.

being unconnected with either or any cord conductor and adapted to serve when the plug is in a socket as a medium for uniting spring-contacts of said socket; a local central-station circuit including the locking-helix of the annunciator and said spring-contacts and adapted to be closed by the ring-contact of a plug; and a central and common battery in a bridge between said cord conductors as a source of transmitter-current and connected with the actuating-helix of the annunciator as a source of incoming signal-current; substantially as set forth.

7. In a branch-terminal switchboard, organized for operation in connection with a system of central and universal current-supply, a switch-cord circuit extending between two switch-plugs having each tip, ring, and sleeve switch-contacts, and comprising two conductors uniting the tip and sleeve contacts respectively of said plugs, the ring-contacts of said plugs being unconnected with either or any cord conductor; the central source of current in a bridge between the said cord conductors; an induction-coil interposed in said cord conductors having half of both of its windings in each, one of the said half-windings on each side of the point of bridge connection; two supervisory relays in said main conductors associated with the said two plugs respectively; and a governing-relay in a branch circuit of said source of current formed in part of a portion of said bridge; combined with two supervisory signals in local circuits external to said switch cord conductors, and a controlling shunt-circuit for each signal, the said local circuits being extended through the local points of said governing-relay, and their shunt-circuits through the local points of the supervisory relays respectively.

8. The combination with a switchboard having terminal plugs provided with a plurality of switch-contacts, and containing two conductors electrically uniting corresponding contacts of said plugs, a source of current in a bridge between said conductors, and two signal devices associated with said plugs respectively, of relay mechanism in the circuits of said conductors and source of current controlling the current supplied to said signal devices, two relays in circuit with the said cord conductors one on either side of the said bridge, and shunt-circuits controlling said signals and controlled by said two relays, thereby determining the display or withdrawal of said signals, substantially as set forth.

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