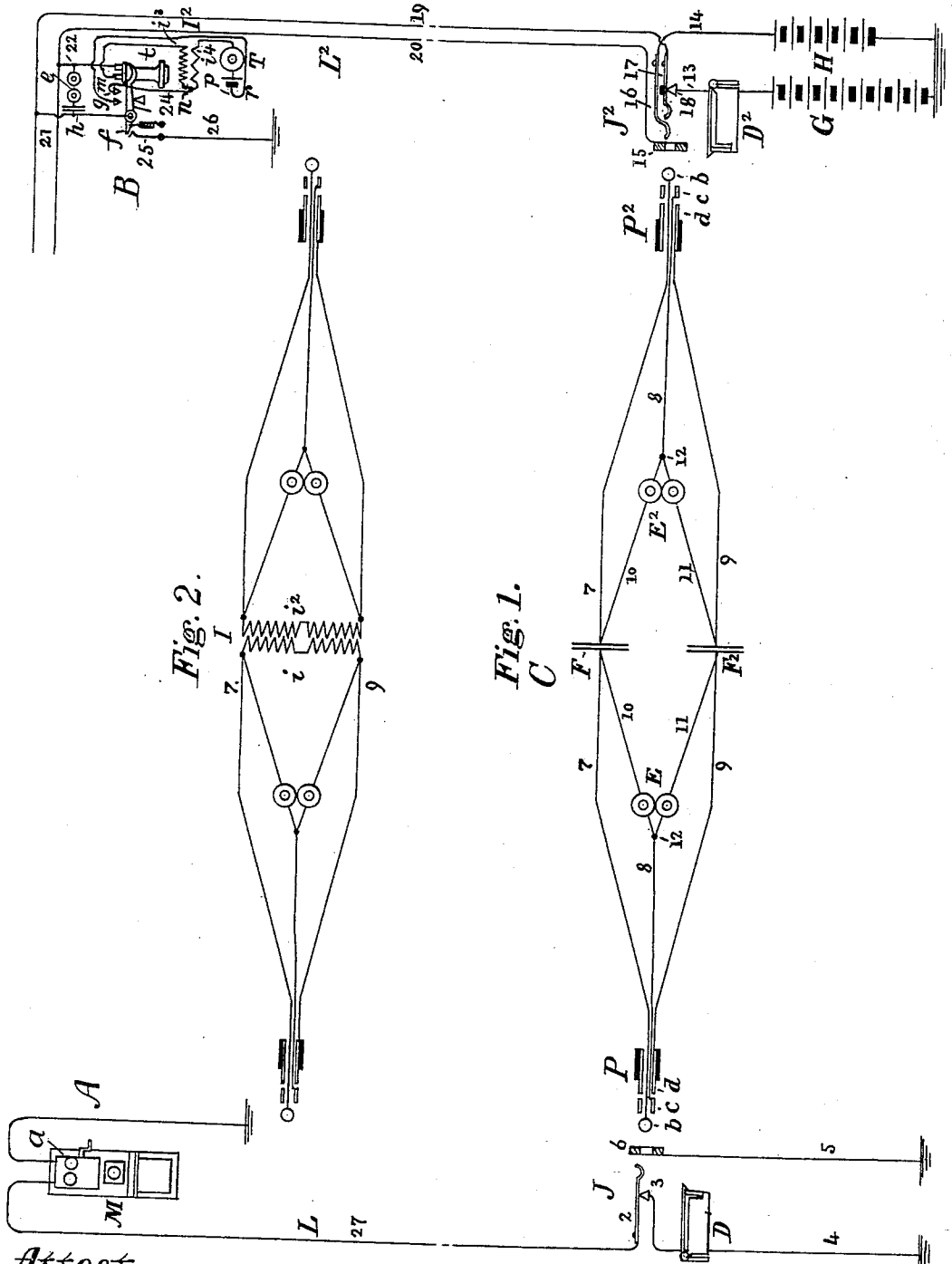
No. 623,437. Patented Apr. 18, 1899.

E. H. SMYTHE.

TELEPHONE SWITCHBOARD CIRCUIT.

(Application filed Feb. 23, 1898.)

(No Model.)



Attest.
Robt. Burns.
W. R. Edelen

Inventor,
Edwin H. Smythe,
by Pollock & Mann,
his attorneys.

UNITED STATES PATENT OFFICE.

EDWIN H. SMYTHE, OF FREEPORT, ILLINOIS, ASSIGNOR TO THE AMERICAN BELL TELEPHONE COMPANY, OF BOSTON, MASSACHUSETTS.

TELEPHONE-SWITCHBOARD CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 623,437, dated April 18, 1899.

Application filed February 23, 1898. Serial No. 671,360. (No model.)

To all whom it may concern:

Be it known that I, EDWIN H. SMYTHE, residing at Freeport, in the county of Stephenson and State of Illinois, have invented certain Improvements in Telephone-Switchboard Circuits, of which the following is a specification.

To meet the requirements of modern telephone service, several different kinds of systems of substation apparatus and circuits have been devised, the members of all of which have to be provided with means for linking one with the other for through communication at the central station at which they terminate or to which they converge.

It is well known that a substation is supplied with means for calling the central office when a connection with another substation is desired and also with means for ordering a disconnection from the circuit of such other substation, and the most common form and arrangement of circuit and apparatus is that in which a magneto-generator is employed in sending the call to operate an electromagnetic line-annunciator placed at the central station, the same generator being employed to cause an electromagnetic device in the cord-circuit to indicate the wish for a disconnection. Among other forms of circuit, however, which have been devised is one in which the removal of the telephone at the substation and the consequent closure or alteration of the circuit by the automatic rising of the hook-switch, permitting the circulation of current from a centralized source of current-supply, causes the line-signal to indicate the call, and in like manner when the telephone is hung upon the hook-switch the centralized source of energy operates the closing-out or supervisory signal. Moreover, various arrangements of these types of circuit have been devised, some having but one substation on the circuit and others a plurality of substations on the same circuit. When the latter are employed, they may be fitted with selective signals in the manner indicated by Letters Patent No. 555,725, granted to Angus S. Hibbard March 3, 1896, and are then designated "selective-signal circuits."

The present invention provides means whereby magneto-generator circuits and automatic signaling-circuits having one or more substations in circuit can be interconnected at the same switchboard-table and with the same pairs of linking or switching cords and plugs that are used to unite substation-circuits of the same kind, so that the disconnecting or supervisory signals are readily operated with every possible combination of connections and without requiring switch cords and plugs of diverse character.

By means of the invention it becomes possible to place the terminals of the automatic call or party-line circuits upon the same switchboard, together with dissimilar circuits, instead of locating them at a special section of the board, and they may be connected between themselves or with lines of other classes by the same means as is employed in the connection or interconnection of the more ordinary circuits.

In carrying out the invention the magneto-generator substation-circuits are provided at the central station with spring-jacks or switch-sockets and annunciators in the usual manner and the test-rings of the sockets or jacks are connected to ground. The automatic signal substation-circuits are branched into their several substations and have a call-bell and condenser in a bridge between the main conductors, which are shunted by the telephones when the receiving-telephone is off its hook, or, alternatively, the station-bells may be in ground branches from the two main conductors, as described in the patent of A. S. Hibbard, to which reference has been made. Means are provided for momentarily grounding one side of the line direct when the telephone is removed and also when it is replaced upon the hook-switch. At the central station one conductor of the line terminates at the test-rings, while the other conductor terminates at the plug-tip jack-spring, which rests upon a contact connected to the line-annunciator battery and ground. A second spring in the jack adapted to register or to be brought into contact with the front sleeve-contact surface of the plug is connected to ground through a battery.

In providing a cord-circuit to connect the two types of circuits indicated it was necessary that it should be so constructed that

when a disconnecting-current was sent in from a substation having a magneto-generator it should have no opportunity to pass through the connections and ring the bells of the substations on the connected party-line circuit, or for the clearing-out-battery current from an automatic signal-circuit substation to pass through them to the substation having the magneto-generator. Hence in a board accommodating battery-call and magneto-call circuits and where the connections include these mixed circuits the cord-circuit connection is made conductively discontinuous, and this is done by the use of a condenser in each cord of the circuit or by the similar introduction of a repeating-coil. Each plug is provided with a tip and with front and rear sleeve-contact surfaces. The tip and rear sleeve contact surface of each plug are conductively connected with each other, respectively, through the magnet-coils of the clearing-out or disconnecting signal, and constitute the registering parts of the talking-circuit with the spring-jacks, and the front sleeve-contact of each plug is connected by a third strand to the middle point of the said annunciator-magnet coils. By this division of the cord-circuit when a clearing-out signal is given from a substation supplied with a magneto-generator the current passes from the generator to line and through the tip of the plug, the supervisory signal or clearing-out annunciator, the rearward sleeve-contact of the plug, and the test-ring to ground or other return-conductor, and when the clearing-out signal is given from one of the automatic signal-line substations the circuit is momentarily closed by the hook-switch at said station, over which current flows from the central battery by way of the forward sleeve-contact of the plug, one coil of the clearing-out signal, the tip-contact of the plug, and one main conductor of the circuit to ground at the substation, all of which I now proceed to describe and claim.

Of the accompanying drawings, Figure 1 is a diagram of two telephone-circuits, one arranged at its substation with magneto-generator call appliances and the other there provided with automatic devices for calling and clearing out, both circuits being shown as terminating at the central office C and associated with a cord-circuit adapted to link or switch them together. Fig. 2 is a diagram of a cord-circuit, showing a modification in arrangement.

L represents a telephone-circuit extending from a substation A to the central station C, and 27 is its line conductor, which connects at the latter station with the line-spring 2 of the jack J, this normally resting upon contact 3, connected through the call-signal D to ground. The jack is provided with a test-ring 6, united by wire 5 to ground. It will be understood that the circuit L is provided with a jack at all the switchboard-sections if a multiple switchboard be employed.

M represents the telephone apparatus at the substation, and comprises a magneto-generator and call-bell a, telephone, and a transmitter-battery.

L^2 is a metallic substation-circuit, which, as indicated, is arranged to supply communication for a plurality of substations, each of which is connected by branches 21 and 22 with the conductors 19 and 20, respectively. The branch 21 terminates at the hook-switch 24, and the branch 22 includes the receiving-telephone and secondary i^3 of the induction-coil I^2 and terminates at the upper limiting-stop m. The local circuit p connects with the branch 22 at the point n and includes the primary i^4 of the induction-coil, transmitter T, and battery r and terminates at the limit-stop g. A bell e and condenser h are bridged between the said branches. A projection f from the hook-switch is adapted to swing against the grounded spring 25, forming a transient earth connection for the main conductor 19 when the telephone is removed and replaced. Conductor 20 terminates at the test-ring 15 of the switch-socket J^2, and conductor 19 connects with the contact-spring 17 of the said socket, which spring normally rests upon contact 18, giving a normal connection by wire 13, call-signal D^2, and battery G to ground. A second contact-spring 16 of the jack J^2 has its free end projecting forwardly to a position between the test-ring and the free end of spring 17 and at its fixed end is connected by wire 14 with a battery H and ground.

The plugs of the cord-circuit have three contact-surfaces—viz., the tips b and the front and rear sleeves c and d. The cord-circuit shown in Fig. 1 is divided into conductively-separate but inductively-united terminal loop-sections by the condensers F and F^2, placed between the tip and rear sleeve contacts of the plugs P P^2, respectively, in the cord-strands 7 and 9, and the two loops thus formed between the tip and sleeve contacts b and d of each plug are made to include in their circuits, by means of the wires 10 and 11, the clearing-out signals E E^2. The conducting-strand 8 of the forward sleeve-contacts of the plugs connects in each case with its loop at a point 12 at the middle of the magnet-winding of the said clearing-out annunciator.

In the cord-circuit shown in Fig. 2 the two loops are conductively separated but inductively united by the repeating induction-coil I, whose windings i and i^2 are connected at their ends to the opposite cords 7 and 9 in each of the said loops. In this case the loops are closed in parallel through one winding of the repeating-coil and through their clearing-out signals, but neither interferes with the operation of the other.

In the operation of the invention the subscriber at substation A, in making a call, actuates the magneto-generator and causes the operation of the line-signal D in the usual manner. When the plug P is inserted into

the jack J, its tip *b* raises the spring 2 from contact 3 and the cord strand 7 is made continuous with the conductor 27, and when the subscriber rings off current from the generator flows by conductor 27, spring 2 of the jack, tip-contact *b* of plug, cord-strands 7 and 10, signal E, cord-strands 11 and 9, rearward sleeve-contact *d*, test-ring 6, and wire 5 to ground; and when a subscriber at B wishes to signal the central station he removes the telephone *t* from the switch 24, which rises to make contact with the limit-stops *g* and *m*, while the part *f*, moving reversely, makes momentary contact with the spring 25 and completes a circuit by way of the ground, wire 26, spring 25, switch 24, wire 21, conductor 19, spring 17 of jack or socket-switch J^2, contact 18, wire 13, line-signal D^2, and battery G to ground, over which current flows, which causes the shutter of the signal to fall and indicate the reception of a call. When the plug P^2 is inserted in jack J^2, its tip-contact *b* registers with spring 17, the sleeve-contact *c* with spring 16, and the sleeve-contact *d* with test ring or frame 15, and the spring 17 is thus raised from the point 18, thereby cutting off the line-signal and battery. When the telephone at B is returned to the hook-switch, its weight depresses the same and the part *f* rising makes transient contact with the spring 25 and closes a circuit for the current of battery H from ground by way of wire 26, spring 25, switch 24, wire 21, conductor 19, spring 17 of jack J^2, tip-contact *b* of plug P^2, cord-strands 7 and 10, one coil of signal E^2, cord-strand 8, sleeve-contact *c*, spring 16, wire 14, and battery H to ground, over which current flows from the battery H, which causes the operation of the signal E^2, indicating to the operator that the communication is finished and that the lines may now be disconnected.

Both plugs have the same construction, and each is perfectly adapted to operate with jacks or sockets of either character shown, the only difference in the structure of the system being located in the plug-sockets and the only difference in operation consisting in the fact that when inserted in such a socket as J the tip and rear sleeve contacts of the plug only are concerned, while when placed in such a socket as J^2 all three contacts are employed. In the former case the currents operating the disconnecting-signal pass through both coils thereof, but in the latter case through one coil only. Experience has, however, shown that under the conditions of the latter case one coil can be relied upon for the certain operation of the signal.

The invention and its mode of operation being thus disclosed, I define it particularly in the following claims:

1. In a telephone-switchboard apparatus, a switch-plug and cord-circuit connection comprising two terminal switch-plugs, each having two main contact-surfaces adapted to engage spring-jack contacts; two inductively-continuous but conductively-discontinuous main strand-conductors extending respectively between the corresponding contacts of the said plugs; and a disconnecting signal device for each of the said conductively-divided cord-circuit sections, bridged between the two strand-conductors of its own section as described.

2. In a telephone-switchboard apparatus, a circuit connection formed of two terminal switch-plugs each having two main contact-surfaces adapted to engage corresponding switch-socket contacts; two conductively-discontinuous strands or cord conductors extending between the corresponding contacts of the said two plugs respectively; a condenser or induction-coil interposed between the separated portions of each strand, and establishing therewith inductive continuity between the said plugs; and two electromagnetic disconnecting-signals bridged between the said two strands, one on each side of the said condensers or induction-coils; substantially as described.

3. The combination in a telephone system, of a series of main circuits whose clearing-out current is brought into action by temporarily grounding the line at a substation; and a second series of main circuits having a magneto-generator at their substations, and whose clearing-out current is developed by the operation of said generator; with a switch-cord connection having terminal plugs adapted for insertion in the switch-sockets of the said lines respectively, the said cord connection being divided by interposed induction devices one in each cord-strand, into two conductively-separate, but inductively-united terminal loop-sections; each extending between the two main contact-surfaces of its own plug through an independent clearing-out annunciator; and means for bringing the clearing-out annunciator of either terminal loop-section (when any two main circuits are united by the said switch-cord connection) into operative relation with the signal-sending appliances of the main circuit connected therewith, without regard to the series to which the said main circuit belongs; substantially as and for the purposes specified.

4. In a telephone central-station apparatus, the combination of a spring-jack or switch-socket having two main switch-contacts, and an auxiliary switch-contact united to a source of current; and a plug-and-cord switch connection comprising terminal switch-plugs, each having three contact-surfaces adapted to engage the said three socket-contacts respectively, two main strands extending between the corresponding main contacts of the said two plugs, two inductive devices one in each strand, dividing the same conductively; clearing-out annunciators bridged between the strands, one on each side of the said inductive devices; and a third strand-conductor in each division of the cord connection extending from the middle point of the winding

of the said annunciators respectively, to the third plug contact-surface; for the purposes specified.

5. The combination in a telephone-switch apparatus, of two independent spring-jacks or switch-sockets representing main circuits of diverse construction having their switch-contacts differently arranged, or of diverse number, but having their main circuit-contacts similarly placed; with a switch-plug having contact-surfaces similar in number and arrangement, to those of the switch-socket containing the greatest number of said contacts, and similar in arrangement to those of the remaining socket; substantially as described.

6. In a switch-plug and cord-circuit connection for a telephone-switchboard, a switch-plug having three contact-surfaces, two of which connect with the terminals of a clearing-out annunciator and the third with the middle or neutral point thereof; combined with a spring-jack or switch-socket having a like number of switch-contacts, two constituting the terminals of the main telephone-circuit, and the third being united to and forming the terminal of a source of signaling-current, and being so placed as to register (the plug being inserted) with that one of the said plug-contacts, which connects with the middle point of the annunciator-magnet; substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 16th day of February, 1898.

EDWIN H. SMYTHE.

Witnesses:
E. M. JACKSON,
L. G. RICHARDSON.