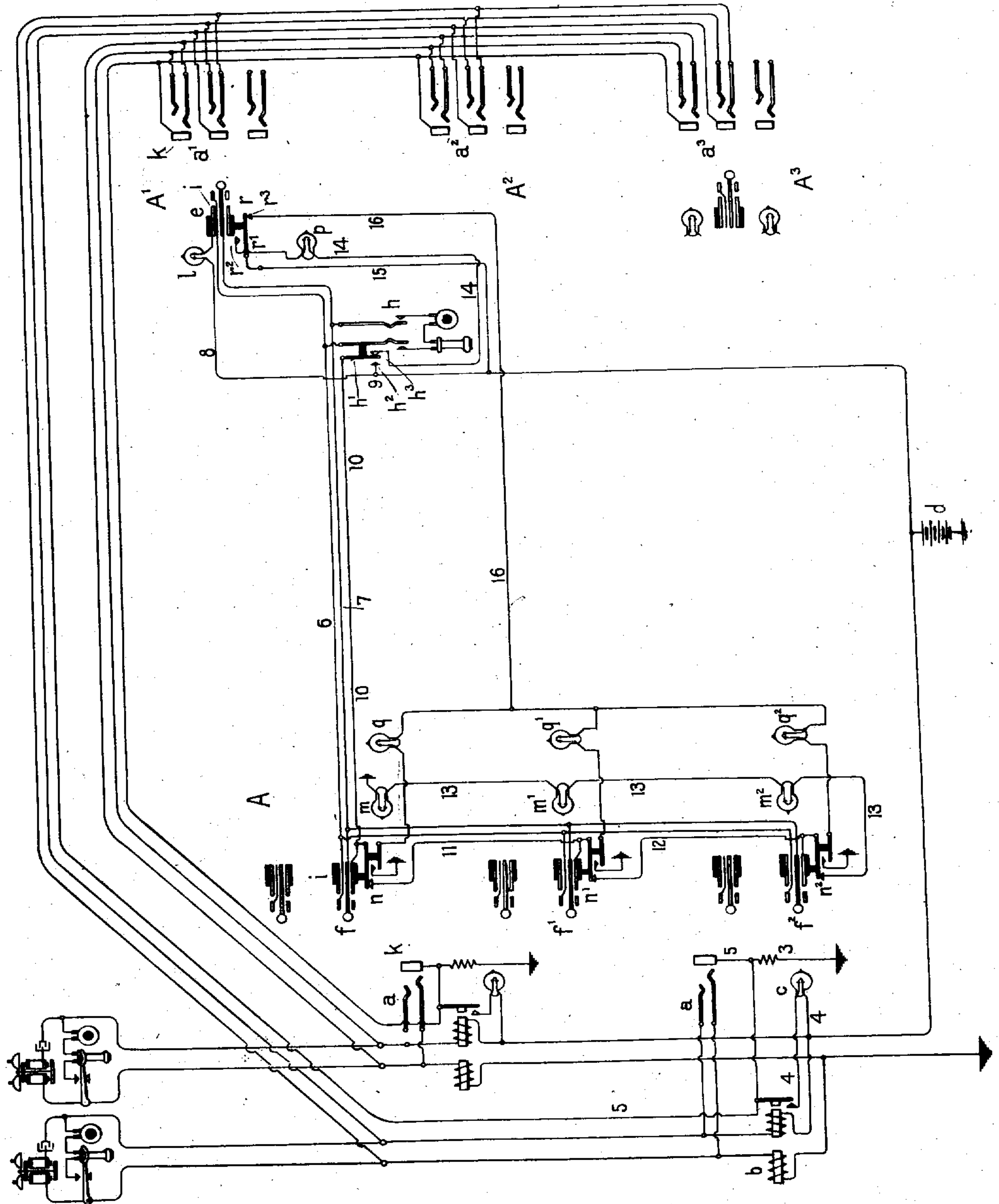


No. 684,289.

Patented Oct. 8, 1901.

F. R. McBERTY.  
SIGNAL FOR TELEPHONE SWITCHING SYSTEMS.  
(Application filed Jan. 26, 1899.)

(No Model.)



Witnesses:

*J. M. Sanner*  
*Edmund*

Inventor:  
Frank R. M. Bertly,

by *Barton Brown* his Att'y.

# UNITED STATES PATENT OFFICE.

FRANK R. McBERTY, OF EVANSTON, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS.

## SIGNAL FOR TELEPHONE SWITCHING SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 684,239, dated October 8, 1901.

Application filed January 26, 1899. Serial No. 703,462. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK R. McBERTY, a citizen of the United States, residing at Evanston, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Signals for Telephone Switching Systems, (Case No. 58,) of which the following is a full, clear, concise, and exact description.

My invention concerns the type of switching system for telephone-exchanges known as the "call-distributing" system, and has for its object to prevent interference between different call-distributing operators.

The system referred to comprises an annunciator or distributing board wherein are located call-indicating instruments for all the lines entering the central office and switchboards, preferably of the multiple type, in each of which are spring-jacks or terminals of all the lines and trunk or transfer lines from the annunciator-board to each of the multiple boards, with means for connecting one terminal of the trunk-line with any line of the annunciator-board and the other terminal of the same trunk-line with any line in a section of the multiple board. A call from a station is observed at the annunciator-board, and thereupon the line is extended by the operator at the annunciator-board through the agency of a trunk-line to any operator at the multiple board who may happen to be free to make new connections, the object of that process being to attain even distribution of the work of switching lines into connection among the different operators at the multiple board. There will of course be as many distributing operators at the annunciator-board as may be necessary to transfer the calls to the operators at the multiple boards and as many of these latter operators as may be necessary to complete and supervise the connections.

When there are several distributing operators, it is essential to the efficient operation of the system that each of the distributing operators have access to trunk-lines to all the switching operators. To this end it is desirable that trunk or transfer lines to each of the switching operators shall appear in the multiple terminals at the distributing-board,

one for each line before each distributing operator. It is to this feature of the call-distributing system that the present invention applies.

In a former patent, No. 567,404, dated September 8, 1896, (Case 34,) I have described and claimed a device by which the switching operator's act of connecting her telephone with a trunk-line in position to receive orders from a calling subscriber automatically sets the signal associated with the trunk-line before the distributing operator to indicate that the switching operator is ready to receive connections. The even distribution of work among the different switching operators is thus facilitated by the device for continuously informing the distributing operator of the busy or idle condition of the different switching operators.

The present invention consists in the combination, with this signaling mechanism for signaling to the distributing operator the idle condition of a switching operator, of multiple terminals for the trunk-line before different operators, a signal associated with each of the terminals, and mechanism whereby the act of connecting either trunk-line with any subscriber's line performed by a distributing operator indicates the use of the trunk-line to the other distributing operators and prevents them from using the line, whereby in the event of unintentional disregard of the signals or simultaneous action on the part of distributing operators a signal shall be displayed before one of the operators, the object being to prevent two distributing operators from connecting a single trunk-line simultaneously with the lines of two calling subscribers.

The invention is represented diagrammatically in the attached drawing in association with a switchboard provided with means for automatically operating signals in the switchboard. Two lines are shown, each connected with an instrument controlling a signal in the annunciator-board, with a socket in the annunciator-board, and with a socket in each of the three sections of the multiple switchboard. A trunk-line is shown extending between the annunciator-board and one of the sections of the multiple board, the trunk-



lines appearing in thrice-multiplied terminals in the annunciator-board for the use of three distributing operators. The drawing represents also the terminal plugs of another trunk-line multiplied before the same three distributing operators and extending to a different multiple section, together with the signal-lamp of this trunk-line at a multiple section, the circuits of this trunk-line having been omitted to avoid complication of the drawing.

Each substation is provided with the usual telephones and signaling apparatus, the appliances and circuits being arranged to close the line-circuit as to continuous currents only during the use of the station-telephone. The line conductors from each station are connected with the line-contacts of a terminal socket  $a$  in the annunciator-board  $A$  and in other sockets  $a'$ ,  $a''$ , and  $a'''$  in the sections  $A'$ ,  $A''$ , and  $A'''$  in the multiple switchboard. Line conductors are extended through the windings of a relay  $b$ , which controls a local circuit including a secondary lamp-signal  $c$ , associated with the corresponding line-socket in the annunciator-board. This local circuit is made up of conductors 3 and 4, the former of which is a ground branch including the resistance-coil and the latter of which is a conductor leading to the free pole of a grounded source  $d$  of current and including the lamp  $c$ . The lever of the relay is connected also by a wire 5 with the thimbles of all terminal sockets  $a$ ,  $a'$ ,  $a''$ , and  $a'''$  of the line. The line-circuits, spring-jacks, and line-signals of two telephone-lines are shown.

A number of trunk or transfer lines 6 7 extend between the annunciator-board and each section of the multiple switchboard. Each trunk-line terminates in a plug  $e$  at the multiple switchboard and is branched to three plugs  $f$ ,  $f'$ , and  $f''$  at the annunciator-board. These plugs are designed for the use of three different distributing operators, giving each of them access to the switching operator having charge of the corresponding trunk-line. There will of course be a sufficient number of distributing operators to distribute all calls received at the annunciator-board to switching operators at the multiple sections. A distributing operator can thus distribute as many as seven thousand calls per day. Hence in an exchange the number of distributing operators required at the annunciator-board will be determined by dividing the total number of calls received at the annunciator-board in a day by seven thousand. Inasmuch as an even distribution of the calls among the switching operators necessitates her receiving calls from each of the distributing operators, the trunk-lines to each of the switching operators should appear before each of the distributing operators. Hence the equipment of plugs for each trunk-line represented in the drawing is sufficient for an exchange having something over twenty thousand calls per day. To transact such an

amount of business as this would require more switching operators than represented in the drawing, but this would merely involve a larger number of trunk-lines. A switching operator can answer three thousand calls and make the required connections per day. Hence seven sections of multiple switchboards will be required and seven groups of trunk-lines extending from the multiple switchboards to the annunciator-board, each trunk-line appearing in three terminals at the multiple switchboard.

The trunk-line is provided at the switching-operator's station with the usual calling-key (not shown) for connecting a generator of calling-current with the terminals of plug  $e$  and with a listening-key  $h$  for connecting the operator's telephone with the trunk-line.

I will now describe the local circuits involved in signaling between operators at the different boards and between subscribers and operators.

Each plug is provided with a contact-piece  $i$  in addition to its line-contacts, designed to register with the thimbles or contact-rings  $k$  of the spring-jacks. The contact-piece  $i$  of plug  $e$  forms the terminal of a wire 8, leading to the free pole of battery  $d$ . This conductor 8 traverses an incandescent lamp  $l$ , which is associated with the plug  $e$  in the switchboard and constitutes a supervisory signal. The mode of operation between the line-signal  $c$  and the supervisory signal  $l$  is well known to those familiar with existing telephone-switchboards, but may be briefly described. The current from battery  $d$  through wires 3 4 of a local circuit, which may become closed at a line-relay, is sufficient to light one of the signal-lamps used in the system; but whenever conductor 8 becomes connected with wire 4 through the agency of contact-pieces  $i$  and  $k$  of a plug inserted in a spring-jack lamps  $c$  and  $l$  are brought into parallel, both being in series with the resistance-coil in wire 3, under which condition neither lamp receives sufficient current to light it. If during the existence of these conditions the line-relay becomes inert and separate the conductor 3 from the wire 4, the full current from battery  $d$  will be diverted through wires 8 and 3, whereby the supervisory lamp  $l$  will become lighted.

A signal-lamp is associated with each of the plugs  $f$ ,  $f'$ , and  $f''$ , which form the terminals of the trunk-line at the annunciator-board. These lamps are designated  $m$ ,  $m'$ , and  $m''$ , respectively. These lamp-signals are included in a local circuit associated with the corresponding trunk-line whose continuity is normally controlled by switch-contacts on the operator's listening-key, these contacts being adapted to close the local circuit to light the lamps  $m$ ,  $m'$ , and  $m''$  when the operator connects her telephone with the trunk-line. The circuit is also controlled by plug-seat switches of plugs  $f$ ,  $f'$ , and  $f''$ . The switch-levers of the listening-key  $h$  are pro-



vided with an auxiliary switch-contact  $h'$ , which plays between two contact-pieces  $h^2$  and  $h^3$ , being thrust against the contact  $h^2$  when the key is put in position to connect the operator's telephone in a bridge of the trunk-line 6 7. Contact-piece  $h^2$  is connected by wire 9 with the free pole of battery  $d$ . The lever  $h'$  is connected by wire 10 with the switch-lever of a plug-seat switch  $n$  of plug  $f$ .  
 10 The normal resting contact of this switch is connected with the switch-lever of a similar switch  $n'$  of plug  $f'$  by wire 11. The resting contact of the last-mentioned switch is connected with the lever of switch  $n^2$  of plug  $f^2$   
 15 by wire 12. The resting contact of the switch  $n^2$  is connected to earth through wire 13, which includes serially the signal-lamps  $m^2$   $m'$   $m$ , associated with plugs  $f^2$   $f'$   $f$ . Thus while the listening-key is in position to connect the operator's telephone with the trunk-circuit and plugs  $f$ ,  $f'$ , and  $f^2$  are in their resting-sockets a circuit will be complete from battery  $d$  through wires 9, 10, 11, 12, and 13 to light the lamps  $m$ ,  $m'$ , and  $m^2$ . The sleeve  
 25  $i$  of each of the plugs  $f$ ,  $f'$ , and  $f^2$  is connected with the wire extending from wire 10 to the plug-seat switch of the same plug—namely, the sleeve of plug  $f$  is connected with wire 10, the sleeve of plug  $f'$  with wire  
 30 11, and the sleeve of plug  $f^2$  with wire 12.

The alternate contact-piece  $h^3$  of the lever  $h'$  on the listening-key forms the terminal of a conductor 14, which is connected with wire 9, and thus is completed to the free pole of battery  $d$ , which includes a supervisory signal-lamp  $p$ , also associated with plug  $e$  in the switchboard, and which is controlled by a plug-seat switch of plug  $e$ .

Clearing-out lamps  $q$ ,  $q'$ , and  $q^2$  are associated with the plugs  $f$ ,  $f'$ , and  $f^2$ , respectively, in the switchboard. These lamps are located in multiple earth branches of the conductor 16, which terminates in a contact-piece of a plug-seat switch of the plug  $e$ . Each of the  
 45 earth branches is controlled by switch-contacts of the plug-seat switch of the plug  $n$ ,  $n'$ , or  $n^2$ , with which the lamp  $q$ ,  $q'$ , or  $q^2$  in question is associated, these switch-contacts being arranged to open the ground branch including the lamp when the plug is not in use. The plug-seat switch  $r$  of plug  $e$  is arranged to connect the wire 16 with the wire 15, leading by way of wire 9 to battery  $d$ , when plug  $e$  rests in its socket. Hence the general  
 50 circuit, including the clearing-out lamps  $q$ ,  $q'$ , and  $q^2$  of a trunk-line, is established when the terminal plug  $e$  of the trunk-line is replaced in its socket, and the branch, including the clearing-out lamp of the particular  
 60 terminal plug at the distributing-board which may be in use, is closed during the use of that plug.

I will first briefly trace the general mode of operation of the system. Any switching operator who may be free to receive calls and make connections indicates this fact to the distributing operators by connecting her tele-

phone with a trunk-line by means of her listening-key, whereby the lamp-signals associated with the trunk-line at the distributing-board become lighted. A subscriber at one station wishing to obtain connection with another station takes his telephone from its hook, which act causes the illumination of a lamp in the annunciator-board associated  
 75 with his line. The distributing operator observing this signal makes connection with a spring-jack of the calling-line by means of some trunk-plug of which the associated lamp had been lighted, whereby the calling-line is,  
 80 in effect, extended to a switching operator who is free to attend to the subscriber's wants and who already has her listening-telephone connected with the trunk-line, such connection of the telephone with the trunk-line being the cause of the lighted condition of the signals  $m$   $m'$   $m^2$ . The waiting operator immediately demands the number of the line with which connection is required and after receiving it makes the usual test and establishes connection with the required line at the multiple switchboard. Thereafter this operator supervises the connection by means of signal-lamps associated with the trunk-line through which the required connection  
 85 has been established.

Any of the several distributing operators may observe the subscriber's call and attempt to trunk the call to some switching operator. If two distributing operators should attempt  
 100 to make connection with lines of two calling subscribers by means of plugs of the same trunk-line, only one of the connections would be effective. The lighted signal-lamp of that subscriber would become extinguished, while  
 105 the line-lamp of the other subscriber would remain lighted, its illumination being an indication to the distributing operator that another operator had obtained the use of the trunk-line. Thus the mechanism prevents  
 110 confusion which might arise through the accessibility of every trunk-line to each of several distributing operators. When the switching operator removes the connection with the called line, the distributing operator who  
 115 made the connection between the same trunk-line and the calling-line is apprised of this fact by means of a signal-lamp and withdraws the other terminal of the trunk-line from the spring-jack of the calling-line.  
 120

I will now trace the operation in greater detail, following the circuits through the various changes involved in making and breaking connection between lines.

Normally plugs  $e$  and  $f$ ,  $f'$ , and  $f^2$  are in their resting-sockets and the operator's telephone is disconnected from the trunk-circuit. The local circuits, including the signal-lamps  $m$ ,  $m'$ , and  $m^2$ , are thus broken at the switch-contacts  $h'$   $h^2$ . The local circuit of the clearing-out lamps  $q$ ,  $q'$ , and  $q^2$  is broken at the switch-contacts of the plug-seat switches  $n$ ,  $n'$ , and  $n^2$ , although the general circuit is closed at the switch-contacts of plug-seat switch  $r$ .  
 125  
 130



When the switching operator at the switchboard *A'*, for example, is ready to make connections, she brings her telephone into connection with the trunk-line 6 7 by means of key *h*. This act connects contact-pieces *h'* and *h*<sup>2</sup>, thus completing a circuit 9 10 11 12 13 through the lamps *m*, *m'*, and *m*<sup>2</sup>. The lamps mentioned therefore become lighted, indicating to the different switching operators that the trunk-line to which they refer is free for use and that the operator having charge of it is ready to receive calls. A subscriber calling closes his line-circuit as to the central source of calling-current when he raises his telephone from its switch, exciting the relay *b* and closing the circuit 3 4. Line-lamp *c* is thus lighted, which constitutes a call to the distributing operators. A distributing operator—for example, the one having access to plug *f*—seeing the lamp *m* lighted beside the plug *f* raises this plug from its socket and inserts it into the spring-jack *a* of the calling-line. A circuit through wires 9 and 10 is thus brought into shunt about wire 4, including the line-lamp, and in series with the wire 3, whereby the line-lamp is short-circuited and extinguished. The act of raising the plug *f* from its socket permitted the plug-seat switch *n* to break connection between wires 10 and 11, whereby the circuit through lamps *m*, *m'*, and *m*<sup>2</sup> is broken and permits these lamps to become dark. The same switch closes the circuit through clearing-out lamp *q*, associated with plug *f*, which becomes lighted, but its signal is ignored until the operator at switchboard *A'* shall have had sufficient time to make the required connection. The extinction of line-lamp *c* indicates to the distributing operator who inserted plug *f* that the connection has been properly made. If the operator before whom plug *f'* is stationed, having seen the lighted lamp *m'* and wishing to use a trunk-line, had employed plug *f'* to make connection with the line of a calling subscriber, the shunt-circuit 9 10 would be found disconnected from the sleeve *i* of plug *f'*, so that the lamp *c* of the calling-subscriber's line would remain lighted. This would indicate to the operator who had made the connection that another operator had obtained the same trunk-line at nearly the same moment, and the operator would withdraw plug *f'* of that trunk-line from the spring-jack of the calling-line and insert a plug of another trunk-line which was ready for use in place of it. If the plug *f'* should be used in making a connection, the use of the plug *f* a moment later would practically leave the connection with the plug *f*, ordering out plug *f'*—that is, the plug *f* would bring about the extinction of the lamp of the line with which it was connected, while the lamp of the line with which plug *f'* was connected would become lighted and would call for the disconnection of that plug. The operator at switchboard *A*, to whom the call has thus been transferred, receives the calling-

subscriber's order for the required connection, tests the line called for in the multiple switchboard, and makes connection therewith (assuming that she has found it free for use) in the usual way, after which she disconnects her telephone. The raising of plug *e* from its seat breaks connection between wires 15 and 16, depriving the clearing-out lamp *q* of current, and also permits the contacts *r'* *r*<sup>2</sup> to close the break in wire 14. The subsequent disconnection of the operator's telephone by means of the listening-key closes connection between wires 10 and 14, thus completing a circuit through the supervisory signal-lamp *p*. It will be observed that this lamp *p* is now in parallel with the line-lamp *c*. The current through conductor 3 is divided between these two lamps, so that both remain dark. The insertion of plug *e* into a spring-jack of the line called for brings the lamp *l* into parallel with the line-lamp of the line called for; but inasmuch as the circuit through that lamp is broken at the line-relay, the subscriber called having not yet responded, the lamp *l* is lighted by current from battery *d* through wires 8 and 3. The response of the called party is indicated by the extinction of lamp *l*. Supervisory lamps *p* and *l* thus serve as automatic indicators before the switching operator of the positions of the telephones at the calling and called stations. When the calling subscriber replaces his telephone on its switch, his relay *b* is deprived of current and breaks the conductor 4, whereby the current of battery *d* is diverted through conductors 9, 14, and 10, lighting the lamp *p*. Similarly the replacement of the telephone on its switch at the called station will divert the current which previously flowed through the line-lamp of that station into the supervisory lamp *l*, whereby this lamp will be lighted. The simultaneous illumination of lamps *l* and *p* may be accepted by the switching-operator as a signal for disconnection, after which she will remove the plug *e* from the spring-jack and replace it in its resting-socket. This act breaks the circuit through lamp *l* at the separated contacts *i* and *k* of the spring-jack and plug, respectively, and severs the circuit through supervisory lamp *p* at the contacts *r'* *r*<sup>2</sup> of the plug-seat switch *r*. The same act closes together the contact-pieces *r'* *r*<sup>2</sup> of this switch, completing a circuit through wires 15 and 16 to the plug-seat switch *n*, where current finds circuit through clearing-out lamp *q* and the registering contacts of plug-seat switch *n* to earth. Clearing-out lamp *q* is thus lighted. Its illumination calls for the removal of plug *f* from the spring-jack of the calling-line. If plug *f'* or *f*<sup>2</sup> had been employed in making connection with the calling-line the corresponding clearing-out signal *q'* or *q*<sup>2</sup> would become lighted.

It will be observed that of the series of plugs *f*, *f'*, and *f*<sup>2</sup> the plug *f* would always, in effect, cut off the other plugs in the series, so that the distributing operator using plug *f*



would always deprive the other distributing operators attempting to use plugs  $f'$  and  $f''$  of the trunk-line. To compensate for this possible disadvantage, I prefer to arrange 5 plugs located in the signaling-circuit like plug  $f$  at different positions at the annunciator-board. These plugs in each position in the circuit should be located before each of the distributing operators, so that all dis- 10 tributing operators would find trunk-lines busy an approximately equal number of times—that is, assuming, for example, that three trunk-lines terminated in multiple plugs before the three distributing operators 15 I would arrange plug  $f$  of one line, plug  $f'$  of another line, and plug  $f''$  of a third line before one of the operators; plug  $f'$  of the first line, plug  $f''$  of the second line, and plug  $f$  of the third line before another operator, and 20 plug  $f''$  of the first line, plug  $f$  of the second line, and plug  $f'$  of the third line before the third distributing operator, carrying out a similar arrangement for a larger number of plugs.

25 The invention is defined in the following claims:

1. In a call-distributing system comprising telephone-lines, each having a terminal socket and a signaling instrument in an annunciator-board, and a terminal socket in each of 30 several sections in a multiple board, a trunk-line extending from the annunciator-board to each section of the switching-board, of multiple terminal plugs for each of the said 35 trunk-lines at the annunciator-board, whereby several distributing operators have access to the same trunk-lines to equitably distribute the calls to the switching operators, as described.

40 2. The combination with a call-distributing system comprising telephone-lines, each having a terminal socket and a line-signal in an annunciator-board, and a terminal socket in each of several sections of a multiple switch- 45 board, and a trunk-line extending from the annunciator-board to a section of the multiple switchboard, of multiple terminals for the said trunk-lines at the annunciator-board, a signal associated with each terminal, and a 50 local circuit including the said signals, said local circuit being controlled by a switch associated with the trunk-line at the section of multiple switchboard; whereby all distribut- 55 ing operators are apprised of the readiness of a switching operator to receive calls, as described.

3. In combination with a call-distributing system comprising telephone-lines, each having a line-signal and a terminal socket in an 60 annunciator-board, and a terminal socket in each section of a multiple switchboard, and a trunk-line extending from each section of the multiple switchboard to the annunciator-board, of multiple terminals for the said 65 trunk-line at the annunciator-board, a signal associated with each of said terminals, a local circuit including said signals, and a switch

at the multiple section controlling the said circuit and a switch connected with each of said multiple terminals to be actuated in the 70 use thereof also controlling all of said signals; whereby a switching operator may apprise all the distributing operators of her readiness to receive calls, and the act of any distributing operator in making use of the trunk-line may 75 be signaled to the other distributing operators, as described.

4. The combination with a trunk-line between switchboards, of multiple terminal 80 plugs therefor at one switchboard, a signal associated with each of said multiple terminals, a circuit for operating the signal, a switch controlling the circuit at the distant terminal of the trunk-line, and a switch associated with each of said multiple terminals 85 controlling all said signals, as described.

5. The combination with a trunk-line between switchboards, of multiple terminals at one extremity of the trunk-line, a signal associated with each of said multiple terminals, 90 a circuit for operating the said signals simultaneously, a switch at the distant terminal of the trunk-line controlling the said circuit, and a switch connected with each of said multiple terminals to be actuated in the use there- 95 of adapted to render all of said signals inoperative when one of the multiple terminals is used, as described.

6. The combination with a trunk-line having a terminal at one station and multiple 100 connection appliances at the other station accessible to different operators, of signals  $c c$  with which the several connection appliances are adapted to be temporarily associated, a circuit-changing device operated by each con- 105 nection appliance when in use, and circuits associated with the several connection appliances adapted to be brought thereby into temporary association with the several signals 110  $c c$ , said circuits being controlled by the afore-said circuit-changing device, whereby the use of one of said connection appliances is caused to effect the operation of the several signals  $c c$  and so to indicate the busy condition of the trunk-line, as described. 115

7. The combination with a telephone-line and the connection-socket thereof, of a signal near the socket, a link conductor having multiple terminals, each adapted for connection 120 with the socket of a line, switches associated with each of said terminals to be made operative in the use of the terminal, and circuit connections of the said signal controlled by the said switches adapted to cause the display of the signal near one of said terminals 125 in a socket when either of said terminals is brought into use; whereby one operator in making connection with a telephone-line is warned that another operator has made connection with a different line by means of the 130 same link conductor, as described.

8. The combination with a trunk-line having multiple terminal plugs at one station, of a plug-seat switch for each plug, a signaling



instrument adapted for association with any plug, and circuit connections of said signal changed in the simultaneous use of two plugs adapted to operate the warning-signal at one of the plugs, whereby one of two operators attempting to make use of different terminal plugs of the trunk-line will be warned of the use of the line, as described.

9. The combination with subscribers' lines and the terminal sockets and line-signals of each of said lines in a switchboard, of a link conductor having multiple terminals adapted for connection with such sockets, and circuit connections comprising a conductor including one of said line-signals, and switch-contacts operated in the simultaneous use of two of said terminals completing the said circuit connections to cause the display of said signal; whereby one of two operators simultaneously using the trunk-line is warned of such use by the line-signal, as described.

10. The combination with a trunk-line extending between two stations having a single terminal plug at one station and multiple terminal plugs at the other station, of a signal associated with each of said multiple terminals, a local circuit including said signals, and a switch at said single terminal controlling the local circuit, a switch for each of said multiple terminals actuated in the use of the terminal, a signal associated with one of said multiple terminals, and circuit connections of said signal controlled by the switch associated with another of said terminals adapted to cause the excitement of said signal; whereby an operator at the said single terminal may call to all the operators having access to said multiple terminals, but the simultaneous use of said multiple terminals by two operators will be indicated to one of said operators.

11. The combination with a link conductor for uniting telephone-lines having multiple connection terminals at one end thereof, of a clearing-out or equivalent signal associated with each of the said multiple terminals, a device associated with each of the multiple terminals adapted to make the signal associated with the same terminal operative when the terminal is in use, the condition of the remaining signals remaining unchanged, and means for controlling the circuits of said signals, as described.

12. The combination with a link conductor for uniting telephone-lines having multiple terminals at one end, of a clearing-out signal associated with each of the terminals, a circuit common to said terminals, and means associated with the other end of the trunk-line for controlling the operation of said clearing-out signals, and a device associated with each of said multiple terminals operated in the use of said terminal adapted to make the clearing-out signal associated with the terminal operative during the use of the terminal, the condition of the other clearing-out signals

remaining unchanged, substantially as described.

13. The combination with a telephone-line and a trunk-line for making connection therewith, of a line-signal for the line normally in a circuit controlled by current in the line, a connecting-switch for the line, and a circuit of said line-signal formed temporarily through the connecting-switch, and a conductor associated with the trunk-line to the distant terminal thereof, and means at the distant terminal for controlling the circuit thus formed; whereby the subscriber's line-signal may be controlled through the trunk-line, as described.

14. The combination with a telephone-line, a relay connected therewith to respond to current in the line during its use, and a secondary signal controlled by the relay, and a spring-jack for the line, of a link conductor having multiple terminal plugs, a circuit having multiple branches to each plug adapted to be brought into shunt of the signal-lamp of a line through registering contacts of the plug and spring-jack, and a plug-seat switch of each of said multiple terminal plugs having switch-contacts controlling the circuit of said branches to all plugs but its own, as described.

15. In combination with a trunk-line, multiple terminal plugs thereof, and switches, one for each of said multiple plugs, a signal and a circuit thereof traversing said switches in series, and an independent switch at the distant terminal station of said trunk-line controlling the said signaling-circuit, substantially as described.

16. In combination with a trunk-line and multiple terminal plugs thereof, a clearing-out signal for each of the plugs and a switch for each plug controlled thereby, each of said clearing-out signals being together with said switch of the same plug in a multiple branch of the signaling-circuit, and independent means at the distant station of the trunk-line, common to the different signals, for controlling the signaling-circuit; whereby the clearing-out signal of any plug which is in use is made operative to receive the signal for disconnection, substantially as described.

17. The trunk-line circuit provided at one end with multiple plugs  $f f' f^2$ , switches  $n n' n^2$  for said plugs, respectively, a signal and a signaling-circuit thereof traversing serial contacts of said switches, and independent means at the distant terminal of the trunk-line, for controlling said circuit, substantially as described.

18. The combination with a trunk-line and multiple terminal plugs thereof, of plug-seat switches  $n n' n^2$ , one for each plug, a signaling-circuit connected through said switches, clearing-out signals associated with the different plugs, and an individual circuit of each of said clearing-out signals controlled by



the plug-seat switch of the corresponding plug, a switch at the distant terminal of the trunk-line for controlling said signaling-circuit, and a clearing-out switch *r* controlling the general circuit of said clearing-out signals, substantially as described.

19. The combination with a telephone-line, a relay therein responsive to current in the line, a line-signal and a local circuit of the signal controlled by the relay, a plug and spring-jack for making connection with the line, and a conductor terminating in the plug, adapted to form a shunt about said line-signal when the plug is in the jack, and a switch adapted to break the circuit of said conductor and prevent the shunting of the line-signal thereof, substantially as described.

20. The combination with a telephone-line, a relay in the line responsive to current therein, a trunk-line for making connection with the telephone-line, and a supervisory signal at the distant terminal of said trunk-line, a circuit of said supervisory signal completed through registering contacts of the terminal plug of the trunk-line and the spring-jack of the subscriber's line, said circuit being controlled by said relay in the subscriber's line, and an operator's listening-key also controlling said circuit, as described.

21. The combination, substantially as herein set forth, of a telephone-line and a relay therein, a trunk-line and means for making connection from each terminal thereof to a subscriber's line, a supervisory signal associated with the distant terminal of the trunk-line, and a circuit of said signal closed at one point in making connection from said trunk-line to said subscriber's line, said circuit being controlled by the relay in the subscriber's line, and a switch actuated in mak-

ing connection with said distant terminal of the trunk-line, controlling said circuit of the signal.

22. The combination with a telephone-line, a terminal spring-jack thereof and a line-signal associated with the spring-jack, a trunk-line for uniting telephone-lines, and a circuit of said line-signal closed through said spring-jack and a plug of the trunk-line when inserted therein, a conductor of the trunk-line, and a switch at the distant terminal of said trunk-line, actuated in making connection with said distant terminal, controlling the circuit formed through said conductor, including said line-signal; whereby the subscriber's line-signal indicates the formation of connection with the distant terminal of the trunk-line, as described.

23. In a telephone-exchange system, the combination with trunk-lines, each provided with multiple terminal connections, any of said multiple plugs of a trunk-line being adapted to be connected with the spring-jack of a subscriber's line, and each being provided at its distant terminal with a supervising-signal and having a circuit divided into multiple branches terminating in the different multiple terminal connections thereof, a relay in each subscriber's line, and a circuit controlled thereby adapted to be brought into connection with the circuit of said supervising-signals of the trunk-line through the spring-jack of the line and one of said terminal plugs of the trunk-line, as described.

In witness whereof I hereunto subscribe my name this 30th day of December, A. D. 1898.

FRANK R. McBERTY.

Witnesses:

ELLA EDLER,  
D. E. WILLETT.

Correction in Letters Patent No. 684,289.

It is hereby certified that in Letters Patent No. 684,289, granted October 8, 1901, upon the application of Frank R. McBerty, of Evanston, Illinois, for an improvement in "Signals for Telephone Switching Systems," an error appears in the printed specification requiring correction, as follows: In line 66, page 4, the reference letter "A" should read *A'*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 22d day of October, A. D., 1901.

[SEAL.]

Countersigned:

F. I. ALLEN,  
Commissioner of Patents.

F. L. CAMPBELL,  
Assistant Secretary of the Interior.



It is hereby certified that in Letters Patent No. 684,289, granted October 8, 1901, upon the application of Frank R. McBerty, of Evanston, Illinois, for an improvement in "Signals for Telephone Switching Systems," an error appears in the printed specification requiring correction, as follows: In line 66, page 4, the reference letter "A" should read *A'*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 22d day of October, A. D., 1901.

[SEAL.]

F. L. CAMPBELL,  
*Assistant Secretary of the Interior.*

Countersigned:

F. I. ALLEN,  
*Commissioner of Patents.*