

(No Model.)

O. A. BELL.

AUTOMATIC SIGNAL FOR TRUNK LINES OF TELEPHONE EXCHANGES.

No. 507,983.

Patented Nov. 7, 1893.

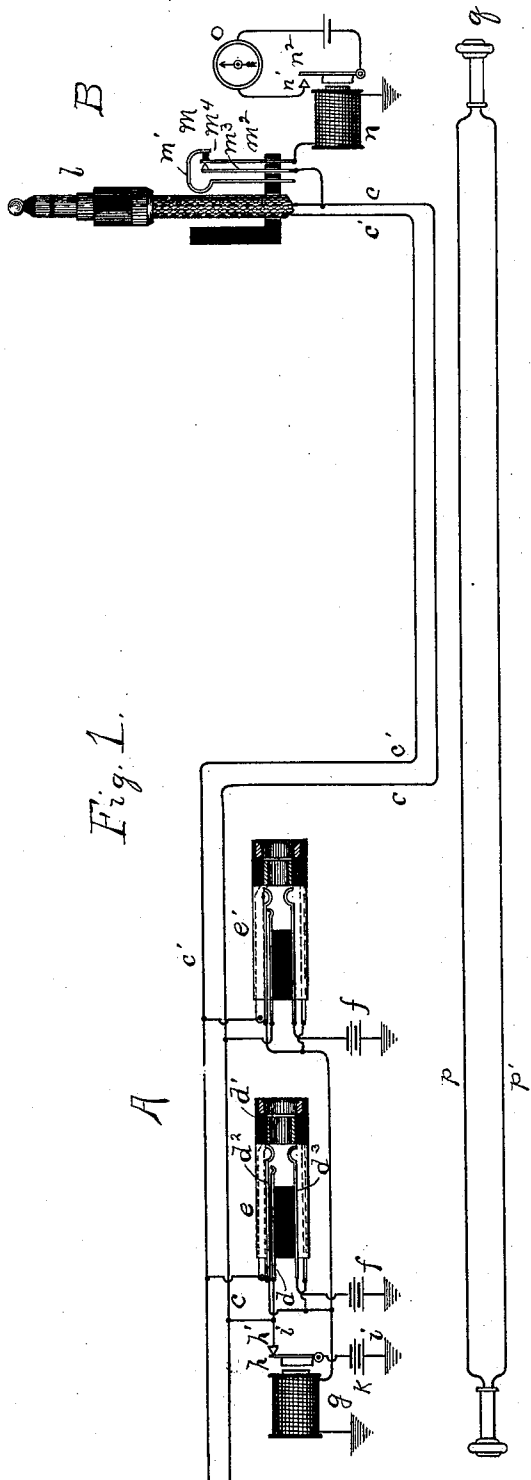


Fig. 1.

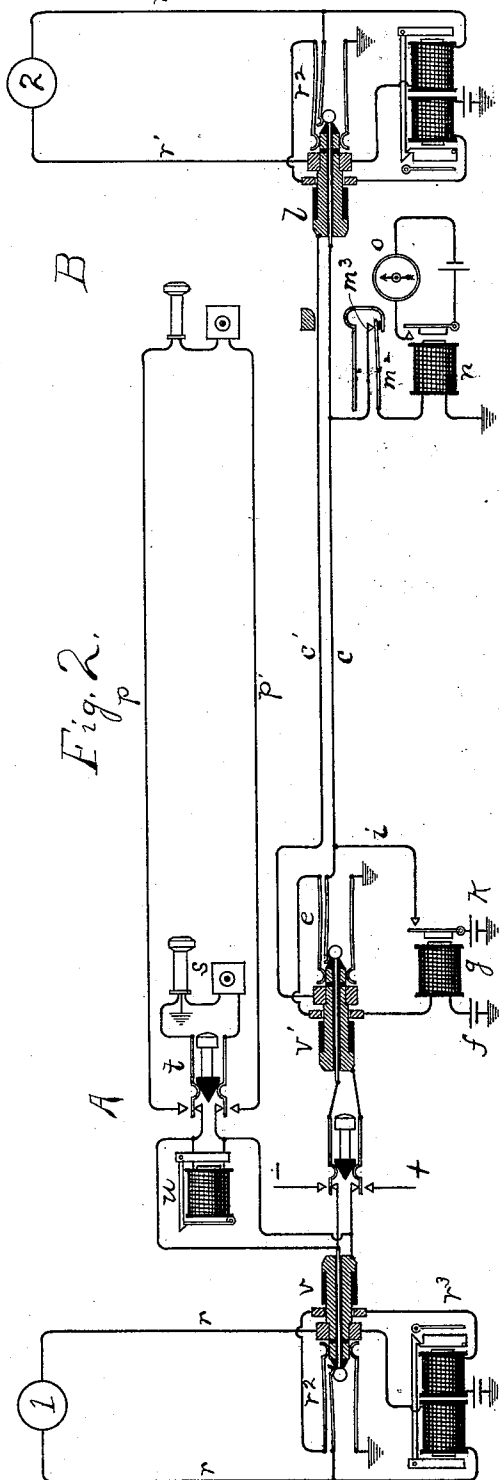


Fig. 2.

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AUTOMATIC SIGNAL FOR TRUNK-LINES OF TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 507,983, dated November 7, 1893.

Application filed February 7, 1893. Serial No. 461,315. (No model.)

To all whom it may concern:

Be it known that I, ORO A. BELL, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented a certain new and useful Improvement in Automatic Signaling Apparatus for Trunk-Lines of Telephone-Exchanges, (Case No. 8,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to signaling apparatus for trunk lines of telephone exchange systems.

Telephone exchange systems frequently comprise a number of exchange offices, to each of which a large number of telephone lines are connected. Each exchange office is provided with switching apparatus by which connections may be made between the different telephone lines connected with it, and the different offices are connected with each other by line circuits, by means of which any telephone line terminating at one office may be connected to a line terminating in any other office of the system. These circuits extending between the different exchange offices of the exchange system are termed "trunk lines." When a subscriber, whose line terminates at one exchange office, desires a connection with the subscriber whose line terminates at another office, the calling subscriber may send his signal to his own office in the usual manner; the operator thereat, who receives the signal, having received the order for connection, will connect the subscriber's line with a trunk line extending to the exchange office at which terminates the line with which connection is desired, and will signal the operator at that office. When this operator has responded, the first operator will communicate the order to the second operator, who will thereupon establish connection between the trunk line and the line called for. Thus the subscribers' stations are connected together in a circuit including their respective lines, the connecting apparatus at the two exchange offices, and the trunk line extending between the two offices.

Heretofore it has been customary to provide lines and telephonic appliances by which

an operator at one office might give the order orally to the operator at another office to connect a particular trunk line with some particular subscriber at the second office. When the subscribers had finished their conversation and signaled for disconnection, such signal has ordinarily been received by appropriate apparatus at the office of the operator who first received the call; and apparatus is arranged so that the act of disconnecting the trunk line from the telephone line at that office automatically transmitted a signal to the operator at the other office. Upon receiving the automatic signal, the operator at the second office proceeded to disconnect the trunk line from the subscriber's line at her switchboard.

My invention particularly relates to apparatus for transmitting such automatic signals for disconnection over trunk lines of exchange systems; its object is to provide improved apparatus therefor, and to adapt the same to the exchange systems in general use.

The systems heretofore in use have required two or more conductors in addition to the conductors of the trunk line circuit. This is not desirable on trunk lines of any considerable length, since such trunk lines commonly extend through cables, and the existence of any unnecessary wire reduces the efficiency and desirability of the system.

In my invention I employ but two conductors for the automatic disconnection circuit; one of these conductors may be one of the trunk line wires, and the return circuit may be through the earth. In my invention I provide a springjack and mechanism in connection therewith by which the said signal circuit is normally closed at the sending office, but is opened thereat by the insertion of a connecting plug into the springjack; and other mechanism at the receiving station retaining the signaling circuit normally open thereat, but adapted to be operated in the act of making connection with the trunk line to close the same. An annunciator, or any suitable indicator, is located at the receiving end of the trunk line, included in the signaling circuit, and a source of electricity is also included therein.

In practice the trunk line may terminate

in a springjack located upon the switchboard at the sending office, or, when the switchboard is of the multiple type, in several springjacks connected in parallel therewith, located upon the different sections of the switchboard; and at the receiving end the trunk line may terminate in a terminal plug adapted for insertion into any springjack, and normally resting in a socket provided with a cord switch.

I preferably employ springjacks comprising, in addition to the line springs, contact pieces adapted to be crossed together by the insertion of a plug into the jack. These contact pieces form the normally separated terminals of a local circuit including a battery and the coils of a relay whose contact points are arranged to open the signaling circuit, as described, when its coils are energized. Thus, when an operator desiring to use a trunk line, inserts a connecting plug into a springjack of that trunk line, she closes the normally open local circuit, whereby the relay is actuated to separate its contact points and open the signaling circuit, as described. The cord switch at the receiving end may have contact points which are normally separated from each other, but which are closed together when the plug is removed from its socket. These contact points are included in the signaling circuit. Thus as long as no connecting plug is present in any springjack of the trunk line at the sending end, the signaling circuit is normally closed thereat; and as long as the terminal plug of the trunk line at the receiving end is not in use, the signaling circuit is open thereat; but in making use of a trunk line, the signaling circuit is opened at the sending office when connection is made to the trunk line; and is closed at the receiving end as soon as the operator thereat, having received the order to connect the trunk line with some subscriber connected with her office, has lifted the terminal plug of the trunk line from its socket to make the desired connection; whereby the indicator or annunciator at the receiving end remains inert as long as the trunk line is idle, and, also while it is in use in a complete connection; but when the operator at the sending office has received the signal to disconnect the two subscribers, and accordingly removes the connecting plug from the springjack of the trunk line, the signaling circuit is closed and the annunciator or indicator at the receiving end is operated and notifies the receiving operator that she may remove the connection from the trunk line.

In some cases I have employed a second relay in place of the annunciator at the receiving end of the signaling circuit, and have arranged the relay contacts to close a local circuit including a suitable indicator.

I have illustrated my invention in the accompanying drawings, Figures 1 and 2.

In Fig. 1 of the drawings I have shown a trunk line equipped with apparatus such as

I have described, extending between two exchange offices. Fig. 2 represents two subscribers' stations connected by lines with the usual appliances and apparatus at two different exchange offices, a trunk line connecting the two exchange offices, and the operator's connecting appliances at the station at which the call was received, in position of connecting the calling subscriber's line with the trunk line.

Referring to Fig. 1, A and B are supposed to be the different exchange offices, A being the office from which connections to subscribers of office B are made. The different sides $c\ c'$ of the trunk line circuit, extending between the offices A and B, are connected with the line springs d and the thimbles d' , respectively, of two springjacks $e\ e'$, of well known pattern, supposed to be located upon the two different sections of a multiple switchboard. The springjacks e and e' have, in addition to their line contacts $d\ d'$, other contact springs d^2 and d^3 . The contact springs $d^2\ d^3$ of the different springjacks constitute the normally separated terminals of a local circuit which includes a battery f and the coils of a relay g . The contact points $h\ h'$ of the relay control the continuity of a branch i extending from one side c of the trunk line circuit to earth, and including a battery k . The springjacks shown are of well known construction and are employed in connection with a loop plug having, in addition to the tip and sleeve which make contact with the line spring and the thimble, respectively, of the jack, an insulated conducting ring which crosses together the local contacts $d^2\ d^3$. At the receiving station the lines cc' terminate in the plug l . This plug rests normally in a socket, at one side of which is located the cord switch m . This switch comprises the spring m' , which bears against the side of the plug when the latter is in the socket, and two lighter springs $m^2\ m^3$ which tend to separate from each other. While the plug is in its socket, the spring m' is pressed outward and allows the springs $m^2\ m^3$ to separate, but when the plug is removed from its socket, the spring m' moves inward, and, through the medium of the insulating stud m^4 , presses the spring m^2 against spring m^3 , and thus places them in electrical connection. The spring m^3 is connected with the side c of the trunk line circuit. The spring m^2 is connected to earth through a branch which includes the coils of a relay n , whose contact points $n'\ n^2$ control a local circuit including the indicator o . This indicator may be any suitable device adapted to be displaced or caused to give an indication while current traverses it, and to return to its normal position when it is de-energized—such, for example, as a galvanometer. In connection with the trunk line circuits $c\ c'$ is shown a telephone set at each of the stations A and B. This is to enable the operator at the sending station A to transmit the order for the desired

connection orally to the operator at station B, who is assumed to be continually listening at the telephone *q*. An ordinary signaling circuit may, of course, be employed in place of the telephone circuit, or in connection with the trunk line itself; all these appliances are well known in the art, and form no part of my invention herein.

Referring now to Fig. 2, I will describe in detail the apparatus shown therein; and will trace the operation of establishing connection between the two substations shown, by means of the trunk line and other appliances, and will point out the use of my invention in connection therewith. The substations 1 and 2 are supposed to be equipped with telephonic and signaling appliances of the usual character. They are connected by line circuits *r* and *r'*, respectively, each with a springjack *r*² and an annunciator *r*³ upon a switchboard at one of the offices—substation 1 being connected with the office A, and substation 2 with office B. The operator at office A is provided with connecting plugs, and telephonic and calling apparatus of perfectly well known form and arrangement. The different portions of the two connecting plugs are electrically connected together, a ringing key being included in the circuit of the conductors connecting them, adapted to disconnect one of the plugs from the other and to connect it to the two poles of a calling generator. A telephone set *s* is provided for the operator, connected with a key *t*, by which she is enabled to connect her telephone alternately to the connecting plug circuit and to the telephone line *p p'*. A clearing-out annunciator *u* is permanently connected with the plug circuit.

In the operation of the system shown, if the subscriber at station 1 should desire connection with subscriber at station 2, he would send the usual calling signal to the exchange office A in the usual manner, by rotating his calling generator. The operator having charge of the annunciator of the particular line to station 1, seeing the annunciator *r*³ operated, will insert one plug *v* of a pair into the springjack *r*² of the line signaling, and will place her key *t* in position to connect her telephone set with the plug *v*. She is thus enabled to receive the order of subscriber at station 1 for the connection desired. Recognizing that the station called for is connected with a different exchange office, namely, office B, the operator at office A addresses the operator at office B by means of the talking or telephonic circuit *p p'*, and gives an order for the operator at station B to establish connection between the trunk line *c c'* and the subscriber's line to station 2. The operator at office A then inserts the remaining plug *v'* of the same pair of plugs into the springjack *e* of the trunk line, whereby the subscriber's line circuit from station 1 is continued through the contact points of

the springjack *r*² to the like contacts of the plug *v*, and thence to the similar contacts of the plug *v'*, thence to the corresponding conductors *c* and *c'* of the trunk circuit, and thence to the terminal plug *l*. By the act of inserting the plug *v'* into the springjack *e*, the automatic signaling circuit of the trunk line was opened at that springjack. The operator at office B now, complying with the order which she received, inserts the terminal plug *l* into the springjack *r*² of line to station 2 at her switchboard, whereby the line circuit is continued to station 2. The operator at office B may notify the operator at office A that the connection has been completed, and the operator at office A may, by depressing her calling key, send a signaling current to substation 2. When the subscriber thereat has responded and has removed his telephone from its switch-hook, the circuits are in position to allow of communication between the subscribers. When they have completed their conversation, either of them may rotate his calling generator and send a signaling current upon the line circuit. This signaling current will find circuit through the clearing-out annunciator *u* at the office A, and will operate the same, thus indicating to the operator at that switchboard that the connection is no longer desired. That operator then removes the connecting plugs *v v'* from the springjacks into which they are inserted. This act allows the relay *g* to become de-energized, when its contact points close together and complete the earth branch *i* containing the battery *k*; the automatic signaling circuit is thereby completed, being already closed at the contact points *m*² *m*³ of the cord switch and the relay *n* is operated, closes its contact points, and thus actuates the indicator *o*. The operator at office B is thus informed that the connection between the line to station 1 and the trunk line has been removed, and she removes the terminal plug *l* from the springjack of line to station 2 and returns it to its socket. The cord switch is thus operated to open its contact points, and the indicator *o* returns to its normal position.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination with a trunk line, of a signaling circuit including a source of electricity, contact points at one of the offices included in the signaling circuit adapted to be separated by the act of connecting with the trunk line, contact points included in the signaling circuit at the other station adapted to be closed together by the act of making connection with the trunk line thereat, and an indicator in the signaling circuit at said second office, whereby said indicator is operated by the removal of the connection at the first office when connection exists from the trunk line at the second office, substantially as described.

2. The combination with a trunk line, of a signaling circuit including a portion of the trunk line, contact points at one end of said trunk line adapted to be separated when connection is made to the trunk line at that end, contact points at the other end of the trunk line adapted to be closed when connection is made to that end of the trunk line, said contact points being included in the signaling circuit, and an indicator connected with the signaling circuit, substantially as described.

3. In combination with a trunk line extending between two exchange offices and terminating at one of said offices in a springjack, and at the other in a terminal plug, of a signaling circuit normally closed at the first of said offices through contact points controlled by the springjack to be separated when connection is made to the springjack, included in said signaling circuit, a socket and cord switch for said terminal plug arranged to close said signaling circuit at that office when the terminal plug is out of the socket, a source of electricity in the signaling circuit,

and an indicator controlled by current in said circuit, substantially as described.

4. The combination with a trunk line circuit terminating in a springjack at one office, and in a terminal plug at the other office, of contact points controlled by said springjack to open a branch circuit from one side of said trunk line to earth when connection is made with the springjack, a cord switch for said terminal plug adapted to close a branch from the same side of said trunk line to earth, when the plug is removed therefrom, a source of electricity included in the circuit formed by the two earth branches and one side of the trunk line, and an indicator at the second office included in said circuit, substantially as described.

In witness whereof I hereunto subscribe my name this 10th day of December, A. D. 1892.

ORO A. BELL.

Witnesses:

MILLS H. LANDON,
A. L. SAER.