

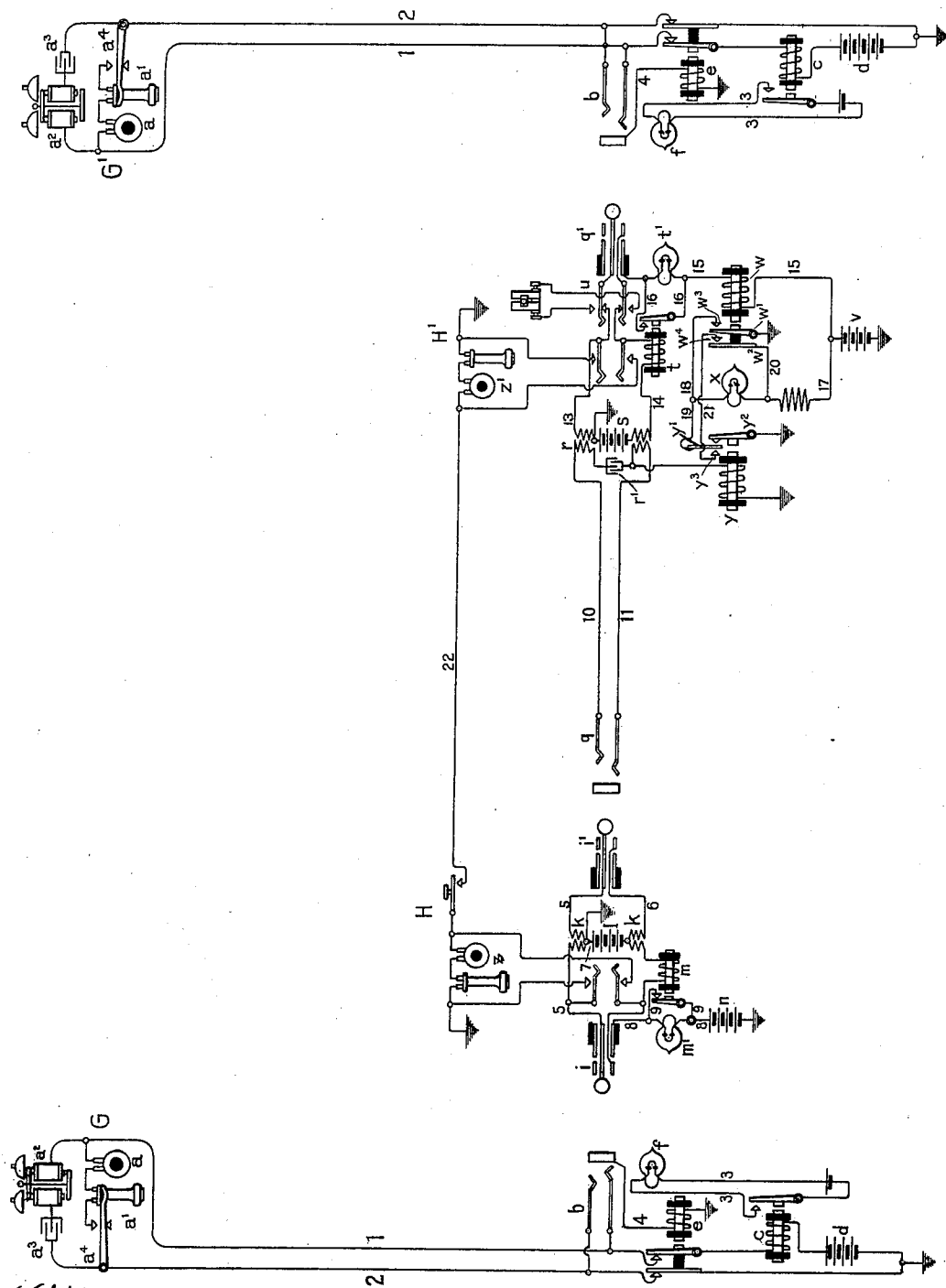
No. 650,485.

Patented May 29, 1900.

C. E. SCRIBNER.
SIGNAL FOR TELEPHONE TRUNK LINES.

(Application filed June 15, 1898.)

(No Model.)



Witnesses:

A. M. Danner

George L. Cragg

Inventor,

Charles E. Scribner

By *Barton & Brown*
Attorneys.

UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN
ELECTRIC COMPANY, OF SAME PLACE.

SIGNAL FOR TELEPHONE TRUNK-LINES.

SPECIFICATION forming part of Letters Patent No. 650,485, dated May 29, 1900.

Application filed June 15, 1898. Serial No. 683,477. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Signals for Telephone Trunk-Lines, (Case No. 463,) of which the following is a full, clear, concise, and exact description.

This invention applies to trunk-lines between different offices of a telephone-exchange system; and it consists in a signal in the nature of a guard-signal before the operator who completes the connection with the called party to indicate to her any departure from a certain predetermined and normal process of effecting disconnection.

In organizing a system of trunking between different offices of a telephone-exchange it is common to provide means at one exchange for making connection from the line of a calling subscriber to one terminal of a selected trunk-line, whose other terminal is in a switch-board with a terminal connection of the line called for. The former operator might be termed the "outgoing-trunk" operator or the "originating" operator; but inasmuch as in the usual practice she attends to all connections with the subscribers and supervision of the connections she is termed the "supervising" operator. The operator having charge of the distant terminal of the trunk-line, who makes connection with the line of the party called for, is known as the "incoming-trunk" operator. In the mode of operating trunk-lines preferred under usual conditions the incoming trunk operator is directed in the removal of a connection between the trunk-line and the called line by the supervising operator, although the practice may be varied in this respect; but in any event it is desirable that the incoming end of the trunk-line be not disconnected from the called subscriber's line except in coincidence with the disconnection of the outgoing end of the same trunk-line from the line of the calling party. The present invention is addressed to this requirement of operating trunk-lines. It consists in the use at the incoming terminal of a trunk-line of a signal, with means for displaying the signal when the incoming end of the trunk-line is disconnected from the line of

the called party, while connection still remains between the calling line and the trunk-line or when the connection of the trunk-line with the calling line is removed while the incoming terminal of the trunk-line is still united with the called line. This signal is of special utility in connection with lines arranged for the automatic operation of call-signals, which constitute peremptory calls for action on the part of the operator without supervision by means of the telephone. When connection with such lines is made by means of the incoming terminal of a trunk-line with which a signal is associated to be displayed when the telephone of the called party is replaced on its switch, which display constitutes a call for disconnection, it is essential that disconnection be not effected in response to the call until corresponding instruction is received from the supervising operator. In applying the present invention to such an organization of switching and signaling apparatus I provide a clearing-out signal associated with the incoming terminal of the trunk-line, with means for controlling it from the station of the called line, and a guard-signal, also associated with the same terminal of the trunk-line, with means for displaying it in case the connection with either extremity of the trunk-line is removed while that at the other extremity still exists. The supervising operator may have any usual or necessary appliances for ascertaining when the calling subscriber terminates his use of the telephone line, in accordance with which information the supervising operator should remove connection between the calling line and the trunk-line. In the operation of such a system of signals the clearing-out signal of the incoming terminal of the trunk-line will be displayed when the called subscriber has terminated his use of the line; but the incoming-trunk operator will remove connection with the line only when the guard-signal becomes displayed through the disconnection of the outgoing terminal of the trunk-line from the line of the calling subscriber by the supervising operator. In case, however, the incoming-trunk operator should break connection with the line of the called party the guard-signal would be displayed, which, in

connection with the idle condition of the incoming terminal of the trunk-line, would indicate to her that the connection had not yet been broken by the supervising operator.

5 The means for accomplishing these functions of the guard-signal constitute a feature of the present invention. In general this means may comprise switch-contacts which are actuated in making connection between the incoming
10 terminal of the trunk-line and the line of the called party and other switch-contacts actuated in making connection between the outgoing terminal of the same trunk-line and the line of the calling party, together with circuits
15 which are made operative in the joint action of these switches to prevent the display of the guard-signal. A specific form of the instrumentalities for effecting this end may consist in a guard-signal in a local circuit, together
20 with a source of current, a shunt of the guard-signal, a switch which is closed in making connection from the trunk-line to the line of the called party, completing one normal break in the shunt, and a switch closed in making con-
25 nection between the outgoing terminal of the same trunk-line and the line of the called subscriber or other equivalent act to complete a second normal break in the shunt-circuit. I prefer in the commercial application of the
30 invention to employ an incandescent lamp as a guard-signal and to control the normal breaks in the shunt thereof through the agency of relays properly situated in circuits associated with the trunk-line, and I so ar-
35 range connections of the guard-signal that the circuits thereof are broken during the idle condition of the trunk-line to prevent waste of current and inopportune display of the guard-signal.

40 This invention is illustrated, diagrammatically, in the attached drawing in connection with telephone-lines provided with means for operating automatic signals and with the usual switching apparatus and signals pertaining to such lines in the switchboard. Thus
45 the two telephone-lines terminate in spring-jacks associated with line-signals in switchboards at different offices. At one of the offices there are pairs of plugs and supervising apparatus for uniting lines with each other or
50 with trunk-lines, and between the offices extends a trunk-line, terminating in a spring-jack at the originating-office and in a plug at the receiving-office. This trunk-line is fur-
55 nished with automatic supervising and guard signals, of which the first mentioned serves to indicate the response of the called subscriber and the latter calls for disconnection or warns against the reassignment of the trunk-line,
60 according to the position of the terminal-plug.

The apparatus at the substation comprises telephones a and a' , a call-bell a^2 , a condenser a^3 , and a telephone-switch a^4 . The condenser and call-bell are located in a permanently-
65 closed bridge of the line-circuit. The telephones are in a bridge of the circuit, which becomes closed in the operation of the tele-

phone-switch when the receiving-telephone is taken for use. Line conductors 1 and 2 lead from the substation apparatus to a cen- 70
tral office, where they are connected with spring-jacks and calling appliances. Within the central office the line conductors 1 and 2 are connected with the open terminal-contacts of a spring-jack b in a switchboard. From 75
this jack normally-closed extensions to earth exist, that of line conductor 1 including a relay c and a source of current d , and both being controlled by the switch-contacts of a cut-off relay e . The line-relay c serves to close a local 80
circuit 3, which includes a secondary line-signal f , placed near the spring-jack b in the switchboard. The magnet of the cut-off relay e of each line is in a portion 4 of a local circuit, which terminates in a normally-open-con- 85
tact-piece of a spring-jack, which is designed to register with a contact-piece of a plug forming the terminal of another portion of the complete local circuit.

The lines from the different stations G and 90
 G' enter switchboards at different offices H and H' . Connection between lines entering the different switchboards is to be made through the agency of link conductors, comprising a plug-circuit at one switchboard and 95
a trunk-line extending from the same board to the other office and arranged for connection with a line there. This arrangement contemplates the initiation of connections in the first switchboard and the completion of such con- 100
nections in the second switchboard. Obviously reciprocal arrangements would be made in the way of trunk-lines, plug-circuits, and associated apparatus for completing at the first-mentioned switchboard connections which 105
originated at the other office. The switchboard H is equipped with the usual pairs of plugs i and i' , with plug-circuits 5 6 uniting like line-contacts of the plugs. The two conductors of the plug-circuit each include two 110
serially-connected windings of a repeating-coil k , and the points of junction of the windings in the two conductors are united by a bridge 7, which includes a source of current l . The usual listening-key is provided for con- 115
necting an operator's telephone with the plug-circuit. In practice there would be also calling-keys and apparatus for supervising, which are not shown in the drawing, since they are not essential to the operation of the present 120
invention. The conductor 6 of the plug-circuit leading to the line-contact of plug i includes the magnet-winding of a relay m , which controls a supervisory signal m' through the agency of the following circuits: A conductor 125
8 leads from the free pole of battery n to the sleeve of plug i , which is designed to make contact with the ring of a spring-jack, into which it is inserted, forming the terminal of wire 4. About the signal m' is a shunt 9, 130
whose continuity is controlled by the switch-contacts of relay m . Hence while a connection exists current flows through wires 8 and 4, which excites the cut-off relay e and which

lights the signal-lamp m' when current is not diverted therefrom through the shunt 9. A trunk-line 10 11 extends from the office H to the office H', terminating in a spring-jack q at the office H and in a terminal-plug q' at the office H'. The terminal of the trunk-line at the office H' is arranged as respects the circuits and apparatus in the way substantially similar to the plug-circuit of plugs i and i' . A repeating-coil r is interposed in the line conductors. The circuit between the incoming conductors is closed through two windings, which have a condenser r' interposed between them. The circuits of conductors 13 and 14, leading to the terminal-plug q' , which are, in fact, extensions of the trunk-circuit, but which are conductively separated therefrom, are united through other windings of the same repeating-coil, a battery s being connected in the circuit between them. A supervisory relay t has its magnet-winding in the conductor 14 and controls a supervisory signal t' , which is associated with the plug q' in the switchboard and refers to the station of the called line. The switch-contacts of a calling key u are included in the circuit in order that the operator at office H', who will be hereinafter termed the "incoming-trunk" operator, may transmit a calling current to any station with which she may make connection by means of plug q' . The sleeve-contact of plug q' forms the terminal of a conductor 15, leading from the free pole of a grounded battery v , including the signal-lamp t' and the magnet-winding of a relay w . The display of the signal t' is determined by the condition of a shunt 16, controlled by the supervisory relay t . A second signal x is associated with the plug q' and is designed to serve as a guard-signal to prevent the removal of connection with the trunk-line at either terminal station without simultaneous action at the other terminal. This signal is controlled jointly by the relay w and by a relay y . The latter is in a ground branch from the conductor 11 of the portion of the trunk-line leading to station H. The relay y has two pairs of contact-points, which become closed when the magnet of the relay is excited. These consist in springs w' and w'' , which are thrust against springs w^3 and w^4 by the armature. Relay y has three contact-points, which are connected together through the action of the armature. These are springs y' and y'' and contact-anvil y^3 . Spring y'' rests normally on a stop, while the spring y' separates from it by virtue of its own resiliency. When the magnet is excited and the armature is drawn forward, lever y^2 is thrust against spring y' and forces the latter against contact-anvil y^3 . The circuit of lamp x is that before mentioned in the general description of this invention, consisting of two local circuits, either of which may be closed by one of the relays, with a shunt of the guard-signal, which may be closed in the simultaneous operation of both relays. A

conductor 17 leads from the battery v through a resistance-coil and through the guard-signal x , after which the conductor is divided into two, 18 and 19, which lead to the contact-anvil w^3 and spring y' , respectively. The contact-spring w' is connected to earth. Contact-lever y^2 is connected to earth. A wire 20 leads from wire 17 between the lamp and the resistance-coil to the contact-spring w^2 . The contact-anvil w^4 of the same spring is connected by wire 21 with anvil y^3 of relay y . It will be observed that the excitement of either relay will close a circuit to ground through wires 17 and 18 or 19, which would permit the lighting of lamp x ; but the excitement of both relays would close another circuit in addition to these made up of wires 20 21, which would bring about the extinction of the lamp. Of course the resistance in the wire 17 should be sufficient to permit the proper lighting of lamp x by battery v .

The operators at the different offices have telephones z at station H and z' at station H'. These may be brought into circuit together by means of order-wire 22, which is controlled by a key manipulated by the operator at office H to permit communication between the operators.

In the use of this apparatus a connection must be assumed to originate with the subscriber at station G. By removing his telephone from its switch for use the subscriber permits the closure of the line-circuit 1 2 at the station, whereby a path is furnished for battery d through the relay c , which brings about the lighting of the secondary line-signal f . Responding to this call, the operator inserts plug i into the spring-jack b of the calling line and brings her telephone into connection with the plug-circuit to learn the subscriber's order. Having received instructions to make connection with line from station G' entering the office H', the operator at office H brings her telephone into the order-wire 22 and instructs the incoming trunk operator at office H' to make connection with line to station G'. The latter operator, observing that the trunk-line 10 11 is free for use, inserts the plug q' into the spring-jack b of the line called for. At the same moment she designates trunk-line 10 11 to the operator at office H, who then inserts plug i' into the terminal spring-jack q of the designated trunk-line. The two substations are thus brought into electrical connection, the circuit being by way of conductors 1 and 2 of the line to station G, conductors 5 and 6 of the plug-circuit at office H, conductors 10 and 11 of the trunk-line, together with their extensions 13 14, and line conductors 1 and 2 to station G'. The insertion of plug i in spring-jack b closed the local circuit 8 4, including the magnet of cut-off relay e . The cut-off relay being thus excited severed the normal ground connections of the calling line. At the same time current was provided for exciting the supervisory sig-

nal m' ; but inasmuch as current flows from the battery in the bridge 7 of the plug-circuit to excite the relay m this lamp would be shunted and would give no signal. Likewise the insertion of plug q' in spring-jack b of the line called for closed the local circuit 15 4, including the cut-off relay of the latter line, so that the last-mentioned line was placed in similar condition for telephonic use. The circuit at the substation G' remains open as respects the battery s until the telephone at the station is taken for use in response to the call. Meanwhile the relay t remains inert, and the supervisory signal t' is lighted by the current flowing through conductor 15. Current in the same conductor excites the magnet w and brings about the closure of the various pairs of contacts controlled by its armature; but inasmuch as the effect of the action of this magnet is modified by that of magnet y the condition of the latter must now be traced. The insertion of plug i' into the terminal jack q of the trunk-line at switchboard H applied the battery l to the conductor 11 of the trunk-line, whereby a circuit for that battery was formed through a portion of conductor 6 of the plug-circuit, conductor 11 of the trunk-line, and the magnet-winding of relay y at the office H' . The closure of contact-points $w' w^3$ connects the wire 17 with earth and tends to light the lamp x . The closure of contact-points y' and y^2 completes the earth connection of wire 19; but the simultaneous closure of the contacts $w^2 w^4$ and $y^2 y^3$ completes the shunt 20 21 about the lamp, and thus prevents its illumination. Thus until the connected subscribers enter into communication the lamp t' remains lighted, while the lamp x is dark. When the correspondents terminate their conversation and replace their telephones on the switches, lamp m' is lighted at the office H and lamp t' is lighted at office H' . These signals inform the operators at the different terminals of the trunk-line of the idle condition of the telephones at the respective stations with which they have made connection and constitute instructions to each to disconnect the lines. In the normal operation of the switchboard the supervising operator at the office H will rely solely on the signal from the calling subscriber, since it is found in practice that the replacement of the telephone at the calling station is a more positive significance as respects the termination of conversation than the similar act at the called station. Hence the supervising operator at office H will immediately withdraw plugs i and i' from the spring-jacks into which they are inserted. The withdrawal of plug i' from the jack q breaks the connection of battery l with the conductor 11 of the trunk-line, and thus deprives the magnet y at office H' of current. The magnet being thus demagnetized permits its switch-contacts to separate, breaking the earth connection of the shunt-wire 21. Current now flows in the local circuit of lamp x

through wire 17 by way of the contact-points $w' w^3$ of relay w , which still remain closed, and the lamp is lighted to serve as a clearing-out signal to the incoming-trunk operator. The latter operator, observing the illumination of both signals t' and x , withdraws the terminal of the incoming trunk-line from the spring-jack of the called line, and thus completes the act of disconnecting the lines. The breaking of circuit 15 4 in this act deprives the lamp t' of current, and thus effaces its signal, and also renders the magnet w inert, through the action of which the local circuit of lamp x is broken. Thus all the signals become inert and the apparatus is returned to its normal condition.

The operation of lamp x , as just traced, is in its usual function of clearing-out signal to the incoming-trunk operator. It has, however, another use as a guard-signal to warn the incoming-trunk operator in case she should disconnect the trunk-line from the line of the called party before the connection with the trunk-line has been removed at the outgoing terminal. Thus if the incoming-trunk operator should rely on the signal t' or if she should accidentally disconnect the trunk-line from the line of the called party the lamp x should indicate to her that connection still existed with the distant terminal of the trunk-line. This signal x is of largest utility in this respect when the office H is provided with the usual annunciators operated by means of a generator of signaling-current. The special clearing-out signal from the calling station to the office H will then be given considerably later than the automatic display of lamp t' at the office H , and in many cases the act of clearing out will be neglected by the calling subscriber. In the case of trunk-lines extending from annunciator offices to incoming trunk-switchboards provided with automatic signals it is preferable to permit the incoming-trunk operator to disconnect the trunk-line in response to the display of the supervisory signal t' . Then if after disconnecting the trunk-line from the line of the called party the guard-lamp x remains lighted this constitutes a signal to the incoming-trunk operator that the connection has not yet been removed at the other terminal of the trunk-line and is a warning to prevent assignment of this trunk-line for subsequent use while the signal x remains lighted.

The present invention applies, essentially, to the apparatus associated with the incoming terminal of the trunk-line, together with the means for operating the magnet y from the outgoing terminal of the trunk-line in making or breaking connection therewith. Hence the nature of the apparatus at the office G is of no importance as respects the structure of the present invention, but concerns only the mode of its use and the significance attached to the signals. Those skilled in the art of telephony are familiar with numerous ways of applying current to a trunk-line in

connecting or removing connection with it. For these reasons the apparatus of the relay-switchboard only has been illustrated at the outgoing terminal of the trunk-line.

5 I claim as the invention and desire to secure by Letters Patent—

1. The combination with an interoffice trunk-line, subscribers' lines, means for making connection from a calling-subscriber's
10 line to the outgoing terminal of the trunk-line at one office, and supervising mechanism at the said office, means for making connection from the incoming terminal of the trunk-line to the called-subscriber's line, a signal
15 at the incoming terminal of the trunk-line, an exciting-circuit for the signal closed in making connection with the trunk-line at either office, and a circuit closed in completing connection at both terminals of the trunk-line adapted to cause the effacement of the
20 signal; whereby the signal is a clearing-out signal when connection exists only at the incoming end of the trunk-line, but is a guard-signal when connection exists only at the outgoing terminal thereof, as described.

2. In combination with a trunk-line at the incoming terminal thereof, of a signal and two circuits therefor, means for closing one circuit in making connection with the outgoing
30 terminal of the trunk-line, means for closing the other circuit in making connection with the incoming terminal of the trunk-line, and circuit connections made operative in the simultaneous completion of both said circuits adapted to cause the effacement of the
35 indication of said signal, substantially as described.

3. The combination with an interoffice trunk-line at the incoming terminal thereof,
40 of a signal-lamp, a local circuit including the lamp together with a source of current, said circuit being divided at one point into parallel branches, two relays, means for exciting one of the relays in making connection with the
45 incoming terminal of the trunk-line, means

for exciting the other of the relays in making connection with the outgoing terminal of the trunk-line, the continuity of one of said branches being controlled by each of the relays, and means made operative in the simultaneous excitement of both relays to interrupt the current through the lamp, as described.

4. The combination with an interoffice trunk-line at the incoming terminal thereof, 55 of a signal-lamp, a local circuit including the lamp together with a source of current, said local circuit being divided into parallel branches which are normally open, two relays, means for exciting one of the relays in making connection with the incoming terminal of the trunk-line, means for exciting the other relay in making connection with the outgoing terminal of the trunk-line, the continuity of one of said branches being controlled
65 by each of the relays, a shunt of the lamp, and normally-open switch-contacts of both relays included in the said shunt, as described.

5. The combination with an interoffice trunk-line at the incoming terminal thereof, 70 of a lamp-signal, a local circuit therefor including a source of current and divided into parallel branches, two relays, controlling normal breaks in the different branches, a circuit through the magnet of one of said relays, 75 and means for closing said circuit in making connection with the outgoing terminal of the trunk-line, a circuit through the magnet of the other relay, and means for closing it in making connection with the incoming terminal of the trunk-line, a shunt of the lamp, and normally-open switch-contacts of both
80 said relays included serially in said shunt, as described.

In witness whereof I hereunto subscribe my name this 2d day of April, A. D. 1898.

CHARLES E. SCRIBNER.

Witnesses:

ELLA EDLER,
MYRTA F. GREEN.