

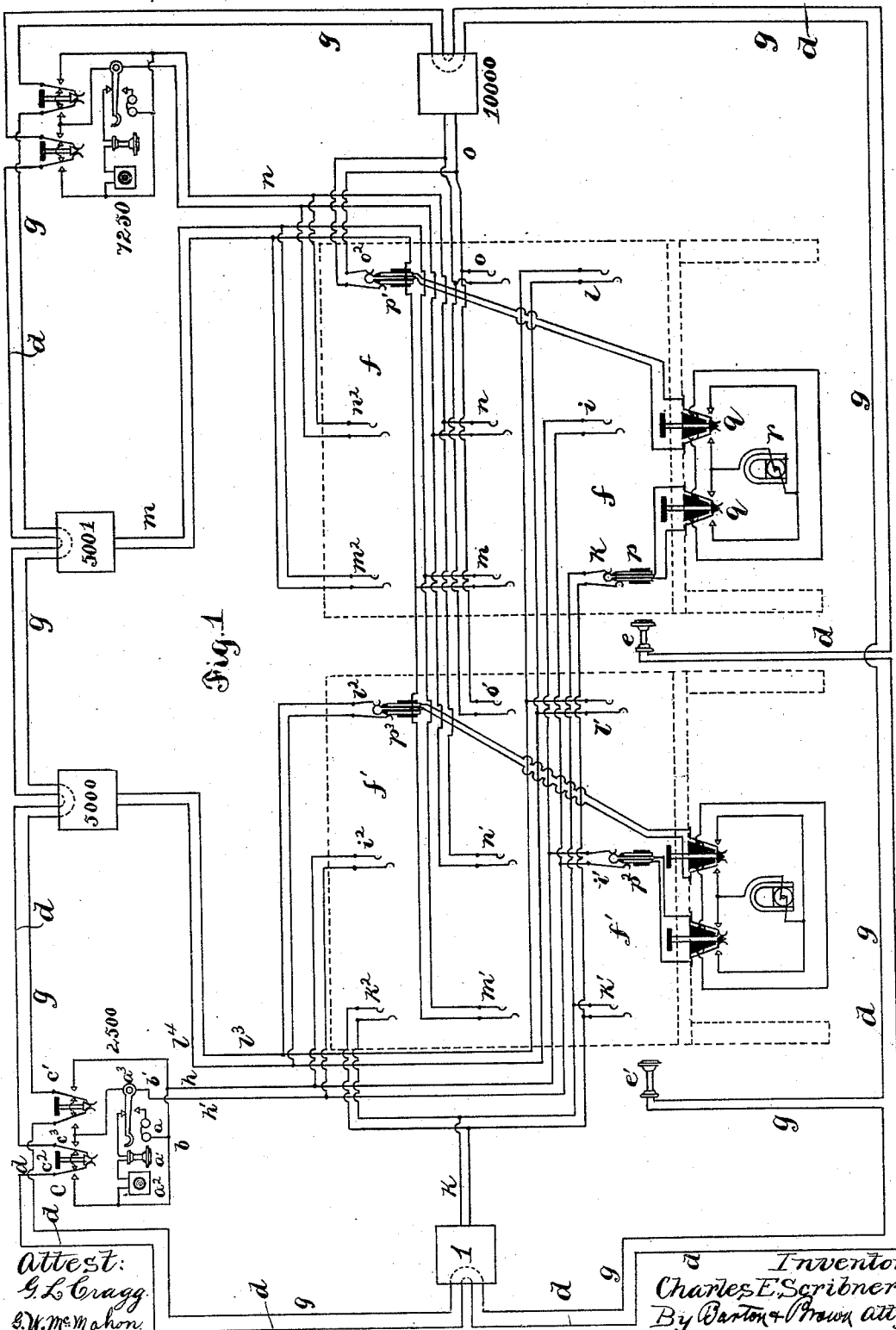
(No Model.)

2 Sheets—Sheet 1.

C. E. SCRIBNER.
TELEPHONE EXCHANGE SYSTEM.

No. 487,097.

Patented Nov. 29, 1892.



Attest:
G. L. Cragg
S. W. McMahon.

Inventor
Charles E. Scribner
By Barton & Brown attys

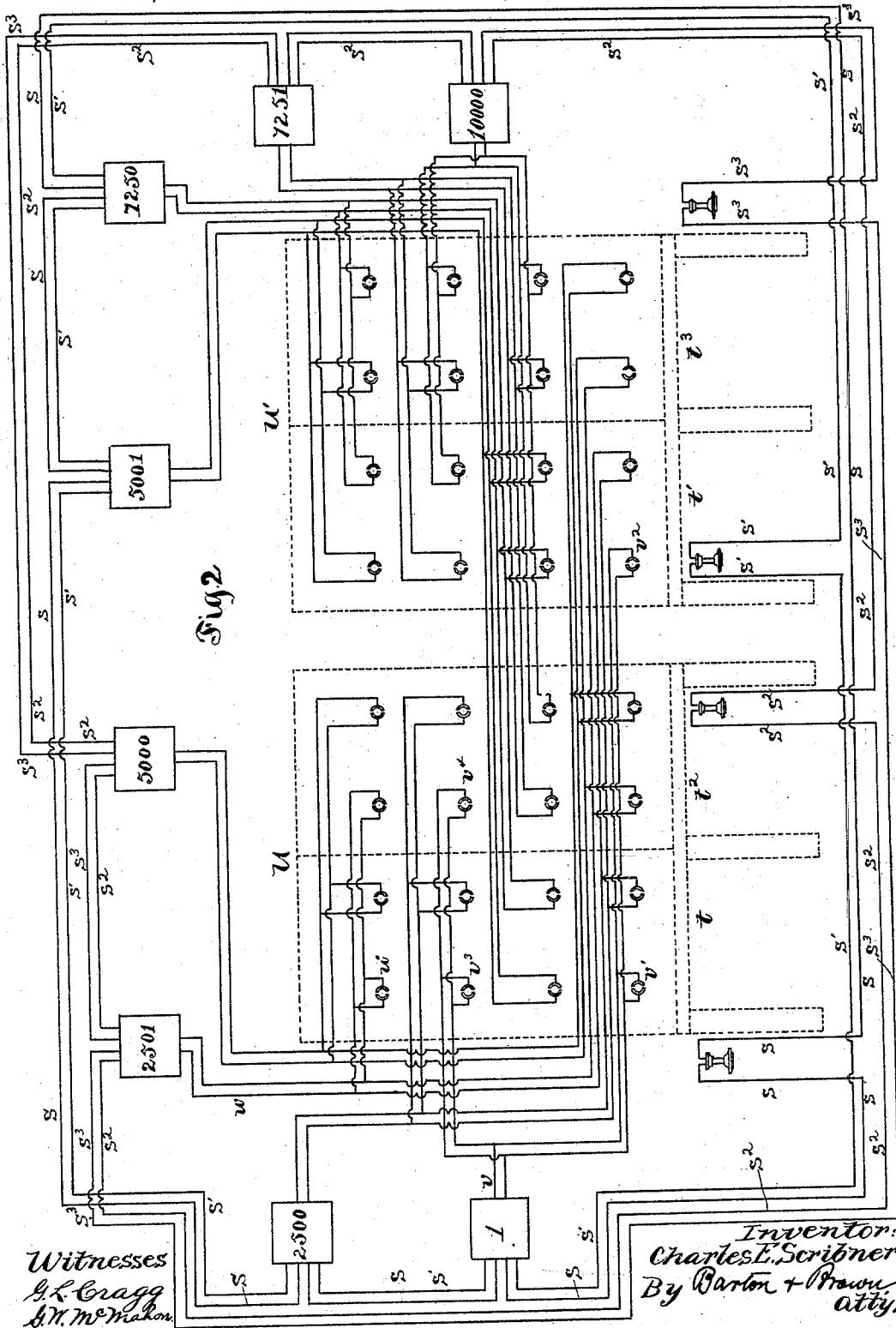
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Witnesses
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UNITED STATES PATENT OFFICE.

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

TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 487,067, dated November 29, 1892.

Application filed April 16, 1892. Serial No. 429,487. (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 Telephone-Exchange Systems, (Case No. 299,) 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 switchboard systems for telephone-exchanges. Its object is to provide means whereby the sub-stations of a telephone-exchange system may be divided into several groups, all the members of each group being connected to a separate switchboard and each member of each group being enabled to obtain connection at one or the other of the switchboards with another member of the same or of another group, respectively.

Heretofore in some exchange systems a "circuit-wire" or a "calling-wire" has been provided, extending to and looping through a considerable number of sub-stations, an attendant being stationed at the exchange, constantly listening at a telephone included in the calling-wire circuit to receive calls from any sub-station connected with that particular calling-wire. In addition to the calling-circuit each sub-station is provided with a line-circuit extending to the exchange, and connected to a terminal socket or spring-jack switch upon a switchboard thereat, whereby the attendant operator, having received an order over the call-circuit, may establish connection by means of connecting cords and plugs between any two lines on the switchboard. Since the number of subscribers to whose wants one operator can attend is limited, a number of operators have each been furnished with terminal spring-jacks of all of the lines extending to the exchange, all the terminal spring-jacks of one line being connected in multiple to the line-circuit. The number of spring-jacks and the number of switchboards is thus, in large exchanges very large, and the exchange is correspondingly expensive and troublesome.

In my invention I have divided the sub-stations into several groups. Each member of each group is connected to the exchange by

a line-circuit and with an answering spring-jack switch upon each of the boards and with a line-jack or terminal switch upon one of the switchboards. Two or more calling-circuits, corresponding to the number of groups, extend to and include every sub-station of the exchange. Each of these circuits terminates in a telephone-receiver or other magnetic indicating device at one of the switchboards. The sub-station is provided with apparatus whereby the subscriber may introduce his telephone set into any calling-circuit at pleasure, and may thus give his order to the listening operator at any switchboard. Should a subscriber desire connection with another sub-station of the exchange system, he first ascertains to which group the sub-station with which he desires connection belongs. Then connecting his telephone set to the calling-circuit terminating at the particular switchboard at which the terminal socket or line spring-jack of the line desired is situated he gives his order to the listening operator thereat. The operator then inserts one loop-plug of a pair into the answering-jack of the calling-line and the other loop-plug of the pair into the terminal jack of the line called for, whereby the two subscribers are placed in communication. Thus each sub-station may be considered as being connected to two separate exchanges by separate calling-wires, but having a line-circuit connected with an answering-jack at each of the exchanges, whereby he is enabled to call up and be connected to any subscriber of either exchange. A great saving is thus effected in the size and expense of the exchange system over an equivalent multiple-switchboard system, in which each subscriber is provided with a terminal spring-jack upon every section of switchboard and an answering-jack at one of the boards. When each of the groups comprises a large number of sub-stations, the switchboard upon which the terminal or line jacks of that group are located may be of the multiple type, a number of line-jacks upon the different sections of a multiple switchboard being connected to each line-circuit.

Since it is impossible for a few listening operators to attend to the wants of all the members of one group, a considerable num-

ber of calling-circuits may be provided for a large exchange, each group of calling-circuits extending to a subordinate smaller group of sub-stations, the different calling-circuits terminating at telephone-receivers upon the different switchboards, as herein described, one circuit terminating at each section of multiple switchboard.

If desired, other signal-receiving apparatus or indicating device than the telephone-receiver may be employed at the sub-station in place of the receivers to receive calling-signals, in which case a suitable source of current may be provided at the sub-station to actuate the signal-receiving device at the exchange.

My invention is adapted to either metallic or grounded circuit systems. The line-circuits or the calling-circuits, or both, may be either grounded or metallic.

My invention is illustrated in the accompanying drawings.

In Figure 1 thereof I have shown six sub-stations divided into two groups of three each, the members of each group being connected, as described, with an answering-jack upon each of two switchboards and with a line-jack upon one of the boards. Two calling-circuits are shown extending to and including all of the sub-stations, each of the calling-circuits terminating in a telephone at one of the switchboards. In Fig. 2 I have represented eight sub-stations divided into two major groups connected to two different multiple-switchboard systems, each line-circuit from a sub-station being connected to an answering-jack upon one section of each of the multiple-switchboard systems and to a line-jack upon each section of one of the multiple-switchboard systems. Each of the major groups of two is divided into subordinate groups of two each, each subordinate group being provided with a pair of calling-circuits, one of which terminates at one section of each of the multiple-switchboard systems.

Referring to Fig. 1, I will briefly describe the apparatus at the sub-station, that at station 2,500 at the left of the drawings being taken for example. The apparatus comprises a signal-bell a and a telephone receiver a' and transmitter a^2 in two separate branches from a conductor b and a gravity-switch a^3 , connected to the other conductor b' of the line and adapted to connect the signal-bell a of the telephone apparatus alternately in circuit between the conductors b b' . Two loop-keys c c' are provided, of well-known construction, arranged to loop the telephone set into the circuit of the conductor connected to the contact-springs c^2 c^3 when the plunger of the key is depressed. The loop-key c is connected with the calling-circuit d , which extends in series through a similar loop-key at each of the sub-stations 1, 5,001, and so on, and through a telephone-receiver e upon a switchboard f at the exchange. The other loop-key c' at sub-station 2,500 is connected

with the calling-circuit g , which is similarly connected through the other loop-keys at the different sub-stations and to a telephone-receiver e' at the switchboard f' . A telephone-line circuit h h' extends from the conductors b b' to answering-jacks i' and i upon the switchboards f' f , respectively, and to a line-jack i^2 upon the switchboard f' . Similar line-circuits extend from the sub-stations 1 and 5,000 to similar answering-jacks k' k and l' l upon the switchboards f' f , respectively, and to line-jacks k^2 and l^2 upon the switchboard f' . Line-circuits m , n , and o extend from the sub-stations 5,001, 7,250, and 10,000 to answering-jacks o' o , n' n , and m' m , respectively, upon the two switchboards f' f and to line spring-jacks o^2 , n^2 , and m^2 upon the switchboard f . It will be noted that the exchange system is supposed in this instance to consist of ten thousand subscribers, which are divided into two groups of five thousand each, each member of each group having an answering-jack upon each of the switchboards f f' , the lines from 1 to 5,000, inclusive, however, having their line-terminals upon the switchboard f' and the stations from 5,001 to 10,000, inclusive, having their line-terminals upon the switchboard f .

The operator at each of the boards is provided with connecting and signaling apparatus, which may be of the usual character. It may comprise a pair of loop-plugs whose like contact-pieces are connected together through flexible cords, calling-keys being included in the cord-circuit, arranged to disconnect both contact-pieces of one of the plugs from those of the other and to connect them to a calling-generator to send signal-current to the sub-stations. Such apparatus is shown at the board f , whereat the operator is provided with a pair of plugs p p' , connected by flexible conductors and connected with calling-keys q q , adapted to connect the contact-pieces of either plug to the calling-generator r .

I will now describe the operation of the system shown. Suppose that subscriber at station 2,500 desires to obtain connection with sub-station 5,000. He depresses the key c' , thereby opening the calling-circuit g and looping his telephone set a' a^2 , the receiver having been removed from the switch-hook a^3 into the calling-circuit g . He then gives his order to the operator, listening at receiver e' at board f' . This operator then inserts one loop-plug p^2 of the pair at her board into the answering-jack i' of line from station 2,500 and the other loop-plug p^3 into the line-jack i^2 of line to station 5,000 at her board. The two sub-stations are thus looped together into a continuous metallic circuit, which may be readily traced over conductors h h' to answering-jack i' , thence through plug p^2 and the cord-circuit to plug p^3 , thence to line-jack i^2 , and thence over line l^3 l^4 to sub-station 5,000. The operator then depresses the plunger of a calling-key included in circuit with the plug p^3 , connecting that plug to a calling-generator

and sending a calling-current to sub-station 5,000, where the current finds circuit through the signal-bell *a*, which is thereby operated.

When the subscriber at station 5,000 has removed his telephone from his switch-hook, the subscribers at station 2,500 and 5,000 are in communication. The apparatus at board *f*' is shown in the position of connecting the sub-stations 2,500 and 5,000, as described. Suppose, again, that subscriber at station 2,500 should desire to communicate with a subscriber of the other group—say sub-station 7,250. He would then depress the plunger of key *c*, connecting his telephone set into the calling-circuit *d* and giving his order through the telephone *e* to the operator at switchboard *f*. This operator would then insert one connecting-plug *p* of a pair into the answering-jack *i* of station 2,500 and the other plug *p*' into the line-jack *n*² of station 7,250, whereby the sub-stations 2,500 and 7,250 would be connected into a similar continuous loop-circuit. The sub-stations 1 and 10,000 are shown thus connected at the board *f*.

In Fig. 2 are shown eight sub-stations, being members of an exchange system of ten thousand subscribers, which are similarly divided into two groups of five thousand each; but these groups are further subdivided into groups of two thousand five hundred each. Four calling-circuits are provided, arranged in two pairs, both members of each pair extending to two stations of each large group, one calling-circuit terminating in a telephone-receiver at each section of switchboard. Thus the circuit *s* extends to and includes the sub-stations 1, 2,500, 5,001, and 7,250 and terminates at the section *t* of the switchboard *u*. The alternate of the circuits *s*—that is, the circuit *s*'—extends to the same sub-stations and terminates at the section *t*' of the switchboard *u*'. Similarly the circuit *s*² terminates at the section *t*² of the board *u* and its mate or alternate *s*³ terminates upon the section *t*³ of board *u*'. The line-circuit from each sub-station extends to an answering-jack upon one section of each switchboard, as stated, and to a line-jack of each section of one switchboard. Thus, for example, the line-circuit *v* of station 1 extends to answering-jacks *v*' and *v*² upon the sections *t* and *t*' of switchboards *u* and *u*' and also to line-jacks *v*³ *v*⁴ upon the sections *t* and *t*² of switchboard *u*. The line-circuits from the other sub-stations are similarly arranged.

Suppose that subscriber at station 1 desires connection with sub-station 2,500. He would send his call-signal over the calling-circuit *s*. The order would be received by the operator at board *t*, who would insert one loop-plug of a pair in the answering-jack *v*' of the line *v* and the other plug of the pair into the line-jack *w*' at her section *t* of the switchboard *u*, thus connecting the two sub-stations over lines *v w*. If a subscriber at station 2,501 should desire to connect with subscriber at station 10,000, he would send his order over

the calling-circuit *s*³ and the operator at section *t*³ of board *u*' would receive the call and establish the desired connection.

Any of the well-known testing systems may be applied to the exchange system herein to enable the operator at one section of the multiple switchboard to determine whether the line is already in use at some other section of switchboard or not. The other connecting appliances and calling apparatus may be variously modified in accordance with the varying conditions. Such modifications will readily suggest themselves to those skilled in the art to which this invention pertains.

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

1. The combination, with a telephone-line circuit extending to an exchange, connecting with two spring-jacks upon two switchboards thereat, of two calling-circuits, each including telephone apparatus at the sub-station and each terminating in a telephone-receiver at one of the switchboards, whereby the subscriber is enabled to call the attention of the operator at either switchboard to his line-circuit and to obtain connection thereto at either switchboard, substantially as described.

2. The combination, with a telephone sub-station, of a line-circuit extending to an exchange and connected with a spring-jack upon each of two or more switchboards, two or more calling-circuits extending from the sub-station to the exchange, each calling-circuit terminating in a telephone-receiver upon a different switchboard, and means at the sub-station for including a sub-station telephone apparatus in any calling-circuit, as desired, whereby a subscriber is enabled to call the attention of the operator at any switchboard to his line and to obtain connection therewith, substantially as described.

3. The combination, with a telephone sub-station, of a line-circuit extending therefrom to an exchange and connected to a spring-jack switch upon each of several switchboards thereat, two or more calling-circuits extending from the sub-station to the exchange, each calling-circuit terminating at the exchange in an electro-magnetic indicator, and means at the sub-station for connecting a source of electricity in any particular one of the calling-circuits, whereby a subscriber is enabled to attract the attention of the operator at any switchboard to his line-circuit and the operator at any switchboard may establish connection therewith, substantially as described.

4. The combination, with a telephone sub-station, of a line-circuit extending therefrom to an exchange, connected at the exchange to a spring-jack upon each of several switchboards, several calling-circuits extending from the sub-station to the exchange, each calling-circuit including at the exchange an electro-magnetic indicator, and loop-keys at the sub-station, included in the calling-circuits, adapted to include a source of electric-

ity in said calling-circuit when actuated, substantially as described.

5 The combination, with a telephone sub-
station, of a line-circuit extending therefrom
to an exchange, connected at the exchange
to a spring-jack switch upon each of several
switchboards, and connected to a line-jack
upon one of the switchboards, several calling
circuits, each including an electro-mag-
netic indicator at a different switchboard,
and means at the sub-station for including a
source of electricity in any particular calling-
circuit, whereby a subscriber may call the
attention of any operator, any operator may
answer, and a particular operator may estab-
lish connection with the line, substantially as
described.

6 The combination, with several telephone
sub-stations, of line-circuits, one for each sub-
station, extending to an exchange and con-
nected to a spring-jack upon each of several
switchboards, several calling-circuits, each
extending to several sub-stations and includ-
ing an electro-magnetic indicator at a differ-
ent switchboard, and means at each sub-sta-
tion for including a source of electricity in
any one of the calling-circuits extending
thereto, substantially as described.

7 The combination, with several telephone
sub-stations, of line-circuits, one extending
from each sub-station to an exchange and con-
nected to an answering-jack upon each of sev-
eral switchboards thereat and to a line-jack
at one of the boards, the line-jacks being ar-
ranged in groups upon the different switch-
boards, several calling-circuits extending
from the exchange to several of the sub-sta-
tions, one calling-circuit extending from each
of the switchboards to each of the sub-stations,
each calling-circuit including a telephone-re-
ceiver at its particular switchboard at the ex-
change, means at the sub-station for telephon-
ing over any of the calling-circuits, and pairs of
connected loop-plugs at the exchange, where-
by any subscriber of any group may communi-
cate an order to the operator at any switch-
board to obtain connection with a member of
the same or any other group of subscribers,
substantially as described.

8 The combination, with several telephone
sub-stations, of line-circuits, one line-circuit

for each sub-station, extending to an exchange
and connected thereat with an answering-jack
upon each of several switchboards and with a
line-jack upon a particular one of the switch-
boards, several calling-circuits extending
from the exchange to the sub-station, one call-
ing-circuit for each switchboard extending to
each of the sub-stations, each calling-circuit
including a telephone-receiver at its particu-
lar switchboard, loop-keys at the sub-station
of each line-circuit, each adapted to connect
the telephone apparatus of the sub-station in
a particular calling-circuit, a signal-bell at the
sub-station in the line-circuit, pairs of loop-
plugs at the exchange, one plug of each pair
being arranged for insertion into an answer-
ing-jack of the line and the other plug of the
pair being adapted to be inserted into a line-
jack of a line, and keys adapted to include a
source of calling-current in the plug-circuit to
signal to a station, substantially as described.

9 The combination, with several telephone
sub-stations, of line-circuits, one for each sub-
station, each extending to an exchange and
connected to an answering-jack upon one sec-
tion of each of several multiple switchboards
and to a line-jack upon each section of a par-
ticular multiple switchboard, calling-circuits,
one extending from each section of multiple
switchboard to several sub-stations, one call-
ing-circuit extending from each switchboard
to each sub-station, calling-circuits of the dif-
ferent sections of one switchboard extending
to different sub-stations, each calling-circuit
including a telephone-receiver at its particu-
lar section of switchboard, means at the sub-
station for including the telephone apparatus
thereof in any calling-circuit connected there-
to, and means upon each section of switch-
board at the exchange for establishing con-
nection between any answering-jack at its
particular switchboard and any line-jack at
the same switchboard, substantially as de-
scribed.

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

CHARLES E. SCRIBNER.

Witnesses:

M. J. TALLETT,
GEORGE MCMAHON.