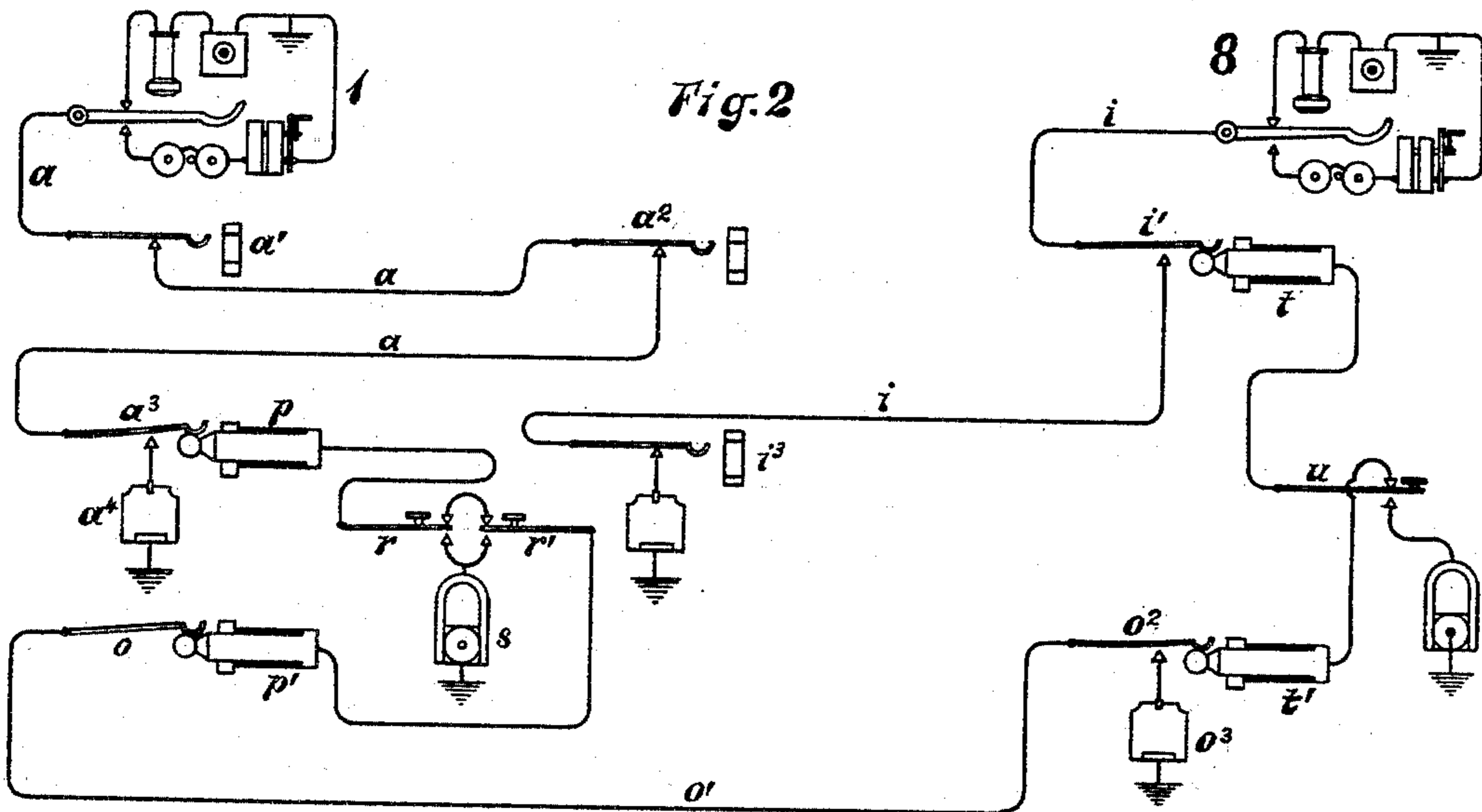
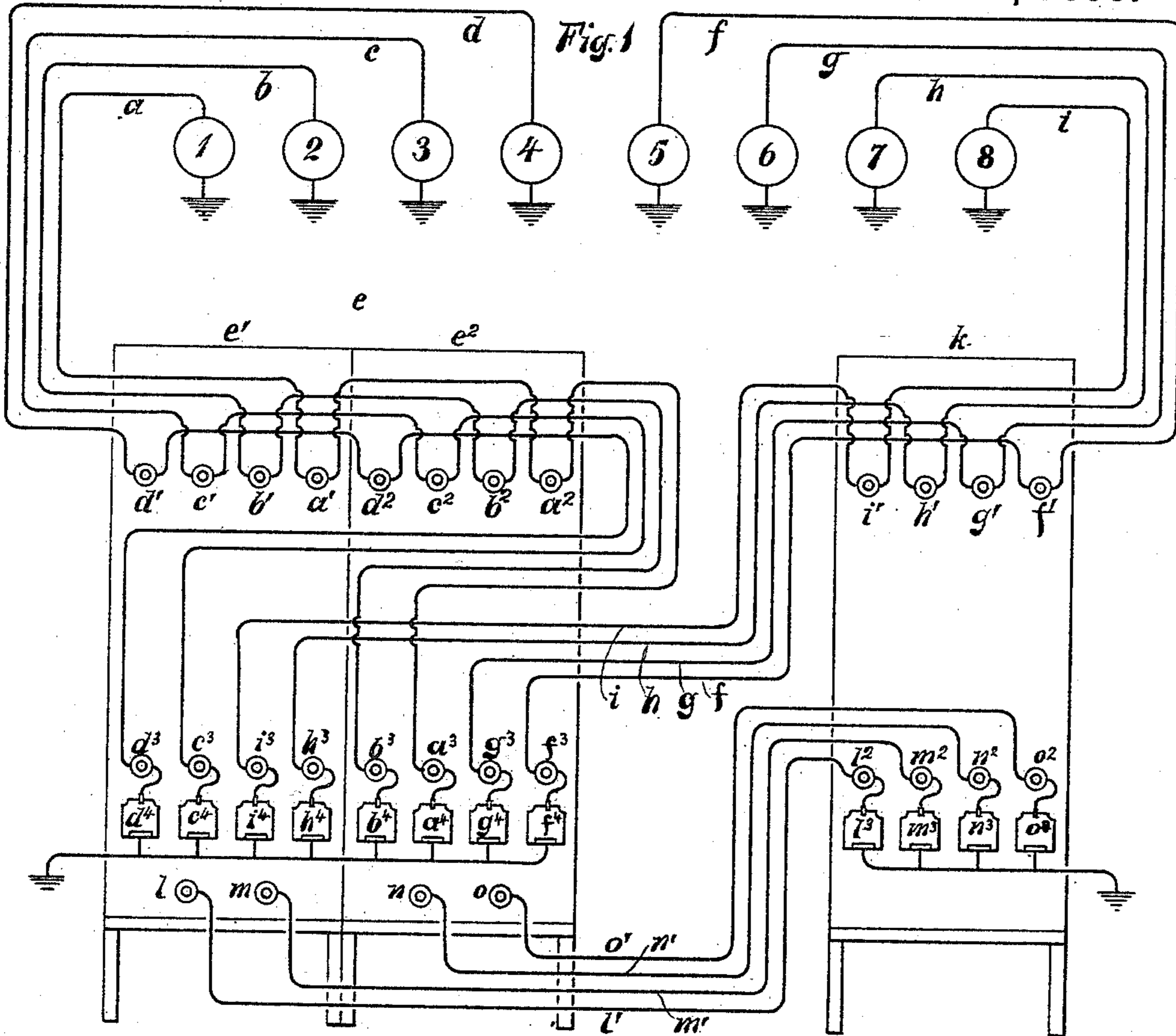


(No Model.)

C. E. SCRIBNER.  
SWITCHING SYSTEM FOR TELEPHONE EXCHANGES.

No. 491,688.

Patented Feb. 14, 1893.



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# UNITED STATES PATENT OFFICE.

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## SWITCHING SYSTEM FOR TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 491,688, dated February 14, 1893.

Application filed May 19, 1892. Serial No. 433,630. (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 Switching Systems for Telephone-Exchanges, (Case No. 311,) 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 simplify the apparatus of such exchanges, more particularly to reduce the number of spring jacks required in a large exchange.

As is well known, the switching apparatus of large exchanges, is ordinarily of the character known as the multiple switchboard system. In this system each subscriber's line is connected with a spring jack, known as the line jack, upon each section of the multiple switchboard, and also with an individual annunciator upon some particular one of the sections of the switchboard; as many subscribers' annunciators being distributed upon one section of the switchboard as can be attended by the operators stationed thereat. As the number of subscribers' lines connected with the exchange is increased, the number of switchboards required is also increased, whereby the number of spring jacks connected to each line is proportionately increased. Thus the number of spring jacks required in an exchange having a large number of subscribers is very great.

In an exchange system having a large number of subscribers, a very large portion of the whole number of connections made in the exchange is made between members of a comparatively small portion of the subscribers, and a very large proportion of the whole number of calls is made for the lines of a small portion of the subscribers. Thus, for example in a city exchange, a large part of the connections during the day is made between subscribers at various business offices, a smaller portion of the connections being made between different residences and business offices. Also, although the calls from, for example, city offices to residences may be very

few, the number of calls from the residences or other such substations to the offices or to business houses of the city, would be comparatively large. Hence, although each subscriber's line is connected with the same number of spring jacks and other apparatus upon the switchboard, a certain large number of spring jacks belonging to lines seldom called for will be used only rarely in establishing connections.

It is the object of my invention to provide means for so arranging and distributing the subscribers' lines and the spring jacks connected therewith at the exchange, that only those lines which are frequently called for shall be provided with the complete equipment of spring jacks throughout the multiple switchboard, while at the same time seldom called for subscribers may be permitted to call up and obtain connection with members of the busier group of subscribers; and to provide suitable means for establishing connections from all of the lines to the seldom called for lines.

In my improved exchange system each busy or frequently called subscriber's line is connected with a line spring jack upon each section of a multiple switchboard system, and with an answering jack and individual annunciator upon some one section of the switchboard as heretofore; the remainder of the lines, the seldom called for lines, are connected with line spring jacks upon a separate switchboard and with answering jacks and annunciators upon some section of the main multiple switchboard, and suitable transfer or trunking systems are provided, extending from the various sections of the main switchboard to the said auxiliary switchboard, by means of which to establish connection from any line at the main switchboard to the auxiliary board. Thus immediate connection between frequently called, or busy lines, whose spring jacks are all located upon the main switchboard, may be made in the usual manner; also, calls from the seldom called for lines may be received at the main switchboard, and immediate connection will be made from the answering jacks of these calling lines to the line jacks of the lines called for, if the latter be of the busy lines having line spring

jacks located upon the main switchboard. A call from either a busy or a seldom called for line for connection with one of the seldom called for lines will be received as usual at the main switchboard, but the connection will be transferred by means of the trunking system from the main switchboard to the auxiliary switchboard, whereat the connection will be established with the line jack of the line called for. Nearly all of the calls received at the exchange are for lines of a group comprising less than one-half of the subscribers of the exchange, that is, comprising the busy or frequently called lines. Thus, by placing the spring jacks of the seldom called for subscribers' lines upon one switchboard instead of upon each section of the multiple switchboard, a saving of nearly half of the spring jacks of a large exchange may be effected.

My invention is illustrated in the accompanying drawings, Figures 1 and 2.

In Fig. 1 of the drawings I have shown eight subscribers' stations, comprising four busy or frequently called for lines, and four seldom called for lines, connected with switchboards at the exchange in accordance with my improved system. In Fig. 2 I have shown two subscribers' stations, one a busy line and the other a comparatively idle line, connected through the medium of the main switchboard, the trunk line, and the auxiliary switchboard, the apparatus of the different switchboards being shown somewhat in detail.

For convenience and clearness of the drawings, the lines shown in the drawings are represented as grounded lines; it is obvious, however, that my invention is applicable to metallic circuits or to mixed systems.

Referring to Fig. 1, substations 1, 2, 3 and 4 represent substations for which frequent calls are received at the exchange, that is busy lines. These substations are connected by lines  $a$ ,  $b$ ,  $c$ , and  $d$  respectively, with spring jacks  $a'$ ,  $b'$ ,  $c'$ , and  $d'$  respectively, upon two sections  $e'$  and  $e''$  of a multiple switchboard  $e$ , each line being connected with a spring jack upon each of the boards. From the line spring jacks the lines pass to answering jacks  $a^3$ ,  $b^3$ ,  $c^3$  and  $d^3$ , upon the same multiple switchboard; two of the lines being connected with answering jacks upon one of the boards; thence the lines pass through annunciators  $a^4$ ,  $b^4$ ,  $c^4$  and  $d^4$  upon the same switchboards,—each annunciator being placed below the answering jack of its particular line,—and thence to a common ground connection. Thus the annunciators and answering jacks of two lines are under the care of an operator at each of the boards  $e'$  and  $e''$ , each operator receiving the calls from the lines at her particular board and being enabled to establish connection with the line jack of any one of the four lines at her own board.

The substations 5, 6, 7, and 8 are of the class or group to which connections are made but rarely,—that is, the comparatively idle

lines. The lines  $f$ ,  $g$ ,  $h$ , and  $i$  from these substations extend to the exchange, where they are connected first with the line jacks  $f'$ ,  $g'$ ,  $h'$ ,  $i'$  respectively, upon the separate or auxiliary switchboard  $k$ ; thence the lines extend to answering jacks  $f^3$ ,  $g^3$ ,  $h^3$  and  $i^3$ , and to annunciators  $f^4$ ,  $g^4$ ,  $h^4$  and  $i^4$ , upon the sections  $e'$  and  $e''$  of the multiple switchboard  $e$ , two of the four lines having their annunciators and answering jacks disposed upon each of the sections  $e'$  and  $e''$  of the switchboard  $e$ . The operator at each section  $e'$  and  $e''$ , by this arrangement, has under her care two annunciators of busy lines and two annunciators of comparatively idle lines, whereby the work of the exchange is distributed to secure uniformity in a well known manner.

The sections  $e'$  and  $e''$  are each provided with terminal jacks  $l$ ,  $m$ ,  $n$ , and  $o$ , of the trunk lines  $l'$ ,  $m'$ ,  $n'$ , and  $o'$ , extending to the auxiliary switchboard  $k$ , and including answering jacks  $l^2$ ,  $m^2$ ,  $n^2$  and  $o^2$ , and annunciators  $l^3$ ,  $m^3$ ,  $n^3$ , and  $o^3$  respectively thereat, and thence to earth.

The operators at each of the switchboards are supposed to be equipped with the usual connecting plugs and cords and calling and listening appliances; these are so well known as to require no description or illustration.

When a subscriber of the exchange system, as for example, subscriber at station 1, desires to obtain connection with some other subscriber, he operates his calling generator, the current finding circuit over his line to operate his particular annunciator  $a^4$  in the usual manner. The operator at board  $e''$  where that annunciator is situated, inserts a connecting plug in the answering jack  $a^3$ , connects her telephone set with line  $a$  and receives the order for connection as usual. Suppose that this order is for connection with another of this group of busy subscribers,—say for example the subscriber at station 4. The operator at board  $e''$  inserts the other of her pair of connecting plugs into the line jack  $d^2$  of line  $d$  to station 4, which line jack is situated upon her own board  $e''$ ; the two subscribers are thus immediately connected in a continuous circuit at section  $e''$  of the multiple switchboard in the ordinary manner. If a subscriber of the less busy group, as for instance subscriber at station 5, desired to communicate with subscriber at station 4, he would send a call to the exchange in the same manner, the call being received at annunciator  $f^4$  at board  $e''$ , and the connection being made between answering jack  $f^3$  and line jack  $d^2$  as before. Suppose, however, a subscriber, as subscriber 1 before, desired to obtain connection with a member of the less busy group, for example subscriber at station 8. The call from subscriber 1 would be received as before at board  $e''$ ; the operator receiving the call would, however, insert the free plug of the pair by means of one of which she answered the call from station 1, into a trunk jack, as  $o$ , at her board; she would then by

suitable means operate the annunciator  $o^3$  at the board  $k$ , attracting the attention of the operator at the board. This operator would answer the call by inserting one plug of a pair into the answering jack  $o^2$  of the trunk line  $o'$ ; having learned the order, for connection with station 8, she would insert the remaining plug of the pair into the line jack  $i'$  at board  $k$ , thus completing the connection between subscriber 1 and subscriber 8.

In Fig. 2 I have shown two substations, which may be assumed to be substations 1 and 8, thus connected by means of the transfer or trunking system. As will be seen in that figure, the apparatus at the substation is of the usual character. The line  $a$  extends from substation 1 through the spring jacks  $a'$  and  $a^2$ , thence through the answering jack  $a^3$ , and thence normally through the annunciator  $a^4$ . The line  $i$  from station 8 extends normally through the spring jack  $i'$  which is upon the board  $k$ , thence through the answering jack  $i^3$  on the section  $e^2$  of the multiple switchboard, and thence through the annunciator  $i^4$  upon the same switchboard. The operator at the board  $e^2$  is provided with connecting plugs  $p$  and  $p'$  of the ordinary character. These are connected together by means of flexible conductors, a pair of ringing keys  $r$  and  $r'$  being included in the circuit between the plugs, each adapted to disconnect one of the plugs from the other, and to connect it with one pole of the calling generator  $s$  whose other pole is grounded. The trunk jack  $o$  is shown connected by line  $o'$  with the answering jack  $o^2$  and the annunciator  $o^3$  at the switchboard  $k$ . The operator at board  $k$  is provided with a similar pair of plugs  $t$  and  $t'$  connected by flexible conductors, a single calling key  $u$  being included in the circuit between the plugs. Calling current sent from station 1 finds circuit through the line  $a$ , spring jacks  $a'$ ,  $a^2$  and  $a^3$ , and annunciator  $a^4$  to earth. Seeing the operation of the annunciator, the operator at board  $e^2$  inserts plug  $p$  into answering jack  $a^3$ , disconnecting the annunciator  $a^4$  from the line circuit and continuing the circuit to the cord connections. The operator may receive the order from station 1 by a telephone connected with the circuit in any suitable manner. She then inserts plug  $p'$  into the trunk jack  $o$ , continuing the circuit from station 1 to the answering jack  $o^2$  at board  $k$ . The operator at board  $e^2$  depresses key  $r'$ , sending a current from the calling generator  $s$  over the trunk line and operating the annunciator  $o^3$  at the board  $k$ . The operator thereat, upon seeing the shutter of the annunciator  $o^3$  fall, inserts plug  $t'$  into the answering jack  $o^2$  of that trunk line, and receives the order for connection with station 8. She then inserts the remaining plug  $t$  of the pair into the line jack  $i'$  of line to station 8, whereby the circuit is completed from station 1 to station 8. It may be traced briefly from earth to station 1 through the telephone apparatus thereat, over line  $a$  to answering

jack  $a^3$ , thence through the plug circuit  $p p'$  to trunk jack  $o$ , thence through trunk line  $o'$  to answering jack  $o^2$ , thence through the plug circuit  $t' t$  to line jack  $i'$ , thence over line  $i$  to station 8, and through the telephone apparatus thereat to earth.

Any suitable transfer system may be used in organizing my invention. That shown in my application for "transfer system for switchboards" (Case No. 232), filed October 27, 1890, is particularly adapted to use therewith. In some cases, for example when the number of calls in the aggregate received at the exchange during the day, is large, it may be necessary to provide more than one section of switchboard  $k$ . This switchboard may then be made a multiple switchboard if desired, each of the lines  $f, g, h$ , &c., being connected with a line jack upon each of the sections of the multiple switchboard  $k$ . An alternative of this method consists in providing several separate switchboards  $k$  and distributing the answering jacks and annunciators of the trunk lines  $l', m', n'$ , and  $o'$  upon the different switchboards  $k$ , the line jacks  $i', h'$  &c. of the seldom called for lines being likewise distributed upon the different switchboards  $k$ . In this case an operator at the multiple switchboard receiving an order for connection with one of the seldom called for lines, will transfer or trunk the connection from the multiple switchboard to that one of the switchboards  $k$  upon which she knows the line jack of the line required to be located. This modification is so obvious that I do not consider an illustration or further description necessary.

The saving in spring jacks which may be effected by organizing the exchange system in accordance with my invention may be best exhibited by a numerical example. Assume an exchange system to have four thousand subscribers. In practice it is usual to dispose about two hundred subscribers' annunciators upon one section of the switchboard; there would thus be required in a multiple switchboard for the four thousand annunciators, twenty sections of switchboard. Upon each of these sections must be placed a spring jack for every line of the exchange, that is four thousand spring jacks, making eighty thousand line spring jacks in the exchange. Of the four thousand subscribers, two thousand of them may receive calls at the rate of from twenty to twenty-five or more per day, the remaining two thousand receiving perhaps only one to two calls in a day.

In my improved exchange system I have provided the two thousand busy subscribers each with line jacks upon the multiple switchboard system. This would require twenty sections of switchboard, each having two thousand line jacks, making forty thousand line jacks in the switchboard. The remaining two thousand subscribers may perhaps receive, on an average, three calls per day of ten hours each. To attend to these six thousand calls per day might require about two

sections of switchboard. Each of these sections would then be provided with two thousand line jacks connected with the different lines of the group of seldom called for lines.

5 There would thus be required in my system, forty thousand spring jacks upon the main switchboard, and four thousand on the auxiliary switchboard, making an aggregate of forty-four thousand line spring jacks in the exchange, thus effecting a saving of thirty-six thousand spring jacks.

I am aware that various exchanges have heretofore been constructed having switchboards each containing spring jacks each connected with subscribers' lines and trunking lines, whereby an operator receiving a call at one switchboard may transfer that call to another switchboard whereat the required connection would be made. My invention

15 herein described differs from such simple transfer systems, in that it affords facilities for immediate connection from any line to any frequently called for line, and for the transference or trunking of calls for seldom

20 called for lines only, by an arrangement of circuits and a disposition of the spring jacks of the different lines of the exchange which is entirely novel.

Having thus described my invention, I

30 claim as new, and desire to secure by Letters Patent:

1. The combination with two groups of telephone lines, of answering jacks one for each line located upon one switchboard, line jacks

35 connected with each line of one group and located upon said switchboard, and line jacks connected with each line of the other group, located upon another switchboard, and circuits adapted to connect any answering jack

40 with any line jack of the exchange, substantially as specified.

2. In combination, two telephone switchboards, line spring jacks and answering jacks located upon one of the switchboards, line

45 spring jacks located upon the other switchboard, telephone lines and circuits connecting each line with one answering jack, other circuits connecting some of the lines with line jacks upon the first mentioned of said switchboards, and other of the lines with line jacks

50 upon the last mentioned of said switchboards, means for establishing electrical connection from any answering jack to any line jack, upon said first mentioned switchboard, and

55 a trunking system for electrically connecting any answering jack upon said first mentioned switchboard with any line jack upon said last mentioned switchboard, substantially as specified.

3. The combination with a multiple switchboard comprising several sections, of an auxiliary switchboard, telephone lines each connected with a spring jack upon each section of said multiple switchboard and with an an-

nunciator at some one section of the same, 65 other telephone lines each connected with a spring jack upon said auxiliary switchboard, and with an annunciator and answering spring jack upon a section of said multiple switchboard, trunk lines each connected with 70 a spring jack at the auxiliary board and with another spring jack at some section of the multiple switchboard, and means at each switchboard for connecting together any two spring jacks thereat, substantially as described. 75

4. In combination, a main telephone switchboard, telephone lines each connected with a spring jack and with an annunciator upon said main switchboard, an auxiliary switchboard, other telephone lines each connected with a spring jack upon said auxiliary switchboard and with an annunciator and a spring jack upon said main switchboard, a trunk line terminating in a spring jack at each 85 switchboard, and connecting cords and plugs for connecting any two spring jacks at either switchboard, whereby calls are received from all subscribers at said main switchboard, but connections are made to subscribers' lines 90 either upon the main board or upon the auxiliary board, according to the location of the line jacks of the line.

5. In combination, a main telephone switchboard, telephone lines each connected with a 95 spring jack and with an annunciator upon said main switchboard, an auxiliary switchboard, other telephone lines each connected with a spring jack upon said auxiliary board and with an annunciator and an answering 100 jack upon said main switchboard, means at said main board for electrically connecting any two jacks thereupon, and means for making electrical connection from any spring jack upon the main switchboard to any 105 spring jack upon the auxiliary switchboard, substantially as described.

6. In combination, a multiple switchboard comprising several sections, telephone lines each connected with line jacks upon each of 110 said sections, an auxiliary switchboard, other telephone lines each connected with a line jack upon said auxiliary switchboard and with an answering jack upon one section of said multiple switchboard, connecting cords 115 and plugs at each of said sections for connecting any answering jack with any line jack thereat, and a trunk system for establishing connection from any answering jack of the multiple switchboard with any line 120 spring jack of the auxiliary switchboard, substantially as described.

In witness whereof I hereunto subscribe my name this 12th day of May, A. D. 1892.

CHARLES E. SCRIBNER.

Witnesses:

FRANK R. MCBERTY,  
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