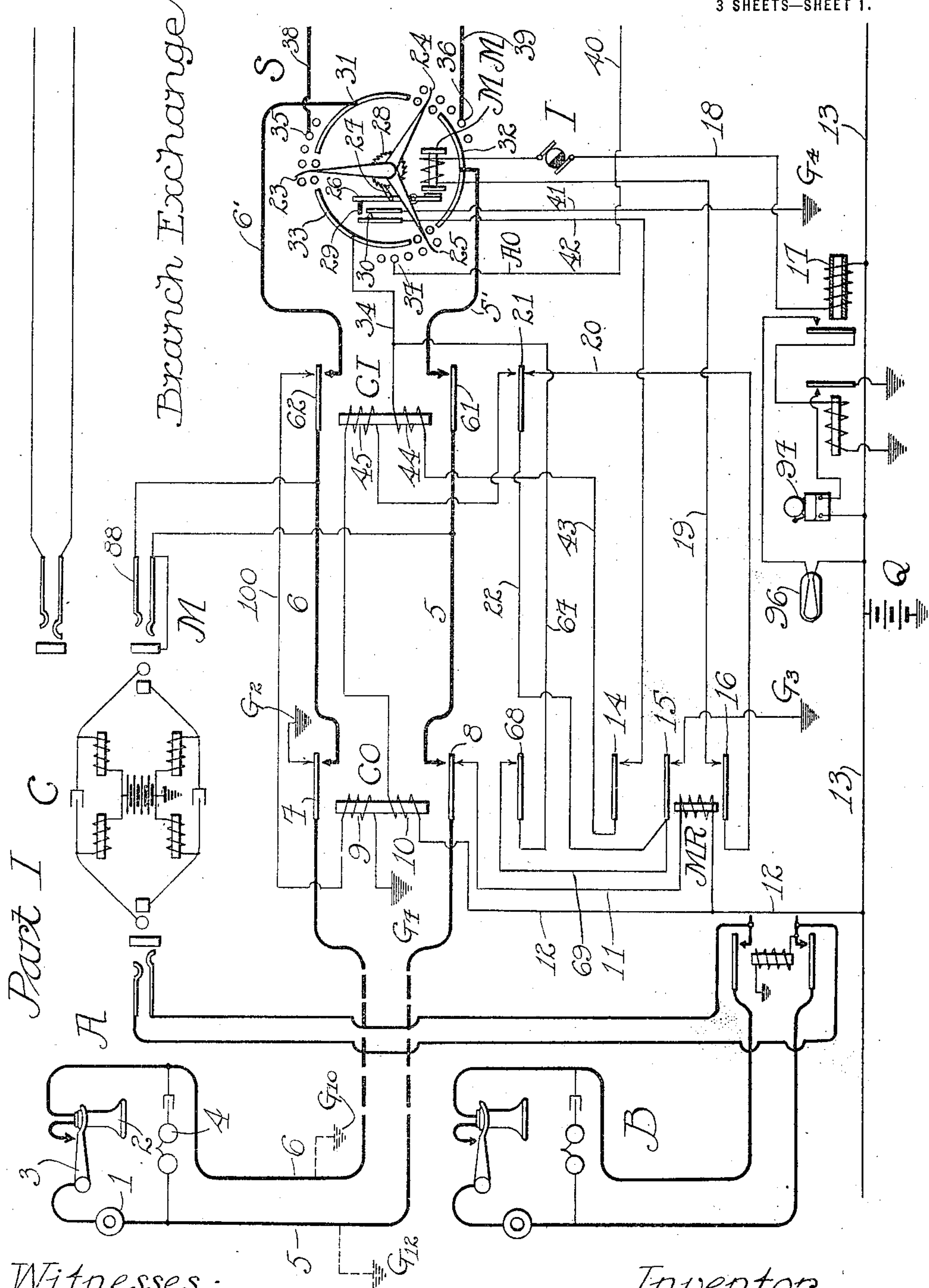


1,293,817.

Patented Feb. 11, 1919.

3 SHEETS—SHEET 1.



Witnesses:

Frederick L. Pierce

John A. Diener

Inventor

John H. Levis, Jr.

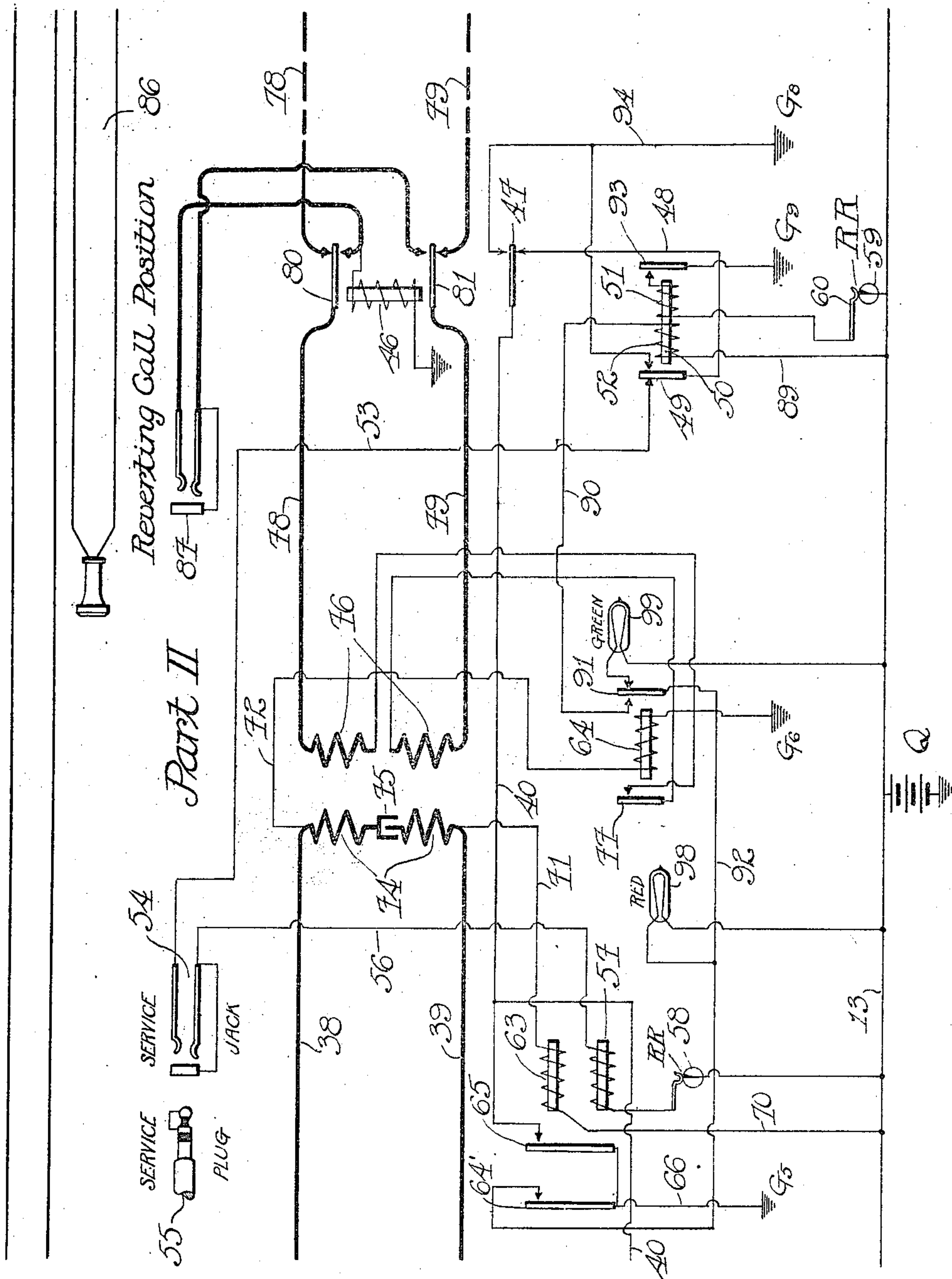
By Brown, Hanson & Battcher
Attorneys

J. H. LEVIS, JR.
CALL DISTRIBUTING TELEPHONE SYSTEM.
APPLICATION FILED OCT. 25, 1916.

1,293,817.

Patented Feb. 11, 1919.

3 SHEETS—SHEET 2.



Witnesses:

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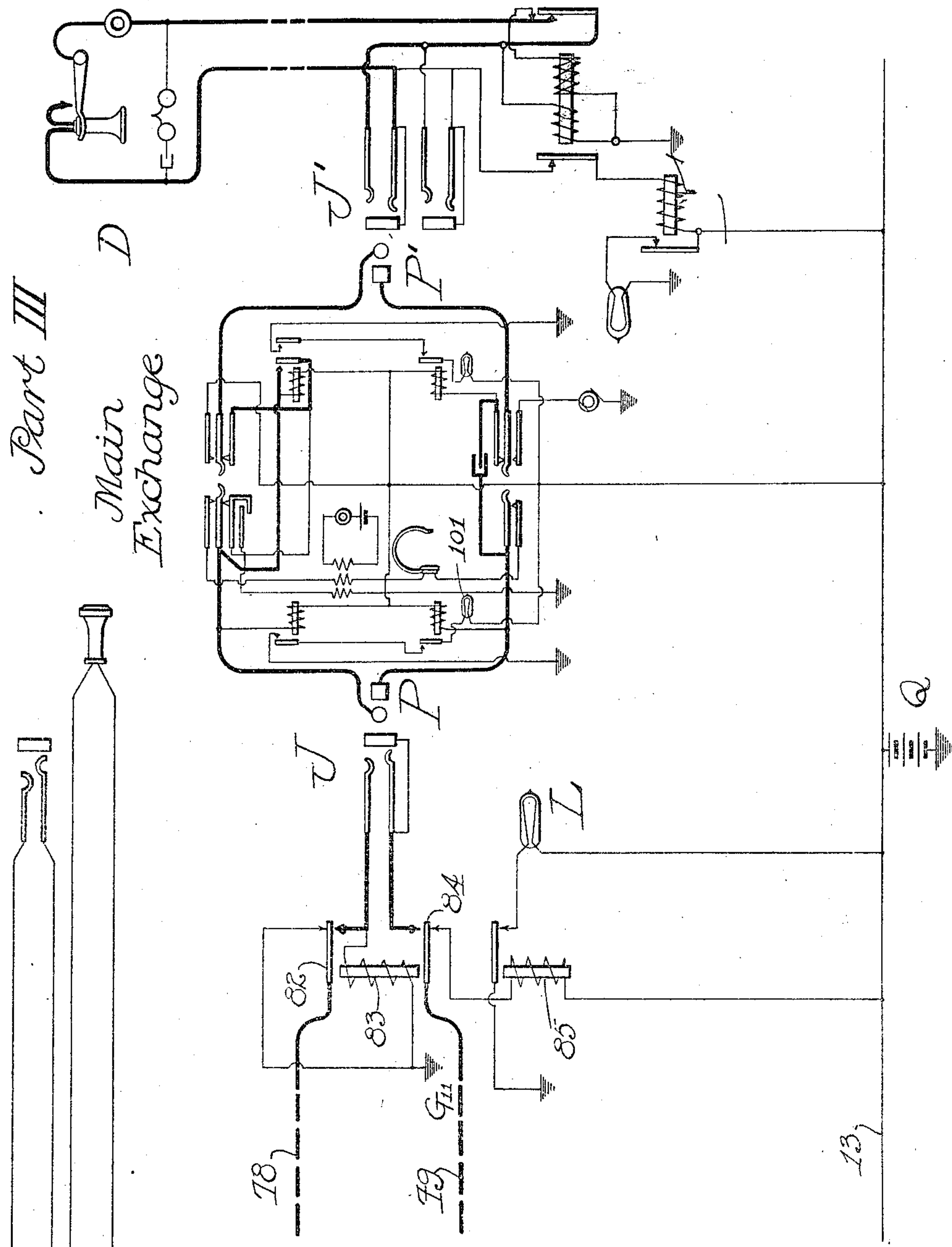
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

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TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPO-
RATION OF NEW YORK.

CALL-DISTRIBUTING TELEPHONE SYSTEM.

1,293,817.

Specification of Letters Patent.

Patented Feb. 11, 1919.

Application filed October 25, 1916. Serial No. 127,520.

To all whom it may concern:

Be it known that I, JOHN H. LEVIS, JR.,
a citizen of the United States, residing at
Rochester, in the county of Monroe and
5 State of New York, have invented a certain
new and useful Improvement in Call-Dis-
tributing Telephone Systems, of which the
following is a full, clear, concise, and ex-
act description, reference being had to the
10 accompanying drawings, forming a part of
this specification.

The present invention provides an im-
proved call-distributing telephone system.

The advantages of general call-distribu-
15 tion are well recognized by those skilled in
the art. The total number of terminals is
less; there is a general gain in speed in
reaching an idle operator; the load on the
operators is more easily distributed, and the
20 wear on the apparatus is equalized. Nu-
merous other advantages accrue.

However, complications often arise which
make it difficult to employ the full advan-
tages of call-distribution, due to other
25 factors entering into the problem, necessi-
tating an entirely different solution. The
definite problem which I have been enabled
to overcome is the following:

There is a central, or main, exchange C,
30 and an outlying or branch exchange B. A
number of the subscribers at the B ex-
change enter a large percentage of calls for
the C exchange, but also enter calls for the
local or B exchange. Others of the sub-
35 scribers at the B exchange enter local calls
almost exclusively. The subscribers who
call the central exchange ordinarily want
prompt service to that point, because the
majority of their calls go there and they
40 would be less affected by slightly slower
service in calling local or B exchange sub-
scribers. The other B exchange subscribers
are more interested in obtaining prompt
service on their local calls and they would
45 be less affected by slightly slower service
on their central exchange calls.

The object of the present invention is
the provision of a system which will satisfy
the above contradictory requirements and
50 which will also provide means for the solu-
tion of similar problems. Other more spe-
cific objects will be apparent from the fol-
lowing description.

I provide the first class of subscribers,
namely the central exchange, with individ- 55
ual switches that allow them to select auto-
matically an idle trunk leading to the cen-
tral exchange. The trunks connecting the
two exchanges terminate at the central ex-
change preferably before a number of oper- 60
ators' positions at the central exchange.

I also provide these lines of the first class
with multiple jacks at the B exchange, so
that calling lines of the second class termi-
nating in the B exchange or trunk calling 65
lines from the central exchange may be con-
nected with these lines as called lines, in
the well-known manner.

To take care of the calls by this first class
of subscribers, or other subscribers either 70
of the first or the second class having termi-
nals in the B exchange, I provide a special
reverting position having jacks connectible
with each of the trunks used in automatic
trunking to the central exchange. An au- 75
tomatically-distributed call appears on one
of the positions at the C exchange, and if it
is for a line having terminals in the B ex-
change, the C operator who answered the
call communicates with the reverting call 80
operator over an order wire, designating to
the reverting call operator the trunk upon
which the call appeared. The reverting call
operator then completes the connection in
the B exchange in any preferred or well- 85
known manner.

For the second class of subscribers, which
may constitute the greater portion of the
total number of subscribers at the B ex-
change, local calls are initiated and com- 90
pleted in the usual way, as by the well-
known operator's cord circuit.

Calls for lines terminating in the central
exchange are trunked by means of the auto-
matic trunking system described and 95
claimed in the patent of John A. Taggart,
No. 1,199,317, or any preferred system.

It can thus be seen that I have provided
a system for a certain class of subscribers,
in which local calls are manually reverted 100
or trunked back, and central exchange calls,
which would normally be manually trunked
between the two exchanges, are automati-
cally distributed to terminals at the central
exchange. 105

In the accompanying drawings compris-

ing three sheets I have illustrated diagrammatically a system embodying my invention.

Part 1 shown on Sheet 1 shows a subscriber's line leading to the local or branch exchange, and shows a part of the apparatus at said exchange.

Part 2 on Sheet 2 shows diagrammatically the remainder of the apparatus at the local exchange.

Part 3 shown on Sheet 3 illustrates the apparatus at the central exchange and the lines terminating in the central exchange. The two classes of subscribers' lines leading into the exchange are illustrated diagrammatically by the lines A—B. The line A is connected by means of an automatic switch S to have access to a number of trunks leading to the central exchange. The other class of subscribers' lines typified by the line B terminates in the branch exchange in the usual line jacks and has multiple terminals, as is well known to those skilled in the art, the same not being illustrated in this diagram, for the sake of clearness.

The subscriber connected by the line B calls an operator at the branch exchange and obtains connection in the well-known manner, by means of an operator's cord circuit and multiple terminals of the called line. In case the called party desired by the B subscriber has line terminals in the central exchange, the operator at the branch exchange will connect the B subscriber through a trunk line to the main exchange, where a main-exchange operator connects the trunk with the desired called line, as is well understood in the art.

The A subscriber's sub-station is provided with the usual transmitter 1, receiver 2, hook-switch 3, and calling signal 4, connected by means of the line-wires 5 and 6 to the spring terminals 7 and 8 of the cut-off relay CO, having windings 9 and 10. When the A subscriber takes the receiver 2 off the switch-hook to close the bridge across the lines 5 and 6, current flows from the battery Q which is a common battery located at central, over the bus 13, wire 12, motor-relay MR, wire 11, back contact of the spring 8, line-wire 5, through the apparatus at the substation A, back over line-wire 6, armature-spring 7, and back contact to ground at G². This energizes the motor-relay MR which attracts its armatures 14 and 15 and 16 to close the circuit through the interrupter I for the motor-magnet MM, to cause the selecting-switch S to connect the calling line A with an idle trunk leading to the main exchange. The circuit for the motor-magnet may be traced as follows: grounded battery Q, bus 13, pilot relay 17, wire 18, through the interrupter I, the motor-magnet MM, wire 19, front contact and armature spring 16, wire 20, back contact and armature spring 21 of the cut-in

relay CI, wire 22, armature 15, and front contact thereof to ground at G³. The interruptions of current through the motor-magnet cause the switch-arms 23, 24 and 25 to be stepped around by means of the armature-lever 26 and the pawl 27 engaging the ratchet 28.

It is to be noticed that the armature-lever 26 bears an insulated end 29 at its outer extremity for breaking circuit at the springs 30 on the back stroke of the pawl 27. A circuit closed through the spring 30 is the busy-test circuit, this circuit being closed at the time that the arms 23, 24 and 25 are at rest, so as to obtain a maximum amount of time for the relays in this circuit to operate before the switch-arms or wipers, 23, 24 and 25 are stepped on to the next contact.

The switch S comprises three wiping contacts 31, 32, which are in connection with the extension of the line limbs 6 and 5, respectively, and the contact 33, which is connected to the private wire 34. The contacts 35, 36 and 37 are grouped about the stationary contacts 31, 32 and 33 so that as the switch-arms 23, 24 and 25 are stepped forward the line-limbs 6 and 5 of the private wire 34 will be brought successively into contact with the trunks and their corresponding third wires, successively.

Assuming that the trunk having the transmission-strands 38 and 39 and the third wire 40 is not engaged, and that the switch-arms step forward to place the segments 31, 32 and 33 in contact with the transmission-strands and the third wire of this trunk, respectively, the busy-test circuit through the contact 30 and the cut-in relay CI will be formed as follows: from ground at G⁴ through the wire 41, contact 30, wire 42, through the front contact of the armature-spring 14, wire 43, through the one winding 44 of the cut-in relay CI, through the wire 34 to the segment 33, over one of the switch-arms to the terminal 37 and third wire 40 of the trunk (continued on second sheet), through the armature 47 of the cut-off relay 46, back contacts of this armature, wire 48, armature-contact 49 of the release-retard relay 50, back contacts of the armature, wire 53, through the service-jack 54, which is normally closed by means of a short-circuited service-plug 55 through the wire 56, relay 57, release-retard contact-breaker 58, and to grounded battery Q over the bus-bar 13. The release-retard circuit-breaker RR, shown at the lower right-hand corner of Sheet 2, comprises a commutator 59 and a brush 60, arranged to break the circuit through the commutator and brush only for an instant at the end of each three-second period of time.

The above circuit being completed through the winding 44 of the cut-in relay CI energizes said relay to connect the line-limb ex-

tensions 5 and 6 through the front contacts of the armatures 61 and 62 to the terminals 31 and 32 in the switch, and thereby to the limbs 38 and 39 of the trunk which has been selected.

Attraction of the armature 21 of the relay CI closes a holding circuit for this relay and a pull-up circuit for the relay CO as follows: grounded battery Q, bus-bar 13, wire 12, through the winding 10 of the cut-off relay CO, winding 45 of the cut-in relay CI, front contact of the armature 21, wire 22, armature 15 of the motor-relay MR, through the front contact thereof to ground at G³; it being noted that the motor-relay MR is still held closed by the current passing out over the line-limbs 5 and 6. The current for the motor-magnet is broken upon the first energization of the relay CI at the armature-contact 21. Hence, movement of the switch is prevented after an idle trunk has been found.

The energization of the cut-off relay CO and the cut-in relay CI now places the sub-station A in direct circuit with the limbs of the selected trunk, 38 and 39. The operation of the cut-off relay CO has removed the ground G³ from the wire 22 by opening the circuit of the motor-relay at the armature-contact 8.

The relay 57, which is in the circuit of the release-retard 58, controls in common with the transmission-relay 63 a pair of armatures 64' and 65. When the armatures 64' and 65 are attracted, there is placed a ground upon the third wire 40 of the trunk, so as to maintain a circuit for the windings 10 and 45 on the relays CO and CI, respectively. This circuit may be traced as follows from ground at G⁵: wire 66, armature 65, front contact thereof, wire 40, bank contact 37 of the third wire, switch-wiper, switch-segment 33, wire 34, wire 67, armature 68 of the relay CO, front contact thereof, wire 69 to the armature 15, and from there to the wire 22, which is connected to the armature 21 through the front contact of the armature 21 of the cut-in relay CI, winding 45 of said relay, through the winding 10 of the relay CO, and to battery over the wire 12 and the bus 13. This circuit serves to hold the relays CO and CI energized and at the same time places ground upon the third wire 40, so that multiple terminals appearing in other switch-banks will not be selected by other calling lines.

Simultaneously with the formation of the above circuit, the transmission-relays 63 and 64, through which battery is fed to the calling line, are energized, so that even if the relay 57 has its circuit broken at the end of a three-second period by the release-retard 58, the ground upon the third wire 40 will be maintained by the energized condition of the battery transmission-relay 63. The cir-

cuit for battery to the calling line may be traced as follows: battery Q, bus-bar 13, wire 70, transmission-relay 63, wire 71, which is connected to the talking-strand 39, through the switch bank contact 36, switch-wiper and switch segment 32, to the calling-line extension 5', over the calling line, through the switch-hook at the sub-station, through the side 6 of the calling line, line-extension 6', switch segment 31, switch-contact 35, talking-strand 38, wire 72, ground transmission relay 64, and ground at G⁶.

The two sides of the trunk 38 and 39 are connected together through a repeating coil having the halves of its winding 74 separated by a condenser 75. The complementary halves of the adjacent winding of the repeating coil 76 are normally open at the front contacts of the armature 77 of the transmission relay 64. When the relay 64 is energized as above described, the repeating coil 76 will be closed at the armature 77, so that voice current will be repeated from the trunk strands 38 and 39 to the corresponding trunk strands 78 and 79, or the reverse. The trunk strands 78 and 79 are broken through the armature-contacts 80 and 81 of the cut-off relay 46, which becomes energized when the reverting-call operator, located at the reverting-call position, inserts the plug of a connecting cord in the jack 87 corresponding to the given trunk on the reverting-call position. The strand 78 is connected to ground at G¹¹ through the back armature contact 82 of the cut-off relay 83, which is located at the main exchange. The strand 79 is connected by way of the back contact of the armature 84 through a signaling-relay 85 to battery Q by way of the battery-bus 13. Thus, as soon as the transmission relay 64 closes the two sides of the talking trunks 78 and 79 together at the contact 77, a current will flow from the battery Q through the signaling-relay 85 over the trunk strand 79, through the windings of the repeating coil 76, which have been closed at the contact 77, back to ground over the trunk strand 78. The calling signal L, which may be a small incandescent lamp, or the like, is displayed in such position as to notify one of the operators at the main exchange that the particular trunk ending in the jack J has been selected by a calling line. An operator at the main exchange answers the call by inserting the plug P of one of her cord pairs into the jack J, thus operating the cut-off relay 83 and placing her set, which is bridged across the cord strand at this time, in communication with the calling subscriber at the sub-station A.

Assuming that the call initiated by the subscriber A is for a subscriber's line having terminals in the main exchange, the main-exchange operator will then complete

the call, as through the line leading to the sub-station D, in the well-known manner.

Assuming that the calling subscriber at the sub-station A desires connection with a subscriber having a line terminating in the B exchange, the operator answering the call at the main exchange upon being notified by the calling party at A that he desires a local or B exchange connection, will notify the reverting-call operator at the B exchange, as by means of the order wire 86, which has been shown diagrammatically as connecting the main exchange with the B exchange reverting-call operator's position, notifying the reverting-call operator that the calling subscriber on the trunks 78—79 desires a local or B exchange connection. The reverting-call operator plugs into the reverting-call jack 87, operating the cut-off relay 46, which, through the armature contacts 80 and 81, and the front contacts connected thereto, places her telephone set in communication with the subscriber at A. Upon ascertaining the number of the called subscriber's line, the reverting-call operator makes connection through multiple jacks, a complete set of which is available to her, to the line of the desired subscriber.

Each of the subscriber's lines leading into the B exchange is provided with multiple jacks, whether the line is provided with line-signaling apparatus terminating in the B exchange, or with a selecting-switch, through trunks and line-signaling apparatus at the main exchange; and if the party at the sub-station A calls for connection with a similar line, which is connected to an automatic switch, connection will be made through the multiple jacks, as illustrated at M, to the desired called subscriber's line.

When the cord circuit C is connected to the multiple jacks M, battery flows over the tip-strand of the cord circuit, tip spring 88 of the jacks M, through the armature 62, back contacts thereof, wire 100, winding 9 of the cut-off relay CO, to ground at G⁷. This operates the cut-off relay CO to disconnect the automatic switching mechanism, holding the line open at the armature-contacts 61 and 62 to the deenergization of the cut-in relay CI. When the operator at the main exchange has inserted the plug P in the jack J, the answering supervisory signal 101 will be subject to the open or closed condition of the line at the switch-hook 3. As soon as the calling subscriber places the receiver on the switch-hook, the transmission relays 63 and 64 are deenergized and the connection between the talking-strands 78 and 79 is broken at the armature contact 77, thereby lighting the supervisory lamp 101 in the well-known manner. The plug P may then be withdrawn at the convenience of the main-exchange operator.

Breaking of the main-line circuit at the

switch-hook 3 is not followed immediately by release of the switch S and the connected apparatus. The switch S is of the non-normaling type—that is, it rests indifferently in any position in which it is left. The busy and idle conditions of the switch are determined solely by the busy potential placed upon the private segment 33.

It is desirable that the busy potential be not removed immediately upon the circuit being broken at the switch-hook 3, because the sub-station switch-hook 3 may be moved accidentally and if the connection were immediately released inconvenience and annoyance would result. It is for preventing the instantaneous release of the apparatus upon a short or accidental opening of the switch-hook contact, that I have provided the release-retard before mentioned.

The release-retard may allow the connection to be broken within any time less than three seconds after the main circuit is broken. Inasmuch as the relay 57 first places busy potential upon the private wiper 33 through the contact 64', this relay, which forms a locking circuit for itself, is connected through the release-retard 58. If after having obtained connection with an idle trunk, as 38—39, the subscriber at A abandons the call, the busy potential will be taken off the private wiper 33 as soon as the circuit is broken through the relay 57 by the release-retard 58. As soon as the transmission-relays 63 and 64 have been energized by connection of a calling line, such as A, with the trunk-strands 38 and 39, the holding of the busy potential is transferred from the relay 57 to these relays 63 and 64, and the breaking of the busy potential for the private segment 33 in the switch S is thereafter placed upon the relay 50. The circuit of the relay 50 may be traced as follows: grounded battery Q, bus-bar 13, wire 89, winding 52 of the relay 50, wire 90, front contact of the armature 91 of the transmission-relay 64, wire 92, armature-contact 64' and to ground by way of the wire 66 at G⁵. This ground at G⁵ is also in connection with the private segment 33 by way of the armature 65 and the private wire—or third wire—40 of the trunk-switches connected to the switch. This circuit through the winding 52 is broken, however, as soon as the calling subscriber breaks his line-circuit at the switch-hook 3, either by accident or upon the conclusion of the conversation. It is desirable that the busy potential should continue for a short time thereafter, so that in case of accident restoration of the switch-hook would allow a subscriber at A to continue with his conversation. Energization of the relay 50 attracts the armatures 49 and 93, the armature 49 breaking the circuit through relay 57 and connecting the third wire 40

to ground at G^8 through the wire 94 and the front contact of the armature 49.

A locking circuit for the winding 51 is formed through the armature 93 from ground G^9 through the release-retard circuit-breaker RR to the grounded battery Q. Hence, after the subscriber at A places his receiver on the switch-hook, ground from the wire 94 and ground G^8 will be maintained upon the private wire 40, even though the winding 52 be deenergized, until the locking circuit through the winding 51 is broken at the release-retard commutator RR.

If connection is made through the reverting-call jack 87 to the trunk-strands 78 and 79, the energization of cut-off relay 46 will attract its armature 47 and place ground through wire 94 and ground G^8 upon the third wire 40, and thus maintain a busy potential upon the private segment 33, so long as the operator's cord circuit is connected to the reverting-call jack, the connection being cut off from the release-retard by the armature 47 being attracted to its front contact. Hence, so long as the plug is in the jack 87, the trunks 38 and 39 cannot be selected by another calling switch, such as S, nor is the line circuit to the sub-station A broken, so that the line A could be called by some other calling subscriber. This is to prevent any possibility of a connection being made at the reverting-call operator's position without the knowledge or control of the connected subscriber.

It will be noticed that in the service-jacks and service-plugs I have provided switching means for cutting any desired trunk out of service, such as may be desirable when all of the calls are to be switched to a given position, in the night or during periods of very light load. Removal of the service-plug cuts off the battery connection to the wire 40, so that there is no potential for stopping the switch S when the contacts thereof wipe over the stationary contacts of the corresponding trunk. This switching mechanism is also useful in preventing connection of a calling line with a trunk which is out of order or under repair, or the like.

The system which I have illustrated is provided with pilot means common to the exchange for indicating an abnormal condition of any one of the line-switches, and I have also provided means individual to each trunk to indicate trouble or incorrect operation on the calling line connected to the trunk. The interrupter pilot-relay 17 controls an interrupter pilot-lamp 96 and an audible signal 97 for apprising the attendants that one of the switches is constantly rotating. The pilot-relay 17 is provided with means for preventing the same from becoming energized upon a short period of interrupted current-flow therethrough, so that only when interrupted current has been

flowing through this relay for a considerable time, the circuit of the interrupter pilot-lamp 96 and the audible signal 97 will be closed.

I have also provided means for indicating ground on either side of a calling subscriber's line.

Assume that a ground is placed upon the sleeve side 5 of the calling subscriber's line, as indicated by the dotted line, and a ground at G^{12} on Sheet 1. As soon as connection is established with an idle trunk, such as the ones illustrated in the drawings, 38 and 39, the transmission-relay 64 will not be energized, due to the fact that it is short-circuited by the ground at G^{12} . As a consequence, the switch S will not release and the red lamp 98 will remain energized continuously, the transmission-relay 63 holding ground G^5 upon the third wire 40 to maintain the switch S in busy position, and holding the cut-off relay CO and the cut-in relay CI in energized condition. The green lamp 99, which is preferably placed in the wire-chief's desk, will also be permanently displayed, due to the circuit closed through it and the ground at G^5 .

The transmission-relay 63 holds the armature 65 in the attracted position, but the release-retard relay 57 periodically drops the armature 64', thereby causing flashing of the red and the green lamps intermittently.

The operation of the system may briefly be described as follows:

Assuming that the subscriber at A is provided with a line having a selecting-switch, such as the switch S, and that he desires connection with a subscriber's line having terminals in the main exchange. The A subscriber raises the receiver from the switch-hook, closing a circuit through the motor-relay, causing the automatic switch S to step forward to find an idle trunk circuit. An idle trunk circuit will be selected, because of the battery potential upon its private wire 40, which will energize the cut-in relay CI and open the motor-magnet circuit. At the same time a holding circuit for the relay CI and a pull-up circuit for the cut-off relay CO is formed. This circuit, which is first closed through the ground G^3 , controlled by the motor-relay MR, is transferred to the ground G^5 by means of the release-retard relay 57. The ground is thereafter maintained by the transmission-relay 63, which remains energized as long as battery is fed out over the calling line.

The transmission-relay 64 closes the line-limbs 78 and 79 through the repeating coil and causes the line-signal to be displayed at the main exchange. If the call is for a subscriber having terminals in the main exchange, the main-exchange operator connects the A operator with the called party's line, which in this case we will suppose to be the

subscriber's line D, and conversation is carried on and completed in the usual manner. Upon restoring the receiver to the switch-hook at the sub-station A, the transmission-relay 63 is deenergized but release of the ground potential from the private segment 33 is not accomplished until the relay 50 is deenergized by breaking of the circuit through the winding 51 by the release-retard circuit-breaker. Thereupon busy potential is removed from the private segment 33 in the switch and the cut-in and cut-off relays are deenergized, restoring the parts to normal.

If the call initiated by the A subscriber should be for a subscriber whose line terminated in the B exchange, the main-exchange operator would refer the call to the reverting-call operator, apprising her of the trunk on which the call appeared over the order wire. Thereupon the reverting-call operator would connect the trunk with the line of the desired subscriber, such, for instance as a subscriber B, having line terminals in the B exchange. Busy potential is held on the private segment 33 and the calling line is locked to the trunk selected until the reverting-call operator withdraws the plug from the corresponding jack.

While I have described my invention with reference to the details of a particular embodiment, it is to be understood that the invention may be practised in other forms of apparatus and with various modifications and substitutions which will at once be apparent to those skilled in the art. I consider such changes to come within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is the following:

1. In combination, a plurality of subscribers' lines terminating in a branch exchange, a plurality of subscribers' lines terminating in a main exchange, multiple jacks connected to all of said subscribers' lines and located in the respective exchanges, one class of said branch-exchange subscribers' lines having active automatic switches connected thereto, said switches being invariably actuated upon initiation of calls originating on said one class of subscribers' lines, trunks between the branch and the main exchange having manual switching terminals in the main exchange, and switching terminals selectable by said automatic switches for connecting subscribers of that class with the terminals at the main exchange, other subscribers' lines having line-signal apparatus terminating in said branch exchange, and means controlled by the operator at said branch exchange, for trunking said lines when calling to said main exchange and for interconnecting all of said subscribers at said branch-exchange.

2. In combination, a branch exchange,

subscribers' lines terminating therein, a main exchange, subscribers' lines terminating in said main exchange, trunks extending between and having operator-controlled switching terminals at said main exchange, automatic switches at said branch exchange, a part of said branch-exchange subscribers' lines having control over said switches to connect said subscribers' lines when calling with idle ones of said trunk lines, line signals for said trunks at said main exchange, others of said branch-exchange subscribers' lines having line signals at said branch exchange, multiple terminals for all of said branch-exchange subscribers' lines in said branch exchange, reverting-call terminals grouped at an operator's position for said trunks, and an order wire connecting said operator's position with said main exchange.

3. In combination, a branch exchange, subscribers' lines terminating therein, a main exchange, subscribers' lines terminating therein, trunks extending between said branch exchange and said main exchange, automatic switches at said branch exchange for selecting idle ones of said trunks, means under the individual control of certain ones of said branch-exchange subscribers' lines for causing said switches to connect the subscriber's line with idle ones of said trunks, line signals for said trunks at said main exchange, others of said branch-exchange subscribers' lines having line signals at said branch exchange, multiple terminals for all of said branch-exchange subscribers' lines at the branch-exchange and means for interconnecting said branch-exchange subscribers' lines at said branch exchange.

4. In combination, a main exchange, a branch exchange, lines terminating in each of said exchanges, a plurality of trunks connecting said exchanges, line signals and operator-controlled switching terminals for said trunks at said main exchange, said branch-exchange lines having multiple terminals in said branch exchange, a plurality of said branch-exchange lines having subscriber-controlled automatic selecting means for selecting an idle one of said trunks when calling, a reverting-call operator's position at said branch exchange, and operator-controlled switching terminals at said position for interconnecting said trunk lines with each of the branch-exchange subscribers' lines.

5. In combination, a main exchange, a branch exchange, lines terminating in said exchanges, a plurality of trunks connecting said exchanges, line signals and operator-controlled switching terminals for said trunks at said main exchange, said branch-exchange lines having multiple terminals in said branch exchange, a plurality of said branch-exchange lines having automatic se-

lecting means for selecting an idle one of said trunks when calling, and displaying a calling signal at the main exchange, a reverting-call operator's position at said branch exchange, and operator-controlled switching terminals for said trunks at said position, said switching terminals having means for effacing the line signal at the main exchange.

6. In combination, a main exchange, a branch exchange, subscribers' lines terminating in said exchanges, a plurality of trunks connecting said exchanges, line signals and operator-controlled switching terminals for said trunks at said central exchange, said branch-exchange lines having multiple terminals in said branch exchange, a plurality of said branch-exchange lines having automatic selecting means for selecting an idle one of said trunks and displaying a calling signal at said main exchange when calling, a reverting-call operator's position at said branch exchange, and operator-controlled switching terminals at said position for connecting a selected trunk with any one of the branch-exchange subscribers' lines, said switching terminals having means for breaking the trunk circuit to the central exchange and for effacing the line signal thereat.

7. In combination, a main exchange, a branch exchange, subscribers' lines terminating in each of said exchanges, trunk lines connecting said branch exchange with said main exchange, automatic switches at said branch exchange, said switches operable to connect calling subscribers' lines at the branch exchange to an idle one of said trunk lines leading to the main exchange, means under the control of a part of the subscribers at said branch exchange for causing said automatic switch to connect said subscribers' lines with an idle trunk, means for placing a busy potential upon the terminals of said trunks when selected, a reverting-call operator's position at said branch exchange, switching means under the control of the operator at said position for connecting said trunks with subscribers' lines having terminals in said branch exchange, said operator-controlled switching means having means for maintaining a busy potential upon said trunk terminals after the subscribers' line connected to said trunk has been disconnected at the sub-station.

8. In combination, a subscriber's line, an automatic switch individual thereto having access to a plurality of trunk lines, said switch being under the control of subscriber's switch-hook for selecting an idle one of said trunk lines, means for placing a busy potential upon the private wire of said trunk line, said means comprising a battery transmission-relay, and means to retain said potential upon said wire, said

last means comprising a relay, and means for periodically interrupting the circuit of said relay.

9. In combination, a subscriber's line, a selecting switch individual thereto, means under the control of the subscriber's switch-hook for causing said switch to select an idle trunk circuit, a plurality of trunk circuits having contacts selectable by said switch, means for stopping said switch upon an idle trunk line, said means applying a busy potential to one of the terminals of said trunk line, said potential-applying means comprising a battery transmission-relay connected to said trunk line, and means for retaining said busy potential upon the terminals of said trunk, said means comprising a periodically-operating circuit-changer.

10. In combination, an automatic switch, a plurality of lines selectable by said switch, said lines comprising a talking strand and a private wire, means for placing a busy potential upon the private wire of a selected switch, said means comprising a periodically-interrupted source of potential, a battery transmission-relay connected to said switch, and means under the control of said transmission-relay for supplying a constant source of potential to said third wire.

11. In combination, an automatic selecting switch, trunks having terminals selectable by said switch, said trunks comprising talking strands and a third wire, means operated by potential applied to the third wire of one of said trunks for stopping said switch in connection therewith, means for applying potential to said third wire, said means comprising a periodically-interrupted source of current, and a transmission-relay operated after the said switch is stopped upon the terminals of the corresponding trunks for applying a constant source of potential to said third wire.

12. In combination, an automatic selecting switch, a plurality of trunks having terminals selectable by said switch, said trunks comprising a talking strand and a third wire, means under the control of the subscriber's switch-hook for starting said switch to connect the corresponding subscriber's line with an idle one of said trunks, means for stopping said switch in contact with an idle trunk, said means comprising a source of periodically-interrupted current, means for applying a constant potential to said third wire, said means comprising a transmission-relay connected to the corresponding trunks, operator-controlled switching means connectible to said trunks, said switching means having means for applying a constant source of potential to said third wire.

13. In combination, an automatic switch, a plurality of trunk lines selectable by said

switch, means under the control of the subscriber's switch-hook for causing said switch to select an idle one of said trunks, said trunks comprising a talking strand and a
 5 third wire, means for applying a source of interrupted current to said third wire to render said trunks busy, operator-controlled switching means at the terminals of said
 10 trunks for connecting the trunks with another subscriber's line, and means intermediate the ends of said trunks for connecting said trunks to a subscriber's line, said last-named switching means comprising means
 15 for applying a constant source of potential to said third wire to render the same busy.

14. In combination, a plurality of telephone lines, a plurality of line extensions, automatic switches for automatically interconnecting said lines and said extensions,
 20 each switch comprising testing contacts, means controlled by the subscriber's switch hook for causing the switch to connect the telephone line with an idle extension, a battery transmission relay having means
 25 adapted to hold the switch in closed position and for applying busy potential to the testing contacts, and further means for holding the switch in closed position and for applying busy potential to the testing contacts,
 30 said further means being periodically rendered inactive.

15. In combination, a plurality of telephone lines, a plurality of line extensions, automatic switches for automatically interconnecting said lines and said line extensions, means controlled at the subscriber's
 35 station for causing the switch to connect the telephone line with an idle line extension, a battery transmission relay having means adapted to hold the switch in closed position and further means for holding the switch
 40 in closed position, said further means being periodically rendered inactive.

16. In combination, a plurality of telephone lines, a plurality of line extensions, automatic switches for automatically interconnecting said lines and said line extensions, each switch comprising testing contacts, means controlled at the subscriber's
 45 station for causing the switch to connect the telephone line with an idle line extension, a battery transmission relay having means adapted to apply busy potential to the testing contact and further means for applying
 50 busy potential to the testing contact, said further means being periodically rendered inactive.

17. In combination, a plurality of lines, a plurality of line extensions, automatic
 60 switches for interconnecting the lines and the line extensions, a battery feed relay on the battery side and a battery feed relay on the ground side of the extensions, a test contact in the switch, a holding relay intermittently deenergized, said relay being adapted

to control the potential on said contact, a lamp of distinctive color controlled by the one battery feed relay and the holding relay, and another lamp of a different distinctive color controlled by the other battery feed
 70 relay.

18. In combination, a branch exchange, a main exchange, a plurality of subscribers' lines having terminals at the branch exchange for local interconnections, a series of
 75 trunk lines from the branch exchange terminating and having call indicating apparatus at the main exchange, automatic switches associated with the trunk lines, said subscribers' lines being divided into two classes, the first class of lines having access for calls originating on said lines to said automatic switches, the second class of subscribers' lines having no access to said switches, means connectible to said trunk lines for
 80 diverting local calls arising on said first class of lines to the branch exchange and means for simultaneously effacing the indication of the call indicating apparatus of the corresponding trunk lines at the central
 90 station.

19. In combination, a branch exchange, a main exchange, a plurality of subscribers' lines having terminals at the branch exchange for local interconnections, a plurality of trunk lines from the branch exchange terminating in and having call indicating apparatus at the main exchange, automatic switches associated with the trunk lines, said subscribers' lines being divided into two
 95 classes, the first class of lines having access for originating calls to said automatic switches only, local interconnecting means independent of said automatic switches for interconnecting the branch exchange terminals of all of said subscribers, the second class of subscribers' lines having no access to said automatic switches, and means connectible to said trunk lines for diverting
 100 local calls arising on said first class of lines to the branch exchange for connection with said local interconnecting means.

20. In combination, a branch exchange, a main exchange, a plurality of subscribers' lines having terminals at the branch exchange for local interconnections, a plurality of trunk lines from the branch exchange terminating in and having call indicating apparatus at the main exchange, automatic switches associated with the trunk lines, said
 110 subscribers' lines being divided into two classes, the first class of lines having access for originating calls to said automatic switches only, local interconnecting means independent of said automatic switches for interconnecting the branch exchange terminals of all of said subscribers, the second class of subscribers' lines having no access to said automatic switches, means connectible to aid trunk lines for diverting local
 120
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calls arising on said first class of lines to the branch exchange for connection with said local interconnecting means, and means for simultaneously effacing the indication of the
5 call indicating apparatus of corresponding trunk lines at the central station.

21. In combination, a main exchange, a branch exchange, a plurality of subscribers' lines terminating in the branch exchange,
10 trunk lines leading from the branch exchange to the main exchange, said branch exchange having an operator's position having regular line terminals for a plurality of said subscribers and having a reverting call oper-
15 ator's position, automatic switches associated with the trunk lines and certain ones of said subscribers' lines, and adapted to invariably connect said latter subscribers' lines when calling, with the said trunk lines.

22. In combination, a main exchange, a branch exchange, a plurality of subscribers' lines having interconnecting terminals in the branch exchange, trunk lines leading from the branch exchange to the main ex-
25 change, said branch exchange having an operator's position having regular line terminals for a plurality of said subscribers and having a reverting call operator's position, automatic switches associated with the
30 trunk lines and certain ones of said subscribers' lines and adapted to invariably connect said latter subscribers' lines when calling with the trunk lines, said reverting call operator's position having switching
35 terminals connectible to the trunk lines.

23. In combination, a main exchange, a branch exchange, a plurality of subscribers' lines having interconnecting terminals in the branch exchange, trunk lines leading
40 from the branch exchange to the main exchange, said branch exchange having an operator's position having regular line terminals for a plurality of said subscribers and having a reverting call operator's posi-
45 tion, automatic switches associated with the trunk lines and certain ones of said subscribers' lines and adapted to invariably connect said latter subscribers' lines when calling with the trunk lines, said reverting
50 call operator's position having switching terminals connectible to the trunk lines, and having means for disabling the end of the trunk line terminating in the main ex-
change.

24. In combination, a main exchange, a branch exchange, subscribers' lines having local interconnecting terminals at said
55 branch exchange, said lines being of two classes, trunk lines between the branch exchange and the main exchange, automatic switches for invariably connecting a calling line of the first class to an idle one of said
60 trunk lines for terminating a call of a subscriber's line of the first class at the main exchange, local interconnecting means inde-

pendent of said automatic switches having access to all of said local interconnecting terminals and means for the other class of lines for invariably terminating a call origi-
70 nating on a line of said latter class at the branch exchange.

25. In combination, a main exchange, a branch exchange, subscribers' lines having local interconnecting terminals at said
75 branch exchange, said lines being of two classes, trunk lines between the branch exchange and the main exchange, automatic switches for invariably connecting the calling lines of the first class to an idle one of
80 said trunk lines for terminating a call of a subscriber's line of the first class at the main exchange, local interconnecting means independent of said automatic switches hav-
85 ing access to all of said local interconnecting terminals and means for the other class of lines for invariably terminating a call origi-
nating on a line of said latter class at the branch exchange, and reverting call inter-
connecting terminals at the branch exchange
90 associated with the trunk lines for making connections between said trunk lines and a subscriber's line of either class.

26. In combination, a main exchange hav-
ing an operator's position, a branch ex-
95 change having an operator's position, subscribers' lines having multiples in the branch exchange, one class of said lines hav-
ing call-indicating apparatus at said branch exchange operator's position, another class
100 having no local call-indicating apparatus, trunks leading from the branch exchange to the main exchange, automatic switches for interconnecting calling lines of said latter
class with idle trunks, and call-indicating
105 apparatus associated with the trunks at the main operator's position, a reverting call operator's position at the branch exchange and an order wire from the main exchange
operator's position to the reverting call oper-
110 ator's position.

27. In combination, a main exchange hav-
ing an operator's position, a branch ex-
change having an operator's position, sub-
115 scribers' lines having multiples in the branch exchange, one class of said lines having call-indicating apparatus at said branch ex-
change operator's position, another class having no local call-indicating apparatus, trunks leading from the branch exchange to the main exchange, automatic switches for
120 interconnecting calling lines of said latter class with idle trunks, and call-indicating apparatus associated with the trunks at the main operator's position, a reverting call
operator's position at the branch exchange,
125 an order wire from the main exchange operator's position to the reverting call operator's position, and switch means at the re-
verting call operator's position for dis-
130 abling the main exchange end of the trunks

and for effacing the indication of the corresponding call-indicating apparatus.

28. In combination, a main exchange, a branch exchange, subscribers' lines of two classes, trunks from the branch exchange to the main exchange having automatic switches, means for automatically extending a call of a line of the first class invariably to the main exchange over one of said trunks, reverting call terminals at the branch exchange associated with the trunks between said automatic switches and the main exchange for making local interconnections between a calling line of the first class with another line of either class.

29. In combination, a main exchange, a branch exchange, subscribers' lines of two classes, trunks from the branch exchange to

the main exchange having automatic switches, means for automatically extending a call of a line of the first class invariably to the main exchange over one of said trunks, reverting call terminals at the branch exchange associated with the trunks between said automatic switches and the main exchange for making local interconnections between a calling line of the first class with another line of either class, and means for invariably terminating calls of a subscriber's line of the second class at the branch exchange.

In witness whereof I hereunto subscribe my name this 14th day of October, A. D. 1916.

JOHN H. LEVIS, JR.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."