

July 5, 1927.

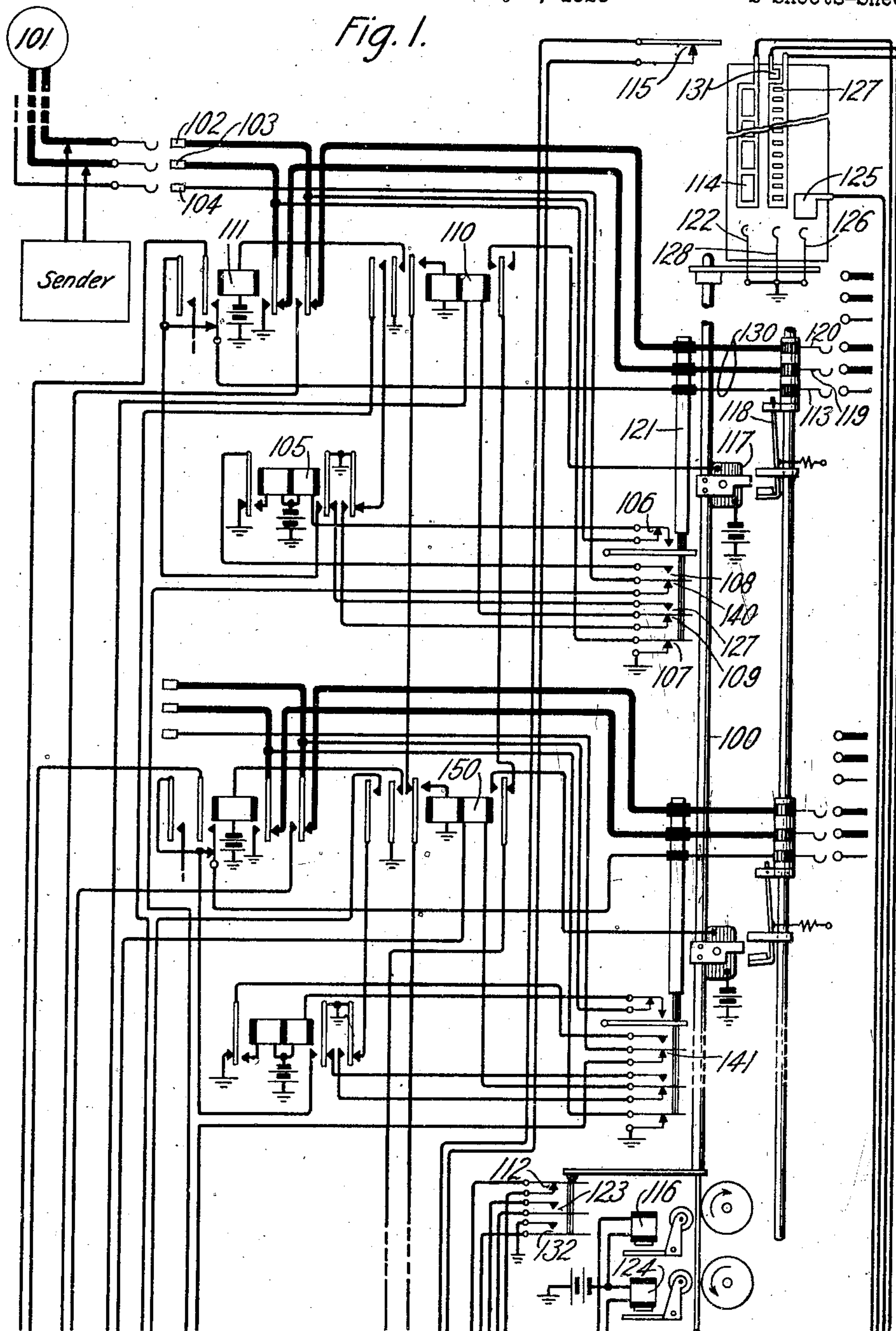
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W. G. BLAUVELT

TELEPHONE EXCHANGE SYSTEM

Filed May 7, 1926

2 Sheets-Sheet 1



by

Inventor:
William G. Blauvelt.
J. E. Foran Atty.

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Fig.2.

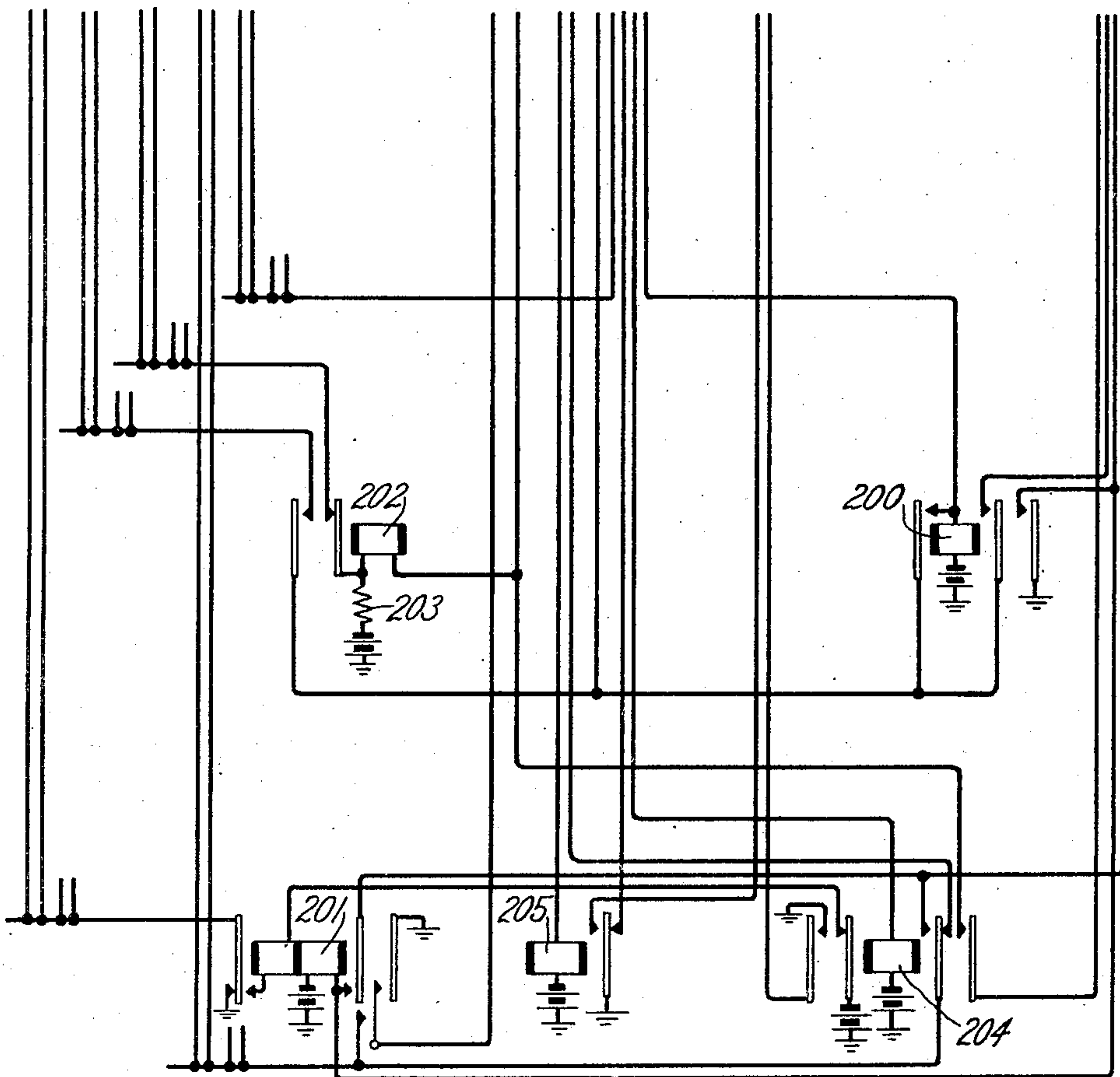
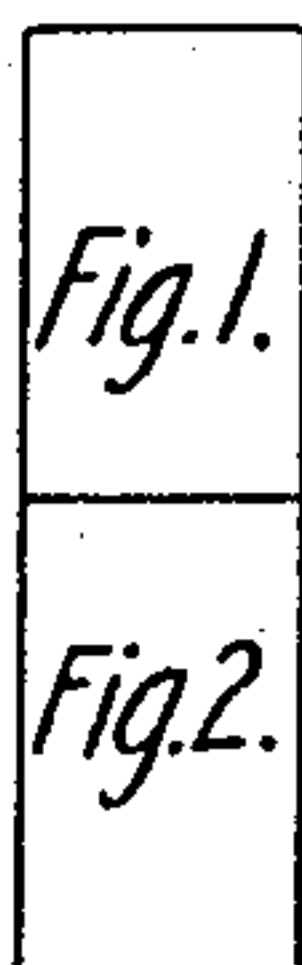


Fig.3.



by

Inventor:
William G. Blauvelt.
J. E. Folsom Att'y.

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1,634,734

UNITED STATES PATENT OFFICE.

WILLIAM G. BLAUVELT, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

TELEPHONE-EXCHANGE SYSTEM.

Application filed May 7, 1926. Serial No. 107,473.

This invention relates to telephone exchange systems and more particularly to systems in which connections are established through the use of automatic switches.

5 The invention is in the nature of an improvement on the system disclosed in my application Serial No. 680,029 filed December 11, 1923, Patent No. 1,577,513, granted March 23, 1926, which application covers a
10 selector switch arrangement in which a plurality of individual switches are operated by means of a common control and driving mechanism. Two sequence switches are employed in that system for associating the in-
15 dividual switches with the common apparatus.

The principal object of the present invention is to simplify and improve the control and operation of automatic switches.

20 According to one aspect of the invention means are provided for making the group selection and trunk hunting operations continuous. According to another aspect of the invention the system is arranged for con-
25 trolling the selector driving apparatus by means of a relay which is held operated continuously under the control of the sender during selections and under the control of the sleeve of the busy outgoing trunks dur-
30 ing trunk hunting.

These and other objects and aspects of the invention will be more apparent from a consideration of the following description in connection with the drawings and
35 appended claims.

In the drawings, Figure 1 shows two trunk circuits each terminating in a selector switch and a common brush rod for operat-
40 ing said switches.

Fig. 2 shows the apparatus common to all the trunk circuits served by the brush rod.

Fig. 3 shows the manner of arranging Figs. 1 and 2 to disclose the invention.

45 The selector switch of Fig. 1 is of the type shown and disclosed in U. S. patent to E. B. Craft and J. N. Reynolds, No. 1,123,696, issued January 5, 1915. As in the case of my above mentioned patent a number of trunk circuits, usually five, are
50 served by a common brush rod and certain common apparatus. Each trunk terminates in a brush set, normally disconnected from the common brush rod. In the present case, however, the brush set of the selected trunk

is associated with the brush rod by an in- 55 dividual magnet and apparatus which is described and claimed in the application Serial No. 105,670, of H. W. Goff, filed April 30, 1926.

In general, upon the initiation of a call 60 by a subscriber a connection will be extended by any well known means such as those disclosed in U. S. Patent No. 1,395,977, issued November 1, 1921, to F. A. Stearn, et al., to the terminals leading to 65 one of the trunks served by brush rod 100. A relay individual to the trunk is operated causing the closure of a circuit which extends serially through the trunks served by brush rod 100 if they are idle, and if the 70 brush rod is free to serve the call. This circuit causes the association of the brush set with the common brush rod and also initiates the group selecting operation. Relay 75 200 controls the operation of group selection and also causes the operation of relay 201 which controls the brush rod and is held to the sleeve of the outgoing trunk if that trunk is busy. As soon as an idle trunk is found, relay 201 releases opening the circuit 80 of the brush set magnet and leaving the brushes engaging the terminals of an idle trunk. The release of relay 201 also causes the closure of the circuit of the downdrive magnet and the restoration of the brush rod. 85 When a brush set is to be restored to normal, the brush rod is moved to the topmost position, where the brush magnet is energized and in moving down past the brush set, associates it with the brush rod and re- 90 stores it to normal.

The detailed operation of these circuits is as follows: Assuming that a call has been initiated by a subscriber at substation 101, the connection will be extended as previous- 95 ly indicated to terminals 102, 103 and 104. A circuit is thereupon established from battery through the right winding of relay 105, normal contact 106 controlled by the brush set, over the tip conductor of the 100 trunk, terminal 102, to the sender, back to terminal 103 and the ring conductor of the trunk, normal contact 107 to ground. Relay 105 operates and prepares a locking circuit for itself through its left winding and 105 left front contact, off normal contact 108 as soon as closed, sleeve terminal 104 to ground in the previous selector. The pres-

ent invention being disclosed in connection with an office selector for simplicity, the previous selector will in this case be a district selector. The sleeve terminals of all
 5 trunks in the group are connected together through normal contacts controlled by the brush set. Therefore, ground connected to terminal 104 will complete a circuit over
 10 normal contact 140 of the first trunk to normal contact 141 and the sleeve terminal of the second trunk, and over similar paths to the sleeves of other trunks of the group, rendering them nonselectable while the com-
 15 mon apparatus is busy with one of the trunks. Relay 105, in operating, closes a circuit from ground over its outer right front contact, normal contact 109, right
 20 winding of relay 110, back contact of relay 202, resistance 203 to battery. Relay 110 operates in this circuit and closes a circuit from ground through its left winding and
 25 inner left front contact, inner left back contact of relay 150, winding of relay 202, resistance 203 to battery. Relay 202 operates in this circuit and opens the original energizing
 30 circuit of relay 110. The series character of the locking circuit of relays 110, 150, etc. creates a preference in favor of the trunk whose relay is nearer the common
 35 apparatus in the series, should two calls reach the group of trunks simultaneously. The energizing circuit of relay 110 shunts the winding of relay 202 sufficiently to prevent
 40 relay 202 from operating until relay 110 has completely attracted its armatures. The operation of relay 202 also opens the energizing circuits of all relays corresponding
 45 to relay 110 in the group thus preventing the seizure of the common apparatus as long as it is in use. Relay 110 also closes a circuit from battery through the winding of
 50 relay 111, inner left front contact of relay 110 to ground. Relay 111 in operating opens the tip and ring conductors and connects them through to the common apparatus
 55 for the purpose of brush selection. The ring conductor is connected to ground on the inner right front contact of relay 111. The tip conductor is connected over the
 60 outer right front contact of relay 111, front contact of relay 202, bottom normal contact 112, winding of relay 200 to battery. The tip and ring conductors are connected
 65 through the stepping relay of the sender in the usual manner. Relay 200 operates and locks over its left front contact, to its energizing circuit independently of the bot-
 70 tom normal contact 112. Relay 200 in operating also closes a circuit from battery over its left front contact and inner right front contact, to commutator segment 114.
 75 It also closes a circuit from battery through the right winding of relay 201 to ground at the outer right front contact of relay 200.
 80 Relay 201 operates and prepares two

locking circuits for itself, one from battery over the left back contact of relay 204, left
 winding and left front contact of relay 201, inner left front contact of relay 111 to sleeve
 brush 113, the other from battery, through
 10 its right winding and inner right front contact, commutator strip 127, brush 128 to
 ground. The operation of relay 201 closes a circuit from battery through the winding
 15 of magnet 117, right front contact of relay 110, right back contact of relay 150, to
 ground at the outer right front contact of relay 201, causing an engagement with its
 20 armature which is attached to brush set 130 whereby the brush set moves with the
 magnet. Relay 201 in operating also closes a circuit from battery, winding of relay 205,
 25 top contact 115, right back contact of relay 204, middle right front contact of relay
 201 to ground. Relay 205 operates in this circuit and closes a circuit from battery
 30 through the winding of updrive magnet 116, right front contact of relay 205 to ground.
 Brush rod 100 and brush set 130 are thereupon moved upward under the control of
 35 the updrive magnet 116.

The upward movement of the brush set raises rod 121, opening the normal contact
 set and closing the group of off-normal con-
 40 tacts. It should be noted that the contacts 106 and 108 are so arranged that off-normal
 contact 108 will be closed before normal contact 106 is broken, thus closing the hold-
 45 ing circuit through the left winding of relay 105, before the original energizing cir-
 50 cuit through the right winding of that relay is opened, holding relay 105 operated
 under the control of the sleeve of the district selector.

As the brush set moves upward the com-
 55 mutator brush 122, which moves with the rod 100, makes contact with conducting
 segments of commutator strip 114. Ground over brush 122 thus serves to complete in-
 60 termittently the holding circuit for relay 200 and shunt the stepping relay of the
 sender in the usual manner. When the stepping relay has been shunted enough times to
 65 satisfy the setting of the sender, the fundamental circuit is opened and relay 200 re-
 70 leases as soon as commutator brush 122 engages the next insulating segment of strip
 114. However, the updrive magnet is under the control of relay 201 and, should the
 75 first outgoing trunk in the selected group prove busy, relay 201 will be held operated
 in the previously traced holding circuit over the sleeve of the outgoing trunk. The brush
 80 rod will continue to move upward until, due to the encountering of an idle trunk
 this holding circuit of relay 201 is opened. The second holding circuit over commuta-
 85 tor strip 127 is effective until the brushes are centered, after which relay 201 releases.
 The release of relay 201 opens the circuit of

the brush set magnet 117 and leaves the brushes engaging the idle outgoing trunk. It immediately connects ground over its back contact, inner left front contact of relay 111 to sleeve brush 113, making the outgoing trunk busy to other selector switches. It also opens the circuit of relay 205, releasing that relay which in turn opens the circuit of the updrive magnet and brings the brush rod to rest.

The release of relay 205 also closes a circuit from battery through the winding of relay 204, off normal contact 123, back contact of relay 205 to ground. Relay 204 in operating removes battery from the holding circuit of relay 201, thus further insuring the release of relay 201 and the brush magnet. It also closes a circuit through downdrive magnet 124 to ground at the left front contact of relay 204. The downdrive magnet now restores brush rod 100 to normal position. As the brush rod approaches its normal position a circuit is closed from battery through the winding of relay 202, outer right front contact of relay 204, normal commutator segment 125, brush 126 to ground. This circuit is in shunt of that through the left winding of relay 110 and releases relay 110 which in turn releases relay 111. The release of relay 111 connects the tip and ring conductors through to the brushes 120 and 119, after which subsequent selections are completed. The release of relay 111 also closes ground over the inner right front contact of relay 105, left normal contact of relay 111 to sleeve brush 113 to hold the outgoing trunk busy when the common apparatus is in use with other trunks. When the brush rod reaches normal the operating circuit of relay 204 is opened at off-normal contact 123 and the downdrive magnet is deenergized.

At the completion of conversation the district selector is released by the calling subscriber restoring his receiver, whereupon ground is removed from terminal 104 thus opening the holding circuit of relay 105. Relay 105 immediately closes ground over its left back contact, off-normal contact 108 to the sleeve terminal 104 to prevent the false selection of this trunk while it is being restored. The release of relay 105 also closes ground over off-normal contact 127, right winding of relay 110, inner back contact of relay 202, resistance 203 to battery. Relay 110 operates and closes the operating circuits of relays 111 and 202 as before. It also closes a circuit from ground at the outer right back contact of relay 105, outermost left contact of relay 110, right back contact of relay 204, top contact 115, winding of relay 205 to battery. Relay 205 operates as before and energizes the updrive magnet 116. Brush rod 100 is driven, under the control of magnet 116 to its topmost posi-

tion, in which position it opens the top contact 115, releasing relay 205 and magnet 116 and bringing the brush rod to rest.

With the brush rod in this position, a circuit is closed from battery, through the right winding of relay 201, top commutator segment 131, brush 128 to ground. Relay 201 operates. The release of relay 205 closes the previously traced circuit of relay 204 which in turn energizes the downdrive magnet 124. Relay 204 also closes a locking circuit for relay 201 extending from battery, through the right winding and inner right front contact of relay 201, inner right front contact of relay 204, middle right front contact of relay 201 to ground. Relay 201 closes the circuit of the brush magnet 117 as before.

Under the control of downdrive magnet 124 the brush rod 100 is lowered. With magnet 117 energized, as the magnet comes opposite the brush set, magnet 117 attracts the armature attached to brush set 130 and lowers the brush set with the brush rod. The further restoration of the common apparatus is the same as described. The restoration of the brush set also closes the group of normal contacts individual to that trunk and opens the off-normal contacts. The opening of contact 108 removes the busy condition from sleeve terminal 104. The closure of contacts 106 and 107 prepares the trunk for use in connection with a subsequent call. It should be noted that whenever the brush rod moves upward, ground is connected from the brush rod off-normal contact 132 to the sleeve terminals of all the trunks of the group, preventing the selection of one of the trunks while the brush rod is busy.

Should no idle trunk be found in the selected group, the ungrounded condition of the sleeve of the overflow terminals releases relay 201. The brush set remains on the overflow terminals while the brush rod is restored in the manner above described. The usual overflow signal is given to the calling subscriber who restores his receiver and releases the connection. The restoration of the trunk is the same as from a successful call.

What is claimed is:

1. In a telephone exchange system, a selector switch, a register sender, a plurality of groups of trunks having terminals and accessible through said selector switch, means for identifying the sleeve terminals of busy trunks, and means associated with said selector switch for causing the operation of said switch to select a particular group of trunks and to find an idle trunk in said group, said means being held operated continuously during the operation of said switch, under the control of said sender during group selection and under the con-

trol of the sleeve terminal of busy trunks during trunk hunting.

2. In a telephone exchange system, brush sets, a group of trunks each terminating in a brush set, a brush rod, means for associating each of said brush sets with said brush rod, a plurality of groups of outgoing trunks accessible to each brush set, means for identifying busy trunks, apparatus common to said trunks for controlling the extension of a connection over one of said trunks, and means in said common apparatus effective when said common apparatus is taken for use with a particular trunk to associate the proper brush set with said brush rod and to operate said brush rod to select a particular group of outgoing trunks accessible to said brush set and to find an idle trunk in said group, said means being held operated continuously during the operation of said brush rod.

3. In a telephone exchange system, brush sets, a group of trunks each terminating in a brush set, a brush rod, means for associating each of said brush sets with said brush rod, a plurality of groups of outgoing trunks accessible to each brush set, means for identifying busy trunks, apparatus common to said trunks for controlling the extension of a connection over one of said trunks, and means in said common apparatus effective when said common apparatus is taken for use with a particular trunk to associate the proper brush set with said brush rod and to operate said brush rod to select a particular group of outgoing trunks accessible to said brush set and to find an idle trunk in said group, said means being held operated continuously during the operation of said brush rod, and immediately released when an idle trunk is found to release said brush set and to leave said brush set in connection with said idle trunk.

4. In a telephone exchange system, brush sets, a group of trunks each terminating in a brush set, a brush rod, means for associating each of said brush sets with said brush rod, a plurality of groups of outgoing trunks accessible to each brush set, means for identifying the sleeve terminals

of busy outgoing trunks, a register sender, apparatus common to said trunks for controlling the extension of a connection over any one of said trunks, and means in said common apparatus effective when said common apparatus is taken for use with a particular trunk to associate the proper brush set with said brush rod and to operate said brush rod to select a particular group of outgoing trunks accessible to said brush set and to find an idle trunk in said group, said means being held operated continuously during the operation of said brush rod under the control of said sender during group selection and under the control of the sleeve terminal of busy outgoing trunks during trunk hunting.

5. In a telephone exchange system, brush sets, a group of trunks each terminating in a brush set, a brush rod, means for associating each of said brush sets with said brush rod, a plurality of groups of outgoing trunks accessible to each brush set, means for identifying the sleeve terminals of busy outgoing trunks, a register sender, apparatus common to said trunks for controlling the extension of a connection over any one of said trunks, means in said common apparatus effective when said common apparatus is taken for use with a particular trunk to associate the proper brush set with said brush rod and to operate said brush rod to select a particular group of outgoing trunks accessible to said brush set and to find an idle trunk in said group, said means being held operated continuously during the operation of said brush rod under the control of said sender during group selection and under the control of the sleeve terminal of busy outgoing trunks during trunk hunting, and means to cause the release of said last means immediately when an idle trunk is found to release said brush set and to leave said brush set in connection with said idle trunk.

In testimony whereof, I have signed my name to this specification this 6th day of May, 1926.

WILLIAM G. BLAUVELT.