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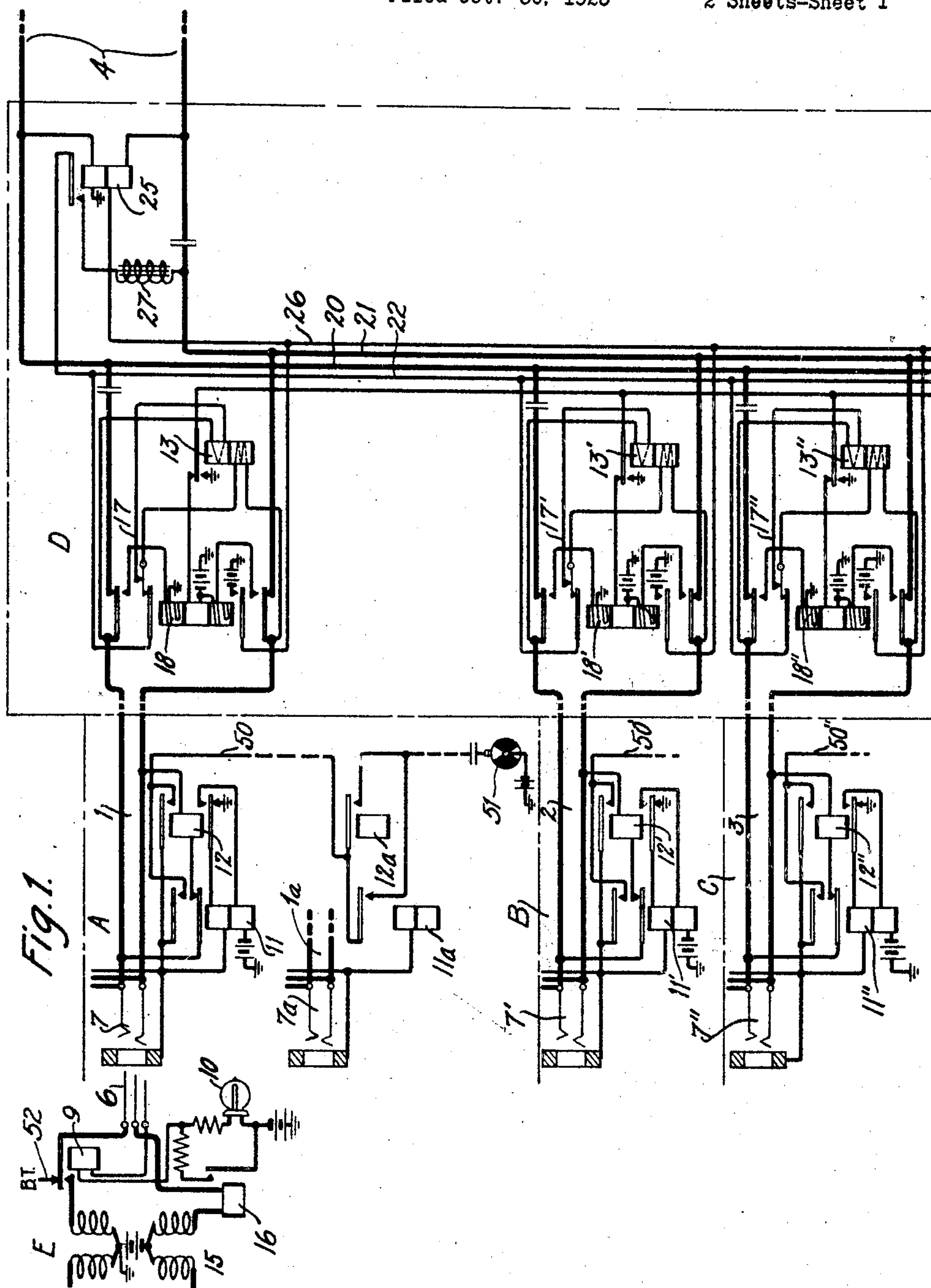
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TRUNKING SYSTEM

Filed Oct. 30, 1925

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

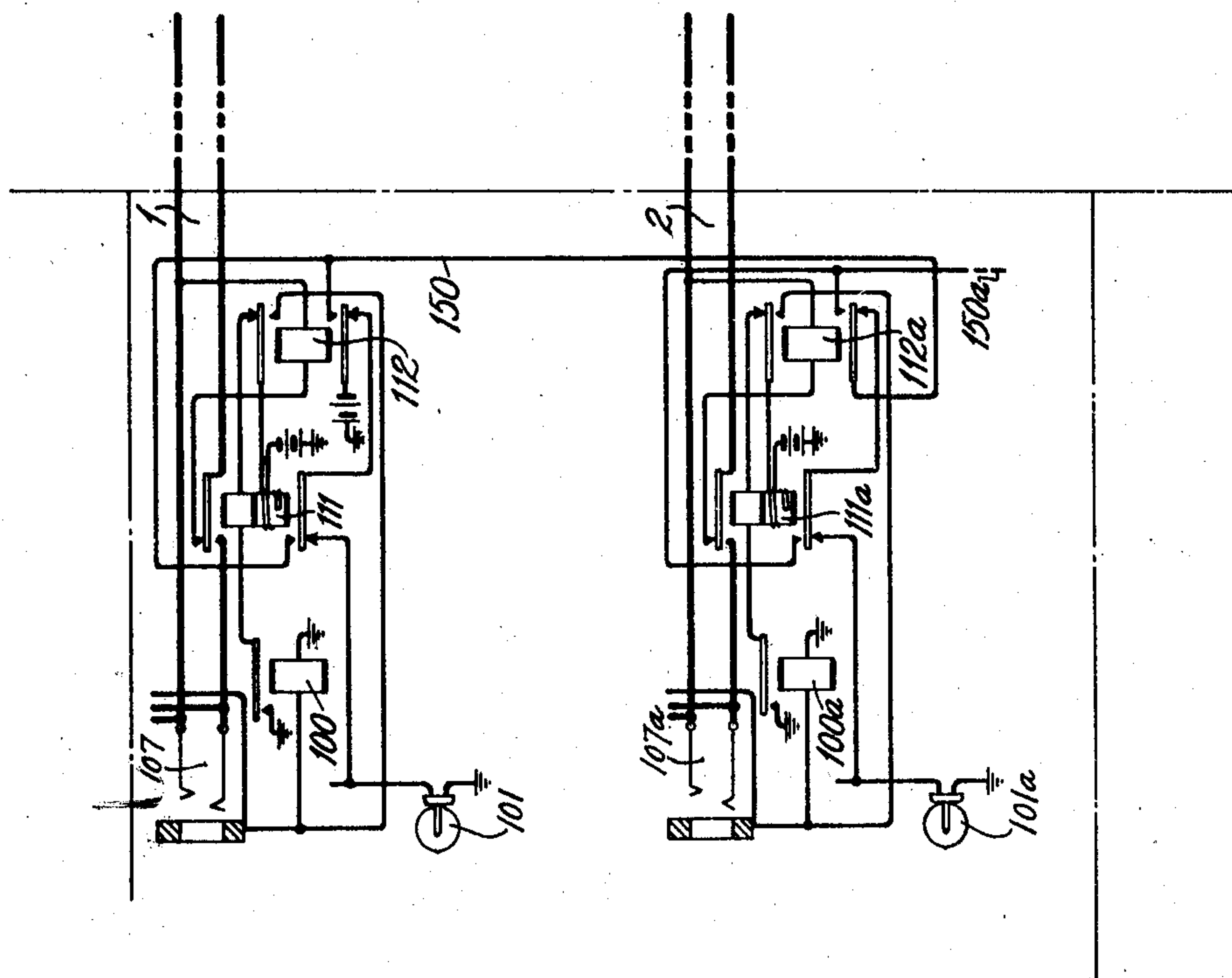


Fig. 2.

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UNITED STATES PATENT OFFICE.

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TRUNKING SYSTEM.

Application filed October 30, 1925. Serial No. 65,744.

This invention relates to telephone systems and more particularly to systems for trunking between a plurality of subscribers' offices, sub-stations and main stations.

5 Systems of this type generally provide for means whereby a plurality of offices located in a group or a certain zone a considerable distance away from a main office are arranged with comparatively short trunk lines
10 leading from these zone offices to a centrally located junction point or office from which a number of comparatively longer trunk lines are provided to the main office. In the type of systems to which the improvements
15 in accordance with this invention relate, the number of trunks between the junction office and the main office are equal to the number of trunks from each of the zone offices to the junction office.

20 It is an object of this invention to reduce the cost of trunking between offices and cheapen and simplify the operation of systems of this general class, and particularly to the type in which the common trunks outgoing to a main office are normally connected at the junction office to all of the
25 branch trunks incoming thereto from the zone offices.

To attain this and other objects of the invention there is provided in accordance with one feature thereof, means whereby if a trunk outgoing from a zone office is taken for use, all the trunks outgoing from the other zone offices normally connected to the
35 same common trunk outgoing from the junction office are disconnected from this common trunk leaving the connection from the zone office from which the connection was made intact. Another feature of the
40 invention resides in the provision of means whereby a busy condition is established for all of said disconnected trunks. Another feature of the invention resides in the provision of means whereby in an arrangement
45 of this sort, group busy conditions are established for all of the trunks outgoing from the zone offices when all of the main trunks outgoing from the junction office are in use.

50 It should be understood that this inven-

tion is not limited to the specific arrangement mentioned above in which trunks from a plurality of zone offices are connected at a junction office to a common trunk extended to a main office but that such zone trunks
55 may very well extend to and terminate at different operators' switchboards in the same office or to any arrangement of a similar nature where a plurality of branch trunks connected to a common trunk regard-
60 less of where these branch trunks begin and where the common trunk terminates.

In the attached drawings, Fig. 1 illustrates an arrangement in accordance with this invention in which a single common
65 trunk outgoing from a junction office is shown with a plurality of zone trunks normally connected thereto and terminating in a plurality of zone offices and a portion of an ordinary cord circuit at one of said zone
70 offices whereby a zone trunk terminating thereat may be seized, while Fig. 2 shows a modified form of the invention with an idle or busy trunk indentifying arrangement applied thereto, this circuit arrangement be-
75 ing the subject matter of a copending application of L. L. Eagon, Serial No. 65,876, filed on even date with the filing of this application.

Referring now to Fig. 1 there is shown the
80 detail equipment for zone trunks 1, 2 and 3 outgoing respectively from zone offices A, B and C and the circuit arrangement at a junction office D whereby said zone trunks are connected together to a common trunk
85 4 leading to a main office. It should be understood that a plurality of trunks such as 4 may be similarly arranged and equipped at the junction office and that a
90 corresponding number of zone trunks may be provided from the various zone offices.

To make clear the operation of this system a connection from the zone office A through junction office D to the main trunk 4 will be described, followed by a descrip-
95 tion showing how the group busy arrangement at each of the zone offices functions when all of the main trunks are engaged.

When the operator at E in zone office A decides to extend a connection to the com-
100

mon trunk 4, she may insert plug 6 into jack 7 of zone trunk 1. The following circuit is thereby closed. Battery, supervisory lamp 10, winding of relay 9, sleeve contacts of plug 6 and jack 7, upper winding of relay 11, lower armature and back contact of relay 12 to ground. This circuit causes the lighting of lamp 10 and the operation of relay 11. Relay 11 in operating opens at its inner armature and back contact a bridge circuit normally closed across the tip and ring conductors of zone trunk 1. Another circuit closed by the insertion of plug 6 into jack 7 causes the operation of relay 13 at junction office D. This circuit is as follows: battery, lower right-hand winding of repeating coil 15 of the cord circuit at E, supervisory relay 16, ring contacts of plug 6 and jack 7, lower winding of relay 13, contacts 17 of relay 18, upper winding of relay 13, tip contacts of jack 7 and plug 6, armature and front contact of relay 9, upper right-hand winding of repeating coil 15 to ground. It should be noted that the circuit for the operation of relay 13 does not cause the operation of relays 13' and 13'', although they are connected in circuits to the common conductors 21 and 22 as follows: from the ring conductor of zone trunk 1, common conductor 21 and in parallel to the lower outer armatures and back contacts of relays 18' and 18'', lower windings of relays 13' and 13'', upper inner armature and back contacts of relays 18' and 18'', common conductor 22, upper inner armature and back contact of relay 18, contact 17, upper winding of relay 13 to the tip conductor of zone trunk 1 and also parallel circuits from the common conductor 21, through tip and ring conductors of zone trunks 2 and 3 and the windings of the bridged relays 12' and 12'' to the upper windings of relays 13' and 13'' to the common conductor 22. As shown by these circuits, the windings of relays 13' and 13'' are connected so that current in the two windings of these relays oppose each other while the current through the windings of relays 13 are in series aiding relation. Hence, relay 13 will operate and relays 13' and 13'' will not be operated on the seizure of zone trunk 1. It is to be understood that the electrical characteristics of relays 12' and 12'' may be such as not to operate in the above circuits on the seizure of zone trunk 1. Relay 13 in operating closes at its armature and front contact a connection to ground for the operation of relays 18' and 18'', in the circuits for zone trunks 2 and 3 and for other similar relays of the circuits for other zone trunks that may be normally connected to the common trunk 4 and extend to other zone offices. The circuits for these relays may be traced as follows: from battery through the windings of relays 18'' and 18' and over the armatures and

back contacts of relays 13' and 13'' in parallel to ground at the armature and front contact of relay 13. Relays 18' and 18'' operate in these circuits and disconnect respectively the zone trunks 2 and 3 at their upper outer and lower outer armatures and back contacts from the common leads 20 and 21, to which all of the zone trunks from the various zone offices are normally connected. It should be noted that relay 18 is not operated in this circuit as the connection from battery through its winding is opened on the operation of relay 13 so that the conductors of zone trunk 1 are maintained connected to the common leads 20 and 21 which are in fact the tip and ring conductors of trunk 4 leading to the main office. The operation of relays 18' and 18'' closes circuits for the operation of relays 12' and 12'', respectively. The circuit for the operation of one of these relays will be traced: battery, lower non-inductive winding of relay 18', lower outer armature and front contact of relay 18', ring conductor of zone trunk 2, winding of relay 12', inner upper armature and back contact of relay 11', tip conductor of zone trunk 2, upper outer armature and front contact of relay 18', upper non-inductive winding of relay 18' to ground. Relays 12' and 12'' in operating close at their lower armatures and front contacts circuits to battery for the sleeve terminals of the corresponding jacks 7' and 7''. The circuit for sleeve terminal of jack 7' will be traced: battery, lower winding of relay 11', lower armature and front contact of relay 12', upper winding of relay 11', sleeve terminal of jack 7'. These connections to battery for the sleeve terminals of jacks 7' and 7'' thus provide busy conditions for these jacks so that in case an operator at any of these offices attempts to make connection with the corresponding jack, she will receive a busy indication as she touches the tip of a plug to the sleeve of the jack, as is well known in the art. The connection from the operator at E from zone trunk 1 to the main trunk 4 is now completed through the tip and ring conductors.

As the connections beyond form no part of this invention, no further description of the extension of the connection will be made, except to say that when the called subscriber at the opposite end of main trunk 4 answers, a circuit will be completed for the operation of relay 25 as follows: battery, lower inner armatures and front contacts of relays 18' and 18'', common conductor 26, lower winding of relay 25, ring conductor of trunk 4, subscriber's loop, back to the tip conductor of main trunk 4, upper winding of relay 25 to ground. The operation of relay 25 closes a shunt circuit through the retardation coil 27 for the lower high resistance winding of relay 13 as follows:

ring conductor of zone trunk 1, retardation coil 27, armature and front contact of relay 25, upper inner armature and back contact of relay 18, contacts 17, upper winding of relay 13 to the tip conductor of zone trunk 1. This circuit across the high resistance winding of relay 13 decreases the resistance of the path across the tip and ring conductor of zone trunk 1, causing the relay 16 in the cord circuit at E to operate and shunt the circuit for supervisory lamp 10 which now is extinguished as an indication to the operator at E, that the called subscriber has answered; a procedure which is well known in the art.

It is evident that if an operator in the zone office B had made a connection to zone trunk 2, the operations would have been the same as described above for the call over trunk 1 from zone office A. In this case, of course, relays 11' and 13' at zone office B, relays 18 and 18'' at the junction office and relays 12 and 12'' at the zone offices A and C would have operated, so that a busy condition would have been established for the jacks 7 and 7'' at the zone offices A and C and the zone trunks 1 and 3 would have been disconnected from the common leads 20 and 21 while zone trunk 2 would have remained connected through to the common trunk 4.

The so-called "group busy" testing arrangements at the zone offices are arranged so that when all of the main trunks outgoing from the junction office are engaged an operator at any zone office attempting to establish a connection over a zone trunk receives the tone. In performing the standard well known trunk group busy test, this arrangement is such that if the operator at a zone office tries to establish a connection over a zone trunk, she will test the jack of a particular trunk to determine if any common trunks at the junction office are available. If no tone is received on testing this jack, she will know that at least one trunk is available at the junction office and in testing this particular jack she will naturally also determine if the corresponding common trunk is engaged. If this particular common trunk is not available she will test the jacks of other trunks in the group until an idle trunk is found.

The circuit connections for transmitting a trunk group busy tone to the jack of a designated trunk in each zone office is arranged as follows: If it is considered that jack 7 in the zone office A is to be tested for trunk group busy tone, it will be seen that the relays 11 and 12 are provided with armatures and contacts so that whichever of these relays is operated, a connection will be established from the sleeve of jack 7 to a common lead 50. Similar armatures

are provided for corresponding relays such as 11^a and 12^a associated with a zone trunk 1^a and for other zone trunks outgoing from zone office A. A connection from lead 50 to these contacts is in the nature of a so-called chain connection, that is, if either of the relays such as 11^a and 12^a are operated in the circuits of all of the trunks outgoing from the zone office A, a connection will be completed through the armatures and front contacts of such operated relays to a tone device 51 from the sleeve terminal of jack 7. It will be seen therefore that if the operator at E touches the tip of her plug 6 to the sleeve of jack 7 and all of the main trunks from the junction office are engaged, a connection from the sleeve terminal of jack 7 to the tone device 51 will be completed and a tone will be heard in the operator's telephone set through the usual busy lead 52 in the cord circuit.

Arrangements identical to this group trunk busy circuit of zone office A are provided for the other zone offices B and C so that the operator in any of these zone offices will receive a busy tone when all of the common trunks outgoing from junction office are engaged.

The modified form of the invention shown in Fig. 2 illustrates how a different idle or busy identifying arrangement may be applied to the trunking system of this invention. This identifying arrangement in itself forms no part of this invention but is disclosed and claimed in the co-pending application of Lloyd L. Eagon, Serial No. 65,876, filed on even date with the filing of this application. This figure shows the terminal arrangement of two trunks outgoing from a zone office and illustrates an arrangement whereby a signal associated with one trunk is normally lighted and the corresponding signals of the other trunks are normally extinguished and whereby the signal of a preceding trunk is extinguished and the signal of a succeeding trunk lighted in response to the seizure of the preceding trunk.

The arrangement shown in this figure is practically the same as that shown in Fig. 1 as far as the making-busy features are concerned except in the arrangement whereby the ring conductor is normally opened and arranged to be closed when the relay 111 is operated and in the arrangement whereby relay 111 is operated from a separate sleeve relay 100, otherwise the functions of relays 111 and 112 are identical with the functions of relays 11 and 12. It will be noted that in this arrangement, as well as in the arrangement shown in Fig. 1, either the relay 111 or 112 is operated when the corresponding trunk becomes busy, that is, relay 111 is operated when jack 107 becomes busy by

being seized and relay 112 is operated when the corresponding jack at another zone office is seized to make jack 107 busy.

A circuit is normally closed for the signal 101 from battery, lower armature and back contact of relay 112, lower armature and back contact of relay 111 through signal 101 to ground. The fact that this lamp is lighted indicates to the operator at this zone office that the trunk associated with jack 107 is idle. If, now, this trunk becomes busy by the operation of either relay 111 or 112, the circuit for signal 101 will be opened at the lower armature and back contact of either relay 111 or 112 and a circuit closed from battery through the lower armature and back contact of relay 112 through the lower armature and front contact of relay 111, or, from battery through the lower armature and front contact of relay 112 to a lead 150 of a chain circuit that extends from the circuits of the trunk 1 to the circuits of trunk 2 through the lower armatures and back contacts of relays 111^a and 112^a through the signal 101^a to ground. Signal 101^a now becomes lighted to indicate to the operator that trunk 2 is idle. If trunk 2 becomes busy by the operation of either of the relays 111^a or 112^a, the lamp 101^a will be extinguished and the circuit will then be extended to the lead 150^a to the next succeeding trunk at this office. It will be seen, therefore, that only one lamp associated with one of the trunks in this zone office will be lighted at the time to indicate that the corresponding trunk is idle. In this manner it will be ordinarily unnecessary for the operators at the zone offices to perform the usual busy test on the jacks of the outgoing trunks. All that the operator has to do is to observe where a lamp is lighted and choose the corresponding trunk for the next outgoing connection.

What is claimed is:

1. In a telephone system, a junction office, a common trunk comprising tip and ring conductor outgoing therefrom, a plurality of branch trunks each comprising tip, ring and sleeve conductors incoming thereto and normally having their tip and ring conductors connected in multiple to said common trunk, and means responsive to the seizing of any one of said branch trunks for disconnecting the tip and ring conductors of all of said branch trunks from the tip and ring conductors of the common trunk except those of the seized branch trunk and for establishing a busy condition on the sleeve conductor of said disconnected branch trunks.

2. In a telephone system, a junction office, a common trunk comprising tip and ring conductors outgoing therefrom, a plurality of zone offices, a branch trunk comprising tip, ring and sleeve conductors and having

its tip and ring conductors outgoing from each zone office and terminating in said junction office, the tip and ring conductors of said branch trunks being normally connected in multiple to the tip and ring conductors of said common trunk at said junction office, and means at said junction office responsive to the seizure of any one of said branch trunks for disconnecting the tip and ring conductors of all of said branch trunks from the tip and ring conductors of the common trunk except the tip and ring conductors of the seized branch trunk, and means operating over the tip and ring conductors of said disconnected branch trunks in response to the seizure of the one branch trunk for establishing at the zone offices where said disconnected branch trunks terminate a busy condition on the sleeve terminals of said disconnected branch trunks.

3. In a telephone system, a junction office, a plurality of common trunks outgoing therefrom, a plurality of zone offices, a group of branch trunks incoming to the junction office from each zone office, each common trunk being normally connected in multiple to a branch trunk incoming from each zone office, means at said junction office responsive to the seizure of any one of said branch trunks for disconnecting the corresponding common trunk from all of the branch trunks to which it is multiplied except the branch trunk seized, and means responsive to the engagement of all of the common trunks for establishing at each zone office a busy condition indicating that all of the common trunks are engaged.

4. In a telephone system, a junction office, a plurality of common trunks outgoing therefrom, a plurality of zone offices, a group of branch trunks incoming to the junction office from each zone office, each common trunk being normally connected in multiple to a branch trunk incoming from each zone office, means at said junction office responsive to the seizure of any one of said branch trunks for disconnecting the corresponding common trunk from all of the branch trunks to which it is multiplied except the branch trunk seized, means responsive to the engagement of all of said common trunks for establishing at the terminals of one of the branch trunks at each zone office a busy condition indicating that all of the common trunk lines are engaged.

5. In a telephone system, a junction office, a plurality of common trunks outgoing therefrom, a plurality of zone offices, a group of branch trunks incoming to the junction office from each zone office, each common trunk being normally connected in multiple to a branch trunk incoming from each zone office, means at said junction office responsive to the seizure of any one of said branch trunks for disconnecting the corresponding

common trunk from all of the branch trunks to which it is multiplied except the branch trunk seized, means for establishing a busy condition at the terminals of all disconnected branch trunks at the corresponding zone offices responsive to the means for disconnecting them, and means responsive to the engagement of all of the common trunks for establishing at each zone office a busy condition indicating that all of the common 10 trunks are engaged.

In witness whereof, I hereunto subscribe my name this 27th day of October A. D. 1925.

HERBERT B. JOHNSON.