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H. M. BASCOM,
TRUNKING SYSTEM.
APPLICATION FILED OCT. 21, 1918.

Patented Dec. 28, 1920.

3 SHEETS—SHEET 1.

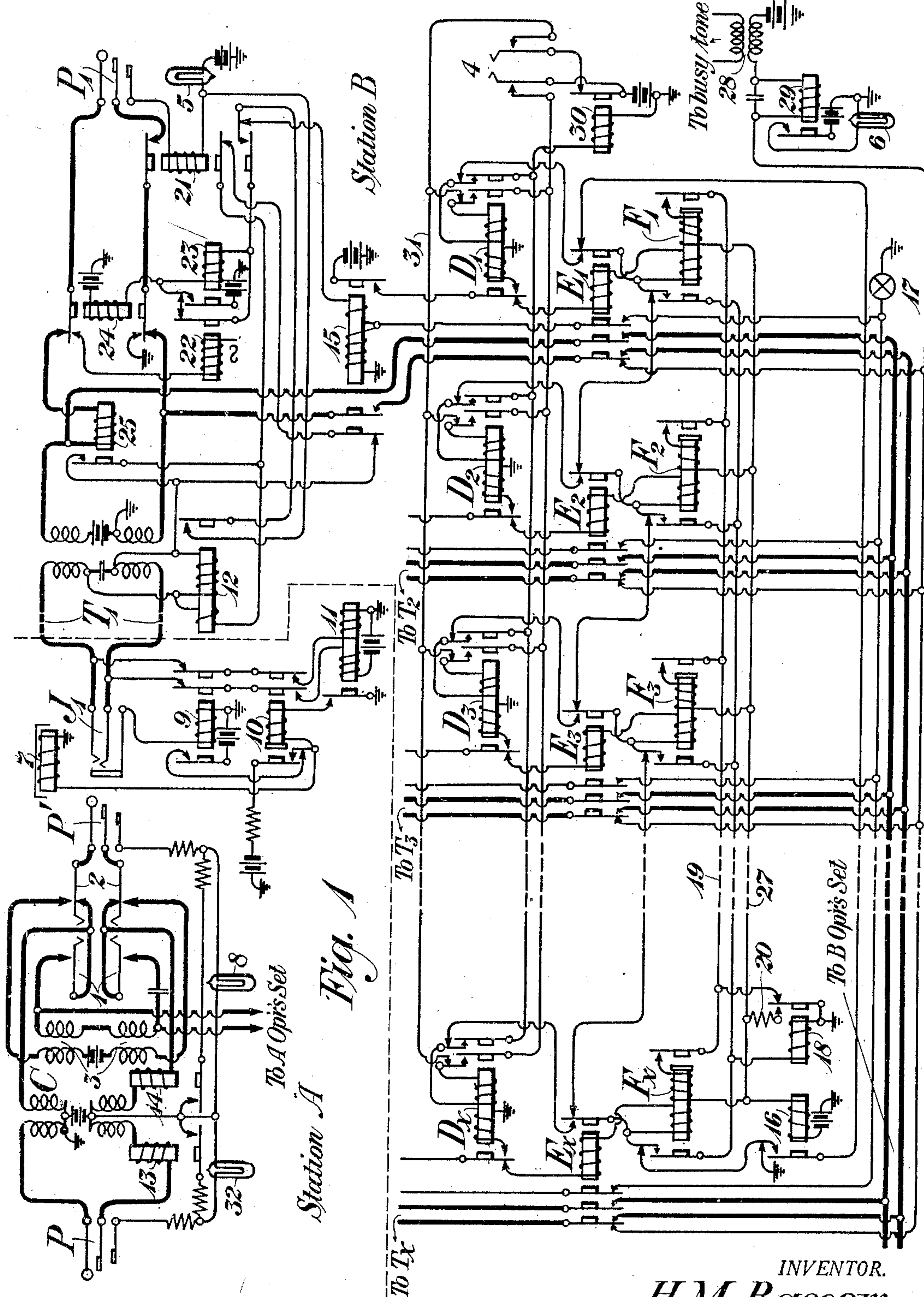


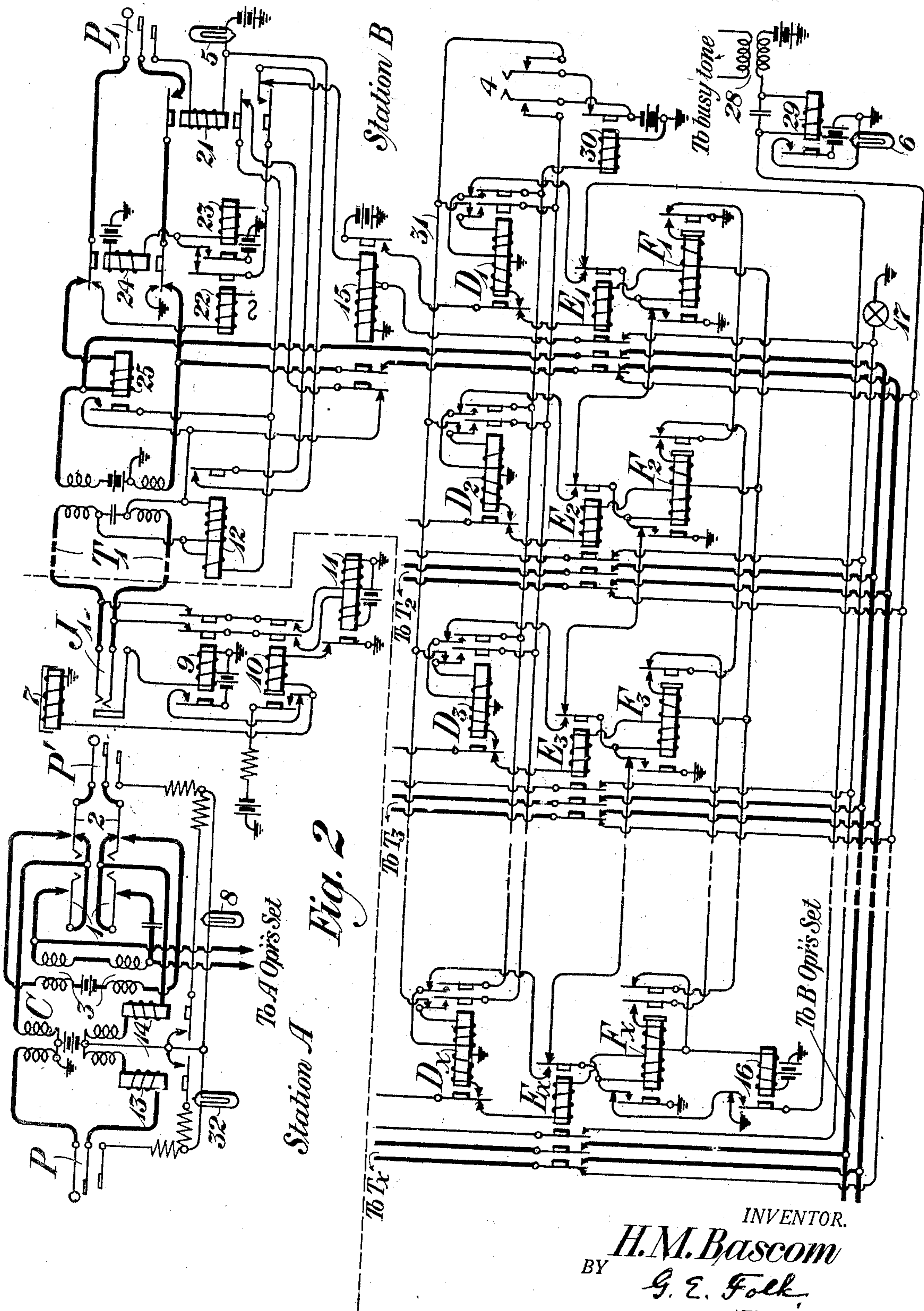
Fig. 1

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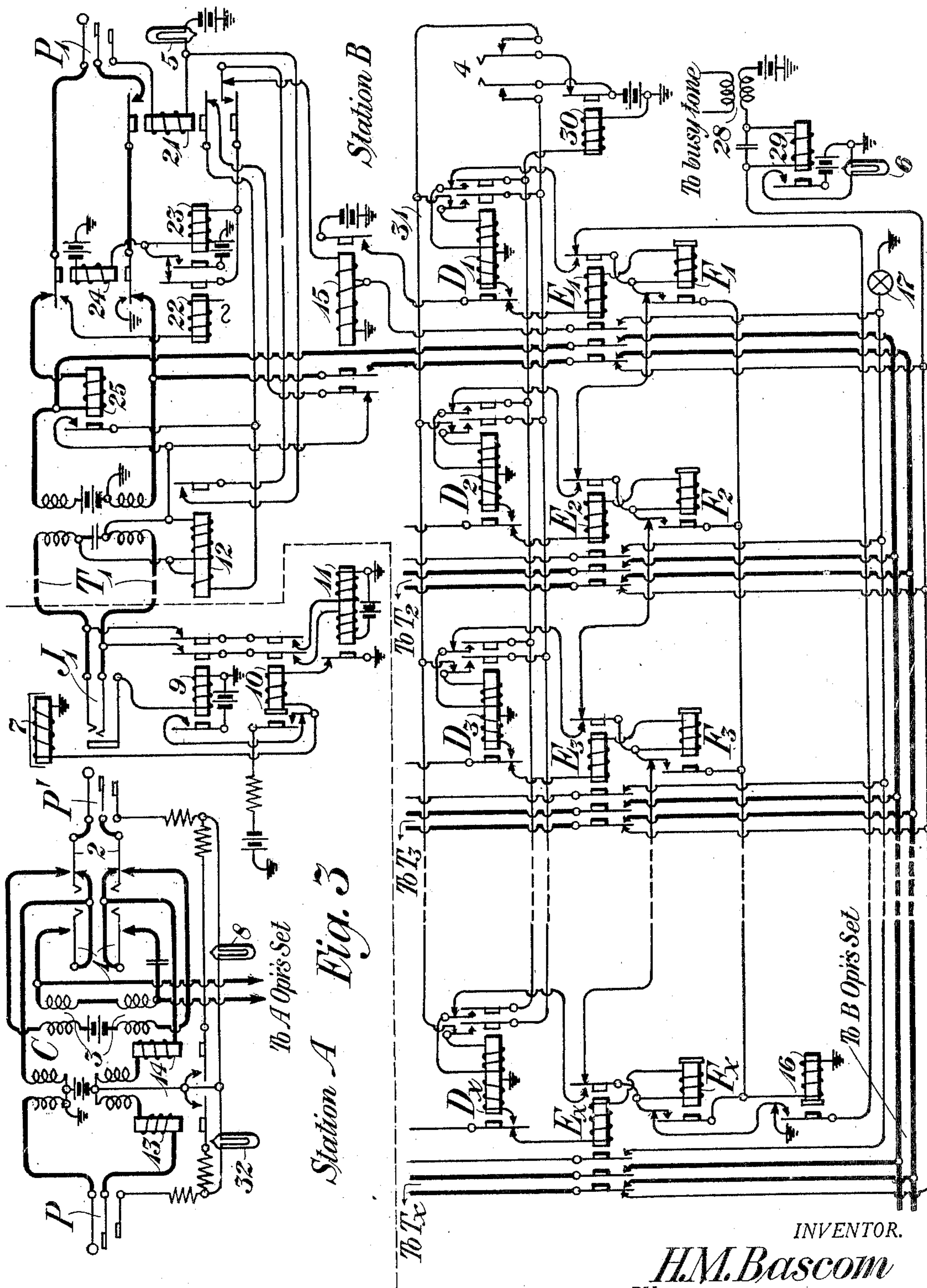
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UNITED STATES PATENT OFFICE.

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TRUNKING SYSTEM.

1,363,219.

Specification of Letters Patent. Patented Dec. 28, 1920.

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To all whom it may concern:

Be it known that I, HENRY M. BASCOM, residing at New York, in the county of New York and State of New York, have invented certain Improvements in Trunking Systems, of which the following is a specification.

This invention relates to telephone systems and more particularly to trunking systems or systems in which calls are extended from one office over trunks to another office where the connection is completed by a so-called B operator.

Heretofore, when it was necessary to extend a call over a trunk to another office, it has been the practice for the A operator to communicate the call over an order wire to a B operator who assigned a trunk to the A operator. The A operator then connected the calling subscriber to the assigned trunk by means of a cord circuit, thereby causing a signal at the B operator's position, whereupon the B operator connected the trunk to the called subscriber.

It is the purpose of the present invention to modify and simplify this practice in such a manner as to expedite the process of trunking calls. In accordance with the present invention the A operator, having first ascertained the connection desired by the calling subscriber, plugs into the jack of any idle trunk of a group of trunks leading to a B operator's position. If the B operator is not engaged her telephone set is at once automatically connected to the selected trunk and a signal is actuated to indicate the trunk selected. The A operator may then communicate directly with the B operator over the trunk itself without the use of an order wire and if desired the calling subscriber may be temporarily excluded from the circuit by means of a splitting key or the like. The B operator having been informed of the connection desired associates the trunk with the line of the called subscriber. If one or more A operators should plug into separate idle trunks while the B operator's set is connected to another trunk, the circuit is so arranged that the B

operator's set will be connected to but one trunk at a time and as each trunk connection is completed her set will be automatically connected in definite order to the waiting trunks. The circuit is also arranged so that as soon as a trunk is seized by an A operator a busy signal appears at each A operator's position to indicate that the trunk is in use and this busy signal remains operated until the connection is taken down.

The invention may now be more fully understood from the following description, when read in connection with the accompanying drawings, Figures 1, 2, and 3 of which constitute circuit diagrams of three different embodiments of the invention.

Referring to Fig. 1, two sets of apparatus located, respectively, at stations A and B are shown, the apparatus included within the dotted lines in the upper left hand corner of the diagram being located at station A and the remaining apparatus at station B. At station A one of a plurality of cord circuits C is shown terminating in the usual plugs P and P' whereby subscribers' lines terminating at said station may be interconnected. The outgoing plug P' of said cord circuit is also adapted to cooperate with any one of the jacks, such as J₁, of a plurality of trunks, such as T₁, which extend from station A to station B for the purpose of interconnecting subscribers whose lines terminate at station A with subscribers whose lines terminate at station B.

In order that the so-called A operator at station A may communicate with the calling subscriber, a listening key 1 is provided whereby the A operator's telephone set may be bridged across the cord circuit in the usual manner. In order that the A operator at station A may communicate with the so-called B operator at station B over the trunk, to the exclusion of the calling subscriber, when the cord circuit is connected with the trunk, a splitting key 2 and a transformer 3 are provided for the cord circuit, the contacts of the splitting key being so arranged that the outgoing end of the cord circuit is disconnected from the re-

mainder of the cord circuit and is directly connected through the transformer 3 to the A operator's set.

The trunks are so arranged that when a
5 cord circuit is connected thereto the B operator's telephone set is automatically connected to the trunk with which the connection is made so that the B operator may receive from the A operator the number of
10 the desired subscriber at station B. Inasmuch as a plurality of A operators may have simultaneously plugged into a plurality of trunks leading to the B operator's position, the apparatus at station B is so arranged that the B operator's telephone set
15 will be connected to but one trunk at a time, and when the connection over that trunk is completed it will be automatically disconnected therefrom and automatically
20 connected to the waiting trunks in a predetermined order.

This result is accomplished by providing each trunk, such as T_1 , with relays, such as E_1 and F_1 . When the E relay of any
25 trunk is operated, the B operator's set is automatically connected to the trunk over the contacts of said relay and the circuits of the E relays of other trunks are held open until the connection over the trunk is completed, whereupon the E relay of that trunk
30 is deenergized. The trunks are arranged in an endless chain with respect to the E and F relays, so that when the F relay of a trunk is operated upon the connection of
35 the B operator's telephone set thereto, said relay is locked up, thereby shifting the circuit connections so that if calls are waiting on a plurality of trunks the E relay of the first trunk next in order to that of the
40 trunk over which a connection was just established will be energized to connect the B operator's set to the trunk to which it corresponds. As each connection is completed the B operator's set is then automatically
45 connected to the next trunk in regular order of rotation. By means of this arrangement of the circuits, the order of rotation begins anew with the last trunk over which the connection was established each
50 time a new call comes in, so that during periods of heavy traffic there is no tendency to discriminate against the last trunk of a series.

Situations may arise during heavy traffic
55 periods such that the A operator is unable to get into communication with the B operator immediately, due to the fact that a number of calls are waiting upon trunks leading to the B operator's position. Should
60 the A operator in such a case restore her splitting key and proceed to answer other calls which may be coming in, the B operator upon being connected to the trunk seized by such an A operator may get no response to
65 her request to know the desired number. In

such a case, it is desirable that the B operator should be able to listen out from a given trunk at will and for this purpose a master listening out key 4 is provided, and each
70 trunk is further provided with a relay, such as D_1 , individual thereto. Upon the actuation of the master listening out key 4, the D relay corresponding to the trunk to which the B operator's set is at that moment connected will be energized and locked up,
75 thereby disconnecting the B operator's telephone set from the trunk and permitting it to be connected to the next waiting trunk in order. The circuit connections are so altered by this operation that the A opera-
80 tor may only procure the attention of the B operator by withdrawing the plug of her cord circuit from the jack of the trunk and again reinserting it to start the succession of operations anew. 85

A signal lamp, such as 5, is provided for each trunk at the B operator's position and the circuit of this lamp is so arranged that when in response to the selection of
90 the trunk by an A operator, the B operator's telephone set is connected thereto, the lamp will be caused to flicker in a distinctive manner to indicate to the B operator the trunk to which her telephone set is connected and over which an A operator desires to
95 communicate with her. If while the B operator is responding to a call of this character another A operator should make a connection to another trunk, the signal lamp associated with that trunk will glow steadily.
100 In addition, a pilot lamp 6 is provided which also glows under these conditions to indicate to the B operator that another call is waiting, while a busy tone is applied to the trunk to indicate to the A operator that
105 the B operator is busy. When the B operator connects the trunk to a called subscriber's line the lamp 5 is extinguished. Its circuit is so arranged, however, that when the connection is taken down by the A
110 operator it is again caused to glow to give a disconnect signal to the B operator who then disconnects the trunk from the called subscriber's line. Each trunk is further provided with a busy signal device, such
115 as 7, at each A operator's position at station A, these busy signaling devices being so arranged as to indicate that the trunk is busy as soon as the A operator plugs into the trunk, and to continue this indication
120 until the entire connection has been taken down.

Further details of the apparatus will now be clear from a description of the operation, which is as follows: Assuming that a call
125 has come in over a subscriber's line (not shown) terminating at the station A, the A operator inserts the plug P of the cord circuit C in the jack of calling subscriber's line and by throwing the listening key 1 130

bridges her telephone set across the cord circuit to ascertain the number of the desired party, in the usual manner. Upon ascertaining that the number is that of a party whose line terminates at a station, such as station B, the operator inserts the plug P' of the cord circuit into a jack, such as J₁, of an idle trunk T₁ leading to a B operator's position at station B. A circuit is now closed from battery, through supervisory lamp 8, over the sleeve contacts of the plug and jack and through the windings of sleeve relay 9 to ground. The supervisory lamp 8 now glows and the relay 9 is energized to complete a circuit from battery, over its left hand front contact and over the left hand back contact of relay 10 and thence in parallel through the winding of the busy signal 7, and through the winding of the relay 10 and over the back contact of the relay 11 to ground. Relay 10 is locked up over its front left hand contact and also completes a locking circuit over said contact for the busy signal 7. Slow releasing relay 10, over its right hand front contacts prepares a circuit whereby the relay 11 is bridged across the trunk, said circuit being held open, however, at this time, at the right hand contacts of the relay 9.

When the plug P' was inserted in the jack J₁, a circuit was also completed over the talking conductors of the cord circuit and the trunk through the right hand high resistance winding of the trunk relay 12. A circuit is also completed for the low resistance left hand winding of the relay 12 in parallel with its high resistance winding, over the middle back contact of the relay 21 and the extreme left hand back contact of relay 15. Relay 12 at its front contact completes a circuit from battery, through the lamp 5, over the front contact of relay 12 lower back contact of relay 21, and through the two windings of relay 15 in series to ground, causing the lamp 5 to glow steadily. The resistance in circuit with the supervisory relay 14, when the high resistance winding of the relay 12 is shunted by its low resistance winding, is such that the relay 14 is energized to shunt the supervisory lamp 8, thereby extinguishing it. The supervisory relay 14 is at once deenergized, however, since the relay 15 at its extreme left hand contact opens the circuit of the low resistance winding of the relay 12 thereby increasing the resistance in series with the relay 14 so that said relay is deenergized and again opens the shunt about the supervisory lamp 8 which continues to glow steadily.

Assuming that the operator's set is not at this moment connected to any trunk, relay 15 at its right hand front contact completes a circuit from battery, over the

left hand back contact of relay D₁, through the winding of relay E₁ and through the left hand winding of relay F₁ to ground, over a circuit which depends upon the conditions then existing. Assuming that no call had previously been answered and that the relay 16 is, therefore, deenergized, the circuit to ground will continue from the left hand winding of relay F₁, over the left hand back contact of said relay, over the right hand back contact of relay E₂, left hand back contact of relay F₂, right hand back contact of relay E₃, left hand back contact of relay F₃ and over the similar back contacts of other E and F relays (not shown), over the right hand back contact of relay E_x and the left hand back contact of relay F_x corresponding to the last trunk of the series and thence to ground over the left hand back contact of relay 16. Relays E₁ and F₁ are energized over the circuit above traced, the former operating to bridge the B operator's set across the trunk by means of its extreme left hand front contacts. At its inner front contact relay E₁ completes a short circuit about the high resistance windings of the relay 15, through an interrupter 17, thereby causing the lamp 5 to flicker or vary in brilliancy in a distinctive manner to indicate to the B operator with which trunk her telephone set is connected. Relay F₁ upon being energized completes a locking circuit over its left hand front contact, from battery, over the right hand front contact of relay 15, left hand back contact of relay D₁, through the windings of relay E₁, left hand winding and left hand front contact of relay F₁, through the winding of the relay 18 to ground. Relay 18 in shifting its armature disconnects ground from the conductor 19 and completes a circuit through a resistance 20, for the relay 16. Relay 16 upon being energized disconnects the ground normally connected to the series circuit over the back contacts of the E and F relays, and over its front contact alters the circuit so that the ground connection for E and F relays hereinafter energized must pass through the winding of the relay 18. Relay E₁ at its right hand contact maintains the initial energization circuits of the E and F relays of all of the other trunks open, so long as the relay E₁ remains energized and the operator's set remains connected to the trunk T₁. This prevents the possibility of the B operator's set being simultaneously connected to more than one trunk.

The B operator upon observing the flashing of the signal lamp 5 is informed that an A operator desires to communicate with her over the trunk T₁. The A operator at station A may now throw the splitting key 2, thereby disconnecting the talking conduc-

tors connected to the plug P' from the remainder of the cord circuits and connecting them to the primary windings of a transformer 3 associated with the A operator's set. The A operator may now converse with the B operator over the trunk T₁, to the exclusion of the calling subscriber. The B operator upon ascertaining the number of the desired subscriber inserts the plug P₁ into the jack of said subscriber, thereby completing a circuit for the relay 21 in series with the lamp 5. Relay 21 at its upper front contact completes the talking strands of the trunk and at its middle contact opens the circuit of the low resistance winding of the relay 12 which, however, had already been opened at the left hand contact of the relay 15. At its lower front contact relay 21 completes a circuit in shunt with the lamp 5, over the sleeve contacts of the plug P₁ and the corresponding jack, through the winding of the relay 21, over the front contact of the relay 12, lower front contact of relay 21, back contact of tripping relay 22, back contact of relay 23 and through the winding of relay 24 to battery. This circuit through the relay 24 is of sufficiently low resistance to extinguish the lamp 5. Relay 24 is now energized and connects ringing current to the line of the calling subscriber over its front contacts and through the winding of the tripping relay 22 in a well understood manner. As soon as the called subscriber responds the tripping relay 22 is energized to open a short circuit about the winding of the relay 23 which is thereby energized to short circuit the ringing relay 24 and to lock up a shunt for the lamp 5 through the winding of relay 23. The response of the called subscriber also results in the energization of the relay 25, which at its front contact completes a circuit for the low resistance winding of the relay 12 in shunt with the high resistance winding of said relay. The supervisory lamp 14 of the cord circuit is accordingly energized to shunt out the supervisory lamp 8, thereby indicating to the A operator that the called subscriber has responded.

Relay 21 upon being energized, in closing its lower front contact with the results just described, at the same time opens the circuit previously described through the relay 15 which is accordingly deenergized, thereby disconnecting the B operator's set from the trunk at the middle contact of said relay. Relay 15 at its right hand contact opens the locking circuit through the winding of the relay E₁ and the left hand winding of the relay F₁, thereby deenergizing the relay E₁ to further disconnect the B operator's set from the trunk at the left hand contacts of said relay. It will be remembered that the locking circuit for the relays E₁ and F₁ included the winding of the relay

18. This relay is also deenergized at this time thereby completing a locking circuit through the right hand winding of the relay F₁ from ground over the back contact of relay 18, conductor 19, right hand front contact and right hand winding of relay F₁, over the conductor 27 and through the winding of the relay 16 to battery. Relay F₁ is sufficiently slow in releasing its armature to permit of this circuit being closed before said relay is deenergized. Relay 16 also remains energized and in fact this relay in the normal operation of the system is permanently energized once the system is set into operation, either by a circuit over the front contact of the relay 18 or by a circuit in series with the right hand winding of some one of the F relays. The relay F₁ remains energized until a call comes in over some other trunk. The relay 16 was provided for the purpose of obtaining an alternative ground connection for the initial energizing circuit of the E and F relays, so that should the F relay last locked up become deenergized, because of the accidental falling off of its armature, no false action will occur due to the opening of the initial energizing circuit through the winding of the relay 18.

Assuming now that a call should come in over trunk T₃ (not shown) a circuit would be completed over the left hand back contact of the relay D₃, through the winding of the relay E₃ through the left hand winding and left hand back contact of relay F₃, over the right hand back contacts of succeeding E relays and left hand back contacts of succeeding F relays (not shown) over the right hand back contact of relay E_x, left hand back contact of relay F_x, front contact of relay 16, right hand back contact of relay E₁, left hand front contact of relay F₁ through the winding of relay 18 to ground. Relays E₃ and F₃ and 18 are now energized, the former connecting the operator's telephone set to the trunk T₃ and the latter disconnecting ground from the right hand locking winding of the relay F₁, which is thereby deenergized and connects ground to the winding of the relay 16 which is maintained energized. As soon as the connection over the trunk T₃ is completed by the B operator, the circuit through relay E₃, left hand winding of relay F₃ and winding of relay 18 is opened and relays E₃ and 18 are deenergized, the former disconnecting the operator's set and the latter at its back contact completing a locking circuit through the right hand winding of the relay F₃ in series with the relay 16.

Let us now assume that while the B operator was disposing of the connection calls had come in upon trunks T₁, T₂, and T_x. The circuits of the relays E₁, E₂ and E_x would be held open at the right hand contact of the relay E₃ so long as said relay is

energized. When relay E_3 is deenergized, however, a circuit will be completed over the back left hand contact of relay D_2 , winding of the relay E_2 , left hand winding and left hand back contact of relay F_2 , right hand back contact of relay E_3 and left hand front contact of relay F_3 to ground through the winding of relay 18. Relays E_2 , F_2 and 18 are energized, the latter opening a locking circuit of the relay F_3 which is now deenergized so that the relay 18 is maintained energized by the locking circuit over the left hand front contact of the relay F_2 . The circuits of the E and F relays corresponding to trunks T_1 and T_x are opened at the right hand contact of the relay E_2 before said relays become effective so that the relays E_2 and F_2 , corresponding to the trunk T_2 which is next in order to the trunk T_3 over which the last call was made, have preference over the relays of all other trunks. In a similar manner, as soon as the relay E_2 is released the relay F_2 will be locked up through its right hand winding and if calls are waiting on trunks T_1 , T_3 and T_x , trunk T_1 will have preference. This results in locking up relay F_1 as soon as the call coming in over trunk T_1 is disposed of so that the trunk T_x has next preference. It will thus be seen that where a plurality of calls are simultaneously waiting upon several trunks the trunk nearest in regular order to that trunk with which the last call was made will have preference over all other trunks and as the operator's set is successively connected to the trunks a different order of rotation is established beginning with the trunk to which the operator's set is connected.

Returning now to the connection originally described with reference to the trunk T_1 , if, when the plug P' was inserted in the jack J_1 , with the consequent energization of the relay 15, the operator's set had been connected to some other trunk so that the relays E_1 and F_1 could not be energized, a circuit would have been completed from battery, through one winding of the transformer 28, winding of relay 29, over the extreme left hand back contact of relay E_1 , middle front contact of relay 15, over the lower conductor of the talking circuit of the trunk to ground. A busy tone would have been transmitted through the transformer 28 and over the circuit just described to the trunk, thereby indicating to the A operator that the B operator was at that moment engaged. The relay 29 would also have been energized to cause the pilot lamp 6 to glow and the lamp 5 would have been steadily illuminated to inform the B operator that a call awaits her upon another trunk.

Should the A operator desire to attend to other calls which might be awaiting her she could do so by restoring the splitting key 2

and throwing the listening key of another cord circuit. In this case when the B operator's set is finally connected to the trunk T_1 the B operator might be unable to secure any response to her request for the number of the called subscriber. Should the B operator desire to take up the next call awaiting her upon a trunk, she could do so by throwing the master listening out key 4, thereby completing a circuit from battery over the back contact of relay 30, right hand contact of key 4, inner right hand back contact of relay D_1 , right hand winding and outer right hand back contact of said relay, right hand front contact of relay E_1 and thence over the left hand front contact of relay F_1 to ground through the winding of relay 18. Relay D_1 is energized over the circuit above traced and at its left hand contact opens the circuit of the relay E_1 and the left hand winding of the relay F_1 , so that the relay E_1 is deenergized to disconnect the B operator's set from the trunk. The operator's set is now free to be automatically connected to the next waiting trunk in regular order. The relay D_1 at its left hand front contact is locked up through its left hand winding over the right hand front contact of relay 15. Relay D_1 upon being energized, in closing its right hand front contacts, completes a locking circuit which is maintained so long as the key 4 is operated, as follows: from battery, over the left hand make contact of key 4, inner right hand front contact of relay D_1 , right hand winding and extreme right hand front contact of relay D_1 , through the winding of relay 30 to ground. Relay 30 disconnects battery from the conductor 31 as soon as the relay D_1 is energized to prevent the possibility of the actuation of the D relay corresponding to the next trunk to which the operator's set is connected, which might occur if the master listening out key 4 was held operated too long.

The relay D_1 now remains locked up over its left hand windings so long as the plug P_1 remains inserted in the jack J_1 . Should the A operator desire to again call the B operator she may do so by withdrawing the plug P' from the jack J_1 and again inserting it, as this action results in the momentary deenergization of the relay 15 which opens the locking circuit of relay D_1 restoring the same to normal. The B operator's set will now be connected to the trunk T_1 in its regular order in a manner already described.

When the calling subscriber hangs up, the supervisory relay 13 is deenergized, thereby causing the supervisory lamp 32 to glow. When the called subscriber hangs up, the relay 25 of the trunk is deenergized, thereby opening a shunt circuit through the low resistance winding of the relay 12 so that the

supervisory relay 14 of the cord circuit is de-energized with the consequent glowing of the supervisory lamp 8. The A operator thereupon withdraws the plugs P and P' from their respective jacks so that the sleeve relay 9 is deenergized. This completes a circuit over the back right hand contacts of the relay 9 and the front right hand contacts of the relay 10 for the relay 11 in series with the high resistance winding of the relay 12. Relay 11 is not energized by current flowing in series with the high resistance windings of the relay 12, however, and no circuit changes controlled by said relay take place. The resistance of relay 11 is sufficiently high to deenergize the relay 12, also, so that the shunt circuit which previously existed about the lamp 5 is opened at the right hand contact of relay 12, thereby causing the lamp 5 to glow. The B operator upon observing the steady lighting of this lamp withdraws the plug P₁ from the jack of the called line, thereby deenergizing the relays 21 and 23. Relay 21 upon being deenergized, at its middle back contact connects the low resistance winding of the relay 12 in shunt with the high resistance winding, thereby increasing the current flow through the windings of relay 11 sufficiently to energize said relay. Relay 11 at its contact opens a circuit of the slow release relay 10 which in turn opens the circuit of the busy signals, such as 7, and disconnects the relay 11 from the trunk. The action of relays 10, 11 and 12, just described, is for the purpose of maintaining the busy signals, such as 7, of the trunk actuated, after the A operator has withdrawn the plug from the jack, so as to indicate that the trunk is busy up to the moment that the B operator finally takes down the connection by withdrawing the plug P₁.

Fig. 2 shows a somewhat modified form of circuit arrangement which differs from that of Fig. 1 mainly in that the relay 18 is omitted and its function performed by the several F relays. It will be remembered that in the arrangement shown in Fig. 1 the relay 16 is at all times locked up in series with the right hand winding of some one of the F relays so that the initial energizing circuit of the E and F relays passes to ground through the winding of the relay 18. The relay 16 was provided in order to obtain an alternative ground connection for the initial energizing circuit of the E and F relays in case the F relay last locked up should be deenergized due to the accidental falling off of its armature, thereby opening the initial energizing circuit through the winding of the relay 18. The relay 18 operated to unlock the F relay corresponding to the trunk over which the last call was made each time a call is initiated on a new trunk. In the circuit arrangement of Fig. 2 the relay 16

performs the same functions as in the arrangement of Fig. 1, while the functions performed by the relay 18 are performed in Fig. 2 by the F relays. In order to secure this result the locking circuit through the right hand winding of each F relay passes in series through the contacts of all of the relays to the right of it so that the operation of initiation of a call on any of the trunks corresponding to said relays unlocks the F relay previously locked up and locks up a new F relay. Furthermore, the F relay of the last trunk of the series which is the F relay shown at the extreme left in the diagram controls the locking circuit of all the other F relays so that a call coming in on the last trunk of the series will unlock any F relay previously locked up.

The operation of the circuit shown in Fig. 2 is similar to that already described in connection with the diagram of Fig. 1 up to the point where the relay 15 is operated in response to the insertion of the plug P' in the jack J₁. As soon as the relay 15 is energized a circuit is completed from battery, over the right hand front contact of said relay, left hand back contact of relay D₁, through the winding of relay E₁ and the left hand winding of the relay F₁ and thence to ground over a circuit depending upon the trunk over which the last call was made. If no call had been previously made the circuit would continue over the left hand back contact of the relay F₁, right hand back contact of relay E₂, left hand back contact of relay F₂ and thence in series over the back contacts of all of the other E and F relays, including relays E_x and F_x to ground, over the back contact of relay 16. If, however, a call had previously been made over the trunk T₂, the relay F₂ would have been locked up in series with the relay 16 so that the circuit would have been extended from the left hand winding of the relay F₁, over the back left hand contact of said relay, back right hand contact of relay E₂ and over the front left hand contact of relay F₂ to ground. Relay E₁ upon being energized shunts the high resistance winding of the relay 15 through the interrupter 17 and causes the signal lamp 5 to flash. Said relay also connects the B operator's telephone set over its left hand front contacts to the trunk T₁. Relay F₁ upon being energized completes a locking circuit for the relays E₁ and F₁, from battery over the right hand front contact of relay 15, left hand back contact of relay D₁, winding of relay E₁, winding of relay F₁ and over the left hand front contact of relay F₁ to ground. A locking circuit is also completed for relay F₁, from ground, over the right hand front contact of relay F₁, extreme right hand back contact of relay F_x and through the winding of relay 16 to bat-

tery. Assuming that the relay F_2 has been locked up by a previous call the energization of relay F_1 opens a locking circuit through the right hand winding of said relay F_2 by disconnecting the ground therefrom at the right hand contact of relay F_1 . If while the circuit arrangement is in the condition just described a call should be initiated on some other trunk as, for instance, trunk T_x , the circuit for the relays E_x and F_x corresponding to said trunk will not be completed as it will be held open at the right hand contact of the relay E_1 .

Assuming now that while the call initiated upon trunk T_1 was being answered calls were initiated on trunks T_2 , T_3 and T_x , as soon as the B operator inserts the plug P_1 in the jack of the called line, the relay 15 is deenergized as described in connection with the circuit arrangement of Fig. 1 and the locking circuit, through the winding of relay E_1 and the left hand winding of relay F_1 , is opened. Relay E_1 is deenergized and disconnects the B operator's telephone set from the trunk T_1 . The relay F_1 , however, remains locked up through its right hand winding. As soon as the armature of the relay E_1 falls off a circuit will be completed for the relays E_x and F_x , through the winding of the relay E_x , left hand winding of relay F_x , left hand back contact of relay F_x , front contact of relay 16, right hand back contact of relay E_1 and left hand front contact of relay F_1 to ground. The E and F relays of the trunks T_3 and T_2 will not be energized as their circuits pass over the right hand back contact of the relay E_x . It will, therefore, be seen that the trunk T_x which is nearest the trunk in the endless chain over which the last call was extended receives preference. Relay F_x at its left hand front contact locks up relays E_x and F_x in series and at its right hand contact opens the locking circuit through the right hand winding of relay F_1 which is accordingly deenergized. The locking circuit is now completed through the right hand winding of relay F_x , from battery, winding of relay 16, right hand winding of relay F_x , inner right hand front contact of said relay, back right hand contacts of all of the other F relays including F_3 , F_2 and F_1 to ground.

As soon as the call originating on trunk T_x has been completed relay E_x is deenergized, and assuming that calls are waiting on the trunks T_1 , T_2 and T_3 , it will be seen that the trunk T_3 will obtain preference over the other trunks. Without further tracing the operation of the circuits in detail it will be apparent that with regard to their E and F relays, the trunks are arranged in an endless chain with the F relay corresponding to the trunk over which the last call was extended locked up so that a

plurality of calls simultaneously originating on other trunks or awaiting the completion of the call on the last trunk will be taken up in regular order beginning with the trunk whose E and F relays are nearest to the right of the corresponding relays of the trunks on which the last call arose. The remaining features of the circuit arrangement are the same as those described in connection with Fig. 1 and need not be further discussed.

A still further modification is illustrated in Fig. 3. In this figure the relay 16 performs a function somewhat similar to that of the relay 18 of Fig. 1 in that it determines the opening and closing of the locking circuit of the F relays. The right hand locking windings of the F relays are omitted with the result that the order of rotation of calls will always begin with the trunk T_x instead of with the trunk over which the last call took place, providing there is an interval between the last previous call and a plurality of simultaneous calls on other trunks. If, however, calls on a plurality of trunks are awaiting the completion of the last call, the order of rotation will begin with the trunk upon which the last call originated with the first calling trunk to the right thereof obtaining preference.

The action just described will be apparent from a more detailed description of the operation. Assuming that a call has originated on the trunk T_1 , the relay 15 will be energized as already described in connection with previous figures, thereby completing a circuit through the windings of the relays E_1 and F_1 in series and thence to ground either over the back contact of the relay 16 or over the front contact of an F relay previously locked up through the winding of relay 16. The locking circuit is then completed for the relays E_1 and F_1 , over the front left hand contact of the relay F_1 and through the winding of the relay 16 to ground. Relay E_1 functions in exactly the same manner as the E relays of the circuits previously described. As soon as the call has been extended to the called subscriber's line relay 15 is deenergized and the locking circuit through the relays E_1 , F_1 and 16 is opened and said relays are deenergized. If no call should be waiting at this moment the circuit is restored to its normal condition and the next call arising on any trunk will close the circuit through the E and F relays of that trunk to ground over the back contact of the relay 16. If, however, at the time the circuit through the relays E_1 , F_1 and 16 was broken a call should have been waiting on some other trunk, as, for instance, the trunk T_3 , relays E_1 and F_1 would have been deenergized but a new circuit would have been completed for the relays E_3 and F_3 , over the back left hand contact of relay F_3 ,

back right hand contact of relay E_x , back left hand contact of relay F_x , front contact of relay 16, back right hand contact of relay E_1 , front left hand contact of relay F_1 , and through the windings of relay 16 to ground. This circuit is possible because the F relays and the relay 16 are slow to release their armatures. Relay 16 will, therefore, remain energized and will be locked up in series with the relays E_3 and F_3 . It will be seen, therefore, that a difference in operation results, depending on whether or not an interval elapse between calls. If the last call, for instance, should come in over the trunk T_2 and after an interval calls should arise simultaneously on trunks T_3 and T_1 , the relay 16 would have been deenergized in the meantime so that the trunk T_3 would obtain preference as the ground circuit for the E and F relays would extend over the back contact of the relay 16 and the relay E_3 on energizing would open the initial energizing circuit of the relays E_1 and F_1 . If, on the other hand, the last call had been made over the trunk T_2 and at the completion of said call other calls were waiting simultaneously on trunks T_3 and T_1 , the relay 16 which is slightly slow acting would not be deenergized and the trunk T_1 would obtain preference, the circuit for its E and F relays extending from battery, over the front right hand contact of relay 15, back left hand contact of relay D_1 , windings of relays E_1 and F_1 , back left hand contact of relay F_1 , back right hand contact of relay E_2 , front left hand contact of relay F_2 , through the winding of relay 16 to ground. The circuit for the relays E_3 and F_3 would pass over the back left hand contact of relay F_3 , back right hand contact of relay E_x , back left hand contact of relay F_x , front contact of relay 16 and over the right hand contact of relay E_1 . Consequently, the relay E_1 upon being energized would prevent the energization of the relays E_3 and F_3 .

Without describing the details of the circuit further, it will be apparent that if an interval elapses between the last call and a plurality of simultaneous calls made thereafter the order of preference will begin with the trunk T_x and pass over the trunks to the right thereof. If, however, no interval elapses between the last call and a plurality of simultaneously awaiting calls, the first trunk to the right of the trunk on which the last call arose will obtain preference and the calls on the remaining trunks will be taken up in regular order from left to right.

By means of the arrangements above described the operation of trunking calls between different offices is much simplified and the possibility of error in making connections is greatly reduced.

Furthermore, it will be obvious that the

general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a telephone system, two offices, link circuits at one of said offices, subscribers' lines terminating at said office, a plurality of trunks extending between said offices for extending connections from said lines and over said link circuits to the other office, an operator's telephone set common to said trunks at the other office, means responsive to the association of a link circuit with one of said trunks to automatically connect said telephone set with said trunk, and means to determine the order in which said set will be successively connected with a plurality of trunks with which a plurality of link circuits have been associated.

2. In a telephone system, two offices, subscribers' lines terminating at each office, a plurality of trunks extending between said offices, an operator's set common to said trunks, means responsive to the establishment of a connection with one of said trunks to automatically connect said set thereto, and means to determine the order in which said set will be successively connected with a plurality of trunks with which connections have been established.

3. In a telephone system, two offices, link circuits at one of said offices, a plurality of trunks extending between said offices, an operator's telephone set common to said trunks at the other office, means responsive to the association of a link circuit with one of said trunks to automatically connect said telephone set with said trunk, and means to automatically vary the order in which said set will be successively connected with a plurality of trunks with which a plurality of link circuits are associated.

4. In a telephone system, two offices, a plurality of trunks extending between said offices, an operator's set common to said trunks, means responsive to the establishment of a connection with one of said trunks to automatically connect said set thereto, and means to automatically vary the order in which said set will be successively connected with a plurality of trunks with which connections are established.

5. In a telephone system, two offices, link circuits at one of said offices, an operator's set common to said link circuits, a plurality of trunks extending between said offices, an operator's set common to said trunks at the other office, means responsive to the association of a link circuit with one of said trunks to automatically connect said last mentioned operator's set with said trunk, means to associate said first mentioned operator's set with said trunk to the exclusion of a call-

ing subscriber associated therewith by means of a link circuit, and means to determine the order in which the operator's set common to said trunks will be successively connected

5 with a plurality of trunks with which a plurality of link circuits have been associated.

6. In a telephone system, two offices, link circuits at one of said offices, an operator's set common to said link circuits, a plurality
10 of trunks extending between said offices, an operator's set common to said trunks at the other office, means responsive to the association of a link circuit with one of said trunks to automatically connect said last mentioned
15 operator's set with said trunk, means to associate said first mentioned operator's set with said trunk to the exclusion of a calling subscriber associated therewith by means of a link circuit, and means to vary the order
20 in which the operator's set common to said trunks will be successively connected to a plurality of trunks with which connections are established.

7. In a telephone system, two offices, link
25 circuits at one of said offices, a plurality of trunks extending between said offices, an operator's telephone set common to said trunks at the other office, means responsive to the association of a link circuit with one of said
30 trunks to automatically connect said telephone set with said trunk, and means to determine the order in which said set will be successively connected with a plurality of trunks with which a plurality of link cir-
35 cuits have been associated, said means being so arranged that when link circuits have been associated with a plurality of trunks said operator's set will be successively connected with said trunks in regular order, be-
40 ginning with the trunk next in order to the last trunk with which a link circuit had been previously connected.

8. In a telephone system, two offices, a plurality of trunks extending between said
45 offices, an operator's set common to said trunks, means responsive to the establishment of a connection with one of said trunks to automatically connect said set thereto, and means to determine the order in which
50 said set will be successively connected with a plurality of trunks with which connections have been established, said means being so arranged that when connections have been established with a plurality of trunks
55 said operator's set will be successively connected with said trunks in regular order, beginning with the trunk next in order to the last trunk with which a connection had been previously established.

9. In a telephone system, two offices, a plurality of trunks extending between said
60 offices, an operator's set common to said trunks, a relay for each trunk responsive to the establishment of a connection with its
65 corresponding trunk to automatically con-

nect said set thereto, and means controlled by said relays to determine the order in which said set will be successively connected with a plurality of trunks with which connections have been established. 70

10. In a telephone system, two offices, a plurality of trunks extending between said offices, an operator's set common to said trunks, a relay for each trunk responsive to
75 the establishment of a connection with its corresponding trunk to automatically connect said set thereto, and means controlled by said relays to vary the order in which said set will be successively connected with
80 a plurality of trunks with which connections have been established.

11. In a telephone system, two offices, a plurality of trunks extending between said offices, an operator's set common to said trunks, a relay for each trunk responsive to
85 the establishment of a connection with its corresponding trunk to automatically connect said set thereto, the circuits of the relays being so arranged that with respect to any given relay the circuits of all of the other
90 relays of the group pass through the contacts of said relay, whereby when the relay corresponding to one trunk is operated the circuits of the remaining relays of the group
95 are held open.

12. In a telephone system, two offices, link circuits at one of said offices, a plurality of trunks extending between said offices, an operator's telephone set common to said
100 trunks at the other office, means responsive to the association of a link circuit with one of said trunks to automatically connect said telephone set with said trunk, means responsive to the connection of said trunk to a
105 called line to automatically disconnect said set from said trunk, and means controllable by the operator at will for disconnecting said set from said trunk while maintaining the set in operative condition for connection
110 with another trunk.

13. In a telephone system, two offices, link circuits at one of said offices, a plurality of trunks extending between said offices, an operator's telephone set common to said
115 trunks at the other office, means responsive to the association of a link circuit with one of said trunks to automatically connect said telephone set with said trunk, signals individual to each trunk to indicate the condition of a connection established over the
120 trunk and means whereby when link circuits are associated with a plurality of trunks simultaneously a special signal will be given for the trunk with which the operator's set is associated. 125

14. In a telephone system, two offices, link circuits at one of said offices, a plurality of trunks extending between said offices, an operator's telephone set common to said
130 trunks at the other office, means responsive

to the association of a link circuit with one of said trunks to automatically connect said telephone set with said trunk, signals individual to each trunk to indicate the condition of a connection established over the trunk, means whereby when link circuits are associated with a plurality of trunks simultaneously a special signal will be given for

the trunk to which the operator's set is connected, and a pilot signal to indicate that 10 calls are awaiting upon other trunks.

In testimony whereof I have signed my name to this specification this 18th day of October, 1918.

HENRY M. BASCOM.