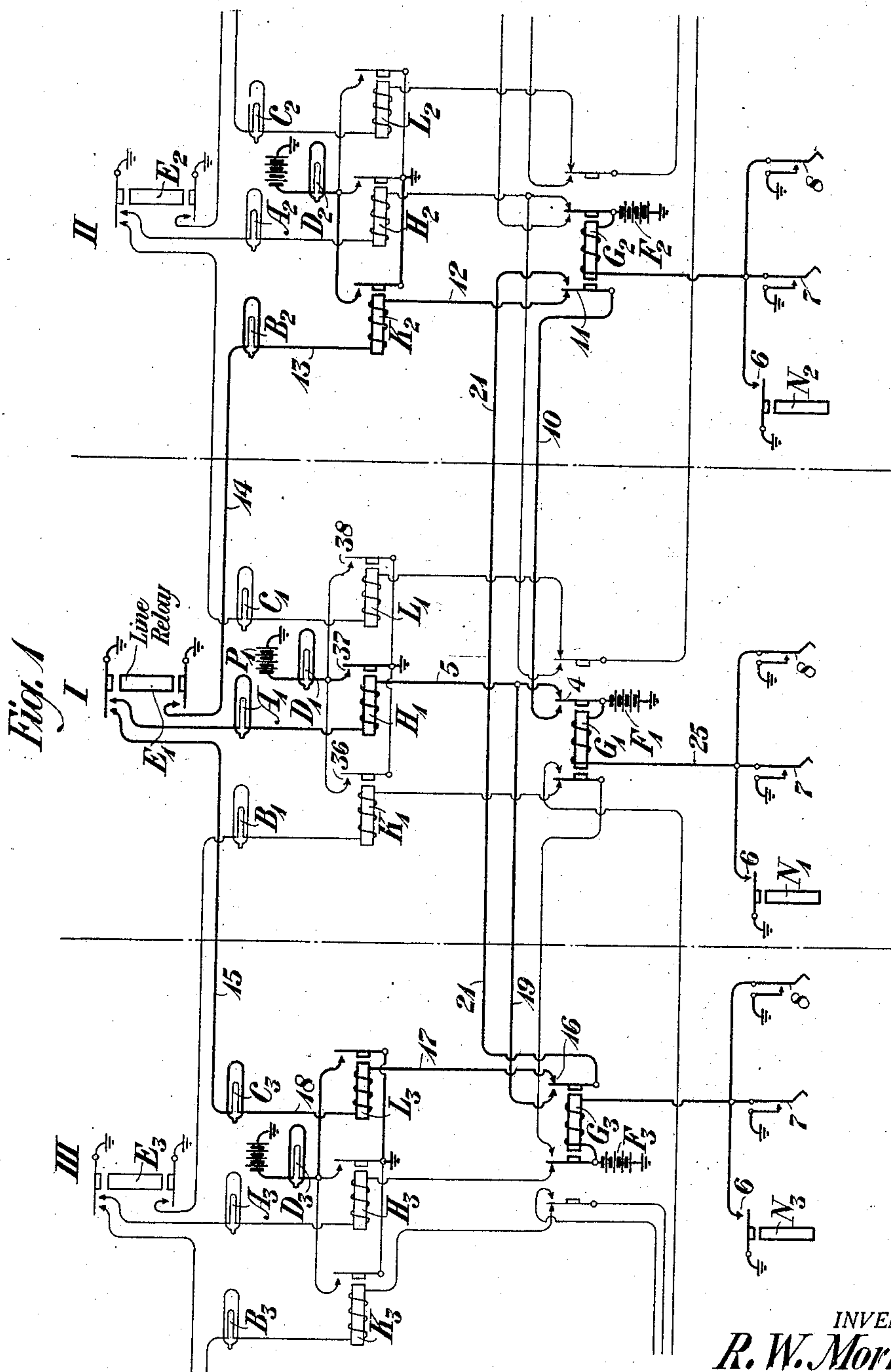


R. W. MORRIS.
SWITCHBOARD CALL SIGNAL APPARATUS AND CIRCUITS.
APPLICATION FILED MAR. 15, 1919.

1,427,695.

Patented Aug. 29, 1922.

2 SHEETS—SHEET 1.



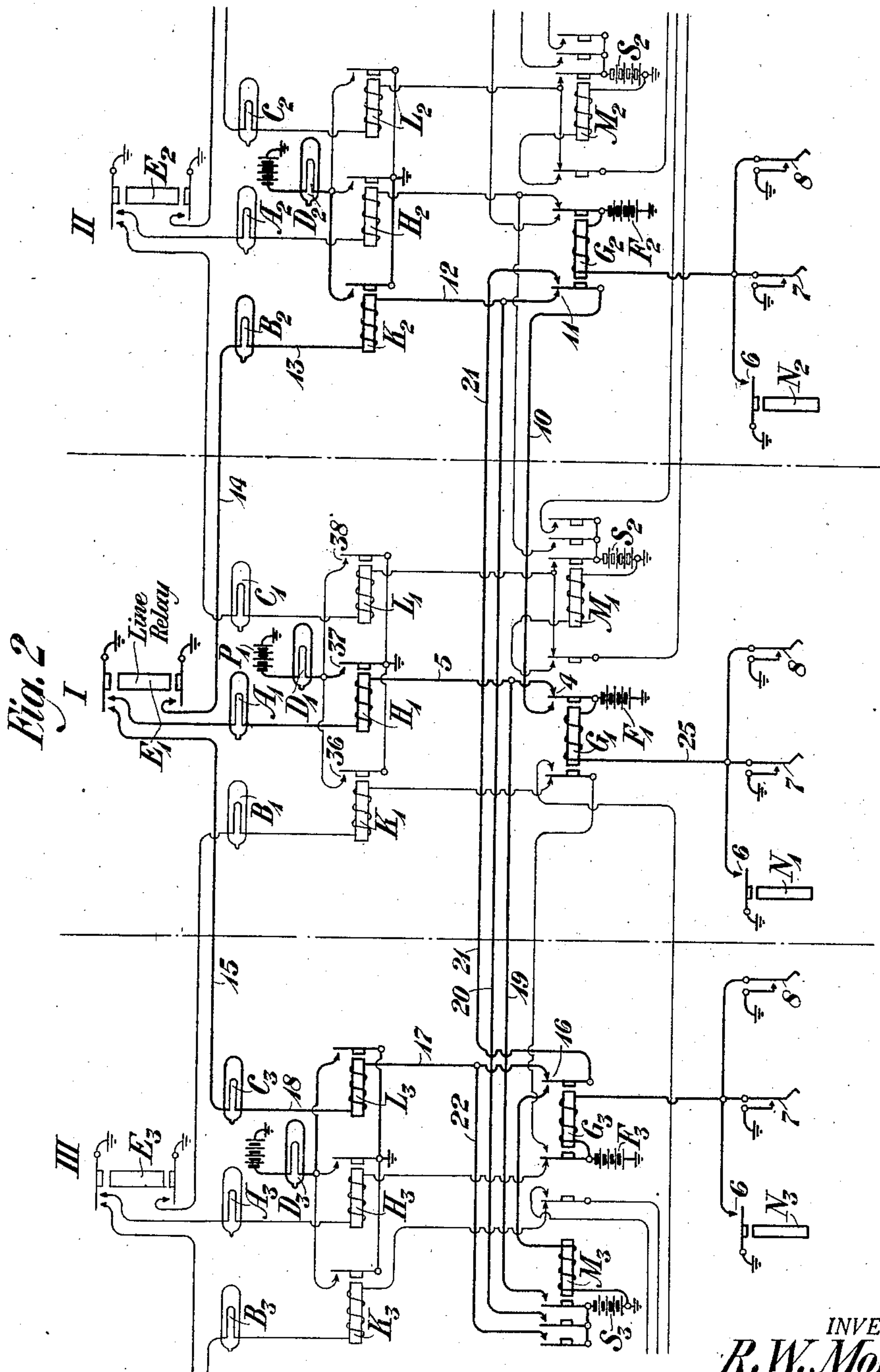
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 ATTORNEY

UNITED STATES PATENT OFFICE.

ROBERT W. MORRIS, OF ROSLYN, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

SWITCHBOARD CALL-SIGNAL APPARATUS AND CIRCUITS.

1,427,695.

Specification of Letters Patent. Patented Aug. 29, 1922.

Application filed March 15, 1919. Serial No. 282,831.

To all whom it may concern:

Be it known that I, ROBERT W. MORRIS, residing at Roslyn, Long Island, in the county of Nassau and State of New York, have invented certain Improvements in Switchboard Call-Signal Apparatus and Circuits, of which the following is a specification.

This invention relates to switchboard call signal apparatus and circuits, and particularly to arrangements for facilitating the answering of incoming calls.

Subscribers' lines and other types of line circuits at the present time are commonly provided, not only with a single answering lamp and answering jack, but with additional lamps and jacks at other positions of the switchboard. All the lamps for any line are connected in multiple and consequently they respond simultaneously to an incoming call. Naturally, several operators often attempt to answer the same call, and in doing so not only perform unnecessary work, but create a certain amount of confusion and delay.

By the present invention these answering lamps are so arranged that under ordinary circumstances a call is indicated only by the main or primary answering lamp. In case the operator for this position of the switchboard is busy or not at her position, the call is indicated by a secondary lamp, unless also the operator for the secondary lamp is busy or not at her position, in which case the signal is given by a tertiary answering lamp. In case the operators at all three positions are busy, the signal is given in one arrangement at any desired position as, for example, by the primary answering lamp. In another arrangement the signal is given simultaneously by all three answering lamps. In the first case the primary answering lamp is extinguished and one of the other lamps is lit if the operator at one of the other answering lamps is first to become free. In the second arrangement the signal disappears at two of the positions as soon as the operator at the remaining position becomes free.

The above and other objects and advantages of this invention are attained as described below, reference be had to the accompanying drawings, in which Figure 1 is a diagrammatic view showing circuits embodying the invention applied to three po-

sitions of a multiple switchboard. Fig. 2 is a diagrammatic view showing a modification of the circuit arrangements of Fig. 1. Similar reference characters refer to similar parts in each of the views.

In Fig. 1, the positions I, II and III of the switchboard are equipped with apparatus of the following description:

E_1 , E_2 and E_3 are line relays which are responsive to subscribers' or other line circuits of the usual type. In practice there are a plurality of line relays associated with each position of the board, but for the present description only one relay is shown for each position for the sake of simplicity.

In front of the board are mounted answering lamps for indicating calls coming in on the line circuits. There are three types of lamps: primary, A_1 , A_2 and A_3 , secondary, B_1 , B_2 and B_3 , and tertiary, C_1 , C_2 and C_3 . These lamps have been shown in a horizontal row for clearness, but it is understood that in practice each position is provided with a bank of each kind of lamp, the primary lamps being located in the lower part of the panel in order to be most convenient to the operator, the secondary lamps being placed above the primary ones, and the tertiary lamps being placed above the secondary lamps.

Auxiliary signal lamps D_1 , D_2 and D_3 of larger candle power than the answering lamps are placed at each position directly in front of the operator. These lamps are provided to draw the operator's attention to a call indicated by any one of the answering lamps at the corresponding position. They are for this purpose controlled by auxiliary signal relays H_1 , K_1 , L_1 ; H_2 , K_2 , L_2 and H_3 , K_3 and L_3 , the windings of which are in series with the answering lamps, as shown in the drawing and explained hereinafter.

The switchboard is further provided with relays G_1 , G_2 and G_3 which control the circuits of the answering lamps in the manner explained below. These relays are in turn governed by contacts 6, 7 and 8, contacts 6 being controlled by the relays N_1 , N_2 and N_3 of the operator's telephone sets, contacts 7 being operated by the listening keys, and contacts 8 being actuated by the call circuit keys.

The control of the above apparatus is effected by the following circuits:

Line relay E_1 , is controlled by a line cir-

cuit of the usual type, which, not forming part of the present invention, has not been shown in order to avoid unnecessary complexity of the drawing. For the present purpose it is necessary only to note that relay E_1 is energized and its contacts closed when the subscriber removes his receiver from the hook to initiate a call. It is understood that the line circuit for relay E_1 is provided with the usual answering jacks, one at each position I, II, III. These jacks have also been omitted from the drawing, forming no part of the present invention.

Three answering lamps, namely primary lamp A_1 , secondary lamp B_2 , and tertiary lamp C_3 , are responsive to line relay E_1 , and in the drawing the circuits for these lamps and the circuits associated therewith are shown in heavy lines so that they may be easily traced.

The circuit for primary lamp A_1 is: from battery F_1 , through back contact 4 of relay G_1 , wire 5, relay H_1 , lamp A_1 and contact of line relay E_1 , through ground back to battery F_1 .

The circuit for secondary lamp B_2 is: from battery F_1 , through front contact 4 of relay G_1 , wire 10, back contact 11 of relay G_2 , wire 12, relay K_2 , wire 13, lamp B_2 , wire 14 and contact of line relay E_1 , through ground back to battery F_1 .

The circuit for tertiary lamp C_3 is the same as that of lamp B_2 up to and including wire 10, then through front contact 11 of relay G_2 , wire 21, back contact 16 of relay G_3 , wire 17, relay L_3 , wire 18, lamp C_3 , wire 15 and contact of line relay E_1 , through ground back to battery F_1 .

The circuits for the answering lamps responsive to the other line relays are similar and need therefore not be separately described.

It will be noted that while the circuits of all three lamps A_1 , B_2 and C_3 are governed by contacts of line relay E_1 , they are so controlled by relays G_1 , G_2 and G_3 that only one lamp at a time is responsive to relay E_1 . As shown in the drawing, relays G_1 , G_2 and G_3 are normally unenergized. The circuit for primary lamp A_1 includes a back contact of relay G_1 and is therefore normally closed. The circuit for secondary lamp B_2 includes a front contact of relay G_1 and a back contact of relay G_2 so that this circuit is normally open at relay G_1 , though closed at relay G_2 . The circuit for tertiary lamp C_3 includes front contacts on relays G_1 and G_2 and a back contact on relay G_3 , so that this circuit is normally open at relays G_1 and G_2 , though closed at relay G_3 . As long as relay G_1 is not energized lamp A_1 alone is responsive to relay E_1 , the circuits of the other lamps being open at relay G_1 . When relay G_1 is energized, lamp A_1 ceases to be responsive to relay E_1 , its circuit being open

at contact 4; however lamp B_2 is now responsive to relay E_1 because its circuit is closed at relays G_1 and G_2 , whereas lamp C_3 remains unaffected by the line relay, its circuit being open at relay G_3 . If both relays G_1 and G_2 are energized, the tertiary lamp C_3 becomes responsive to line relay E_1 and the primary and secondary lamps become unresponsive thereto.

Lamp A_1 is provided with an auxiliary circuit by means of which it is rendered responsive to relay E_1 in case all three relays G_1 , G_2 and G_3 are energized. This circuit extends from battery F_1 , through the front contact 4 of relay G_1 , wire 10, front contact 11 of relay G_2 , wire 21, front contact 16 of relay G_3 , wires 19 and 5, relay H_1 , lamp A_1 and contact of relay E_1 , through ground back to battery F_1 . It will be noted that in this circuit the connection 19 completes a shunt around back contact 4 of relay G_1 , which connection is complete, however, only in case all three relays G_1 , G_2 and G_3 are energized, and is broken as soon as one of these relays is de-energized.

The relays G_1 , G_2 and G_3 , as stated above, are normally unenergized and each of these relays is so controlled that it is energized only in case the operator at the corresponding position is busy or when there is no operator at the position. Thus relay G_1 is controlled by a circuit from battery F_1 , through the winding of relay G_1 , wire 25 and contacts 6, 7 and 8 in parallel, so that the relay is energized when any one of these contacts is closed. Normally each one of these contacts is open, contact 6 being a back contact on the relay N_1 of the operator's telephone set and closed only when the operator is not at her position; and contacts 7 and 8 being on the operator's listening and call circuit keys respectively, and closed when she is talking to a subscriber or another operator. It is to be understood, however, that the above arrangement of contacts for the control of relay G_1 is merely illustrative, and that where desired some of these contacts may be omitted and other contacts or their equivalents added to meet the requirements peculiar to the circumstances under which this invention is to be used. It should here be noted that hereinafter a position of the switchboard is described as "busy" when the operator is engaged with a previous call, or other duty, or when there is no operator at the position, and "free" when the operator is at her position awaiting a call. In similar manner relays G_2 and G_3 are controlled to close their contacts only if their respective positions are busy.

As stated hereinbefore, an auxiliary signal relay is connected in series with each group of answering lamps, thus on position I relays K_1 , H_1 and L_1 are in series with

lamps B_1 , A_1 , and C_1 . The contacts 36, 37 and 38 of these relays are connected in parallel in the circuit of the auxiliary signal lamp D_1 , so that current flows through this lamp from battery P_1 when any one of these contacts is closed. In this manner lamp D_1 is caused to respond to every signal lamp on the corresponding panel and serves to draw the operator's attention to every call indicated on this panel. Lamps D_2 and D_3 are controlled in like manner.

With the above description of the apparatus and circuits in mind, a better understanding of the invention may be had from a description of the operation thereof.

Normally, relay G_1 is unenergized because contacts 6, 7 and 8 are open, as stated hereinbefore. When, therefore, a call comes in on line relay E_1 , it is indicated by primary lamp A_1 but not by the secondary and tertiary lamps B_2 and C_3 . Thus the signal is given only to the operator at position I and she proceeds to answer the same by plugging in at the primary answering jack.

In case position I is busy and position II is free, relay G_1 is energized and relay G_2 is not energized. As explained hereinbefore the secondary lamp B_2 is now responsive to relay E_1 so that it alone responds to a call on the line, the primary and tertiary lamps remaining dark. The operator at position II, not being busy, may proceed at once to answer the call by plugging in at the corresponding multiple answering jack at her position.

If, however, position II is busy, as well as position I, position III alone being free, relays G_1 and G_2 are energized but relay G_3 is not energized. Consequently tertiary lamp C_3 is responsive to line relay E_1 and a call coming in on this relay is indicated by the tertiary lamp, but not by the primary and secondary lamps. In this case, then, the operator at position III is notified of the call and she proceeds to answer the same by plugging in at the multiple answering jack at her position.

Finally, if positions I, II and III are busy simultaneously, the above described auxiliary circuit of lamp A_1 is closed by relays G_1 , G_2 and G_3 so that lamp A_1 responds to a call coming in on relay E_1 , and the operator at position I may answer the call as soon as she is free to do so. If in the meantime either of the other positions II or III becomes free, the signal disappears at busy position I because the circuit of the primary lamp A_1 is broken by the release of relay G_2 or G_3 and the circuit of the secondary or tertiary lamp is closed, as the case may be. Thus, if all three positions are busy when the call comes in, the signal is temporarily given by the primary lamp, but immediately transferred to one of the other positions if the operator thereat is first to become free.

This feature of the invention is of prime importance in effecting a speedy response to calls.

The operation of the other answering lamps of the switchboard in response to calls coming in on the other line relays is similar and needs therefore no separate description.

The modification of the invention shown in Fig. 2 differs from the arrangements described in Fig. 1, in that relays M_1 , M_2 and M_3 are added to the apparatus for the positions. The winding of relay M_3 has one end connected to ground and the other end connected to the front contact 16 of the adjacent relay G_3 , so that relay M_3 is energized by current from battery F_1 when relays G_1 , G_2 and G_3 are closed, i. e., when positions I, II and III are busy. When relay M_3 is closed battery S_3 is connected with wires 19, 20 and 22, which wires are connected respectively to the primary, secondary and tertiary answering lamps A_1 , B_2 and C_3 . It follows that the energization of relay M_3 causes all three answering lamps to light. The circuits for relays M_1 and M_2 are similar to the circuits for relay M_3 .

It is clear from the above description of the circuit of relay M_3 that in the present modification the signal for an incoming call is given by all three lamps in case all three positions are busy. However, as soon as one of the positions becomes free its relay G_1 , G_2 or G_3 becomes deenergized, so that its contact 4, 11 or 16 breaks the circuit for relay M_3 and closes the circuit for the corresponding primary, secondary or tertiary answering lamp, as the case may be. Thus in this modification of the invention, as well as in the previous one, the signal disappears at a busy position remaining only at the position where the operator is free to answer the call.

Although only two forms of the invention are shown and described herein, it is understood that various changes and modifications may be made therein within the scope of the following claims without departing from the spirit and scope of the invention.

What is claimed is:

1. In a switchboard having a number of positions arranged in a designated order, the combination of means for indicating a call only at the first free position of said order with means for causing an indication of said call at a predetermined position of said number when all the positions are busy.

2. In a switchboard having a number of positions arranged in a designated order, means for indicating a call on the first free position of said order and means operating when all positions of the number are busy for causing a temporary indication of said call at the first position of the number until one of the positions becomes free.

3. In a switchboard having a number of

positions arranged in a designated order, a circuit for each position for causing an indication of a call thereon, means for causing the circuit of the first free position of
5 said order to respond to a call, and an electrical connection for the circuit of the first position operating when all of said positions are busy to cause a temporary indication of said call at the first position.

10 4. In a multiple telephone switchboard, an indication circuit comprising a plurality of branches, one for each of a plurality of positions, each branch comprising means for indicating an incoming call, means for each
15 branch operative when the corresponding position is busy for causing the indication current to flow in the succeeding branch and means for causing the current to flow in a predetermined branch when all of said
20 positions are busy.

5. In a multiple telephone switchboard, a circuit comprising a plurality of branches, one for each of a plurality of positions, means in each branch for indicating an in-
25 coming call, a normally closed contact in the first branch, a normally open and a normally closed contact in each succeeding branch, means for each position operative when said position is busy to open the nor-
30 mally closed contact of the corresponding branch and close the normally open contact of the succeeding branch, and means operative on opening of the normally closed con-
35 tacts of all of said branches for causing an operation of the indicating means in a pre-determined branch.

6. In a multiple telephone switchboard, a circuit comprising a plurality of branches, one for each of a plurality of positions,
40 means in each branch for indicating an incoming call, a normally closed contact in the first branch, a normally open and a normally closed contact in each succeeding branch, means for each position operative
45 when said position is busy to open the normally closed contact of the corresponding branch and close the normally open contact of the succeeding branch, an electrical connection to a predetermined branch, and
50 means operative on closure of all of said normally open contacts to cause flow of current through said connection to said pre-determined branch.

7. In a multiple telephone switchboard,
55 a circuit comprising a plurality of branches, one for each of a plurality of positions, means in each branch for indicating an incoming call, a normally closed contact in the first branch, a normally open and a nor-
60 mally closed contact in each succeeding branch, means in each position operative when said position is busy to open the normally closed contact of the corresponding branch and close the normally open contact
65 of the succeeding branch, and an electrical

connection to the first branch to shunt the normally closed contact therein when all of said normally closed contacts are open.

8. In a multiple telephone switchboard, primary, secondary and tertiary answering
70 lamps for each position, means whereby an incoming call on any position is normally indicated by a primary answering lamp of said position, means operative when said
75 position is busy for causing said call to be indicated by a secondary answering lamp of another position, means operative when both of the foregoing positions are busy for causing said call to be indicated by a teri-
80 tary answering lamp of a third position and means operative when all three positions are busy to cause said call to be indicated by the first mentioned primary answering lamp.

9. In a switchboard, three positions, means for indicating a call at the first of
85 said positions when said position is free, means for indicating said call at the second position if the first position is busy and said second position is free, means for indicating said call at the third position if both the
90 first and second positions are busy and the third free, and means for indicating the call at the first position if all three are busy, said means being arranged to transfer the indication of said call to the second or third
95 position in case either of said positions is first to become free.

10. In a multiple telephone switchboard, a device for indicating a call, means for pre-
100 venting the functioning of said device when one position of the board is busy and means governed by the busy or free condition of another position of the board for, at times, rendering said first mentioned means inef-
105 fective to prevent the functioning of said device.

11. In a multiple telephone switchboard, means for indicating an incoming call at one position of the board, a circuit for prevent-
110 ing the operation of said means when said position is busy, a second circuit for, at times, rendering said first mentioned circuit ineffective to prevent the operation of said means and means whereby said second cir-
115 cuit is governed by the busy or free condition of another position of the board.

12. In a switchboard having a number of positions, the combination of means for in-
120 dicating an incoming call only at the first free position of said number, with means for causing an indication of said call at a plurality of positions when all the positions of the number are busy.

13. In a switchboard having a number of positions, means for indicating a call on the
125 first free position of the number and means operating when all positions of the number are busy for causing a temporary indication of said call at all of the positions until one of the positions becomes free.

14. In a switchboard having a number of positions, a circuit for each position for causing an indication of a call thereat, means for causing the circuit of the first free position of the number to respond to a call and electrical connections for the circuits of the said positions operating when all of said positions are busy to cause a temporary indication of said call on all of said positions.

15. In a multiple telephone switchboard, a circuit comprising a plurality of branches, one for each of a plurality of positions, means in each branch for indicating an incoming call, a normally closed contact in the first branch, a normally open and a normally closed contact in each succeeding branch, means at each position operative when said position is busy to open the normally closed contact of a corresponding branch and close the normally open contact of the succeeding branch, and an electromagnetic translating device controlled by a contact in each branch for sending current through a predetermined branch when all of said normally closed contacts are open.

16. In a multiple telephone switchboard, a circuit comprising a plurality of branches, one for each of a plurality of positions, means in each branch for indicating an incoming call, a normally closed contact in the first branch, a normally open and a normally closed contact in each succeeding branch, means in each position operative when said position is busy to open the normally closed contact of a corresponding branch and close the normally open contact of the succeeding branch, a normally open electrical connection to one of said branches, and an electromagnetic translating device for closing said connection when all of said normally closed contacts are open.

17. In a multiple telephone switchboard, a circuit comprising a plurality of branches, one for each of a plurality of positions, each branch comprising means for indicating an incoming call, a normally closed contact in the first branch, a normally open and a normally closed contact in each succeeding branch, means in each position operative when said position is busy to open the normally closed contact of the corresponding branch and close the normally open contact of the succeeding branch, normally open electrical connections to all of said branches, an electromagnetic translating device for closing said connections and means for en-

ergizing said device when all of said normally closed contacts are open.

18. In a telephone switchboard, three positions, means for indicating a call at the first of said positions when said position is free, means for indicating said call at the second position if the first position is busy and said second position free, means for indicating said call at the third position if both the first and second positions are busy and the third free, means for indicating the call at all of said positions if all three are busy, said means being arranged to transfer the indication of said call to the second or third position in case either of said positions is first to become free.

19. In a multiple telephone switchboard, primary, secondary and tertiary answering lamps for each incoming call, said lamps being located at different positions of the switchboard, means for ordinarily lighting only the primary lamp in response to an incoming call, means for lighting a secondary lamp at another position of the switchboard if the operator at the primary lamp is busy, means for lighting only a tertiary lamp at still another position of the switchboard if the operators at both the primary and secondary lamps are busy, and means for lighting all of said lamps when the operators at all of said positions are busy.

20. In a multiple telephone switchboard, a device for indicating a call, means for preventing the functioning of said device when one position of the board is busy and means governed by the concurrent busy or singly free condition of two other positions of the board for, at times, rendering said first mentioned means ineffective to prevent the functioning of said device.

21. In a multiple telephone switchboard, means for indicating an incoming call at one position of the board, a circuit for preventing the operation of said means when said position is busy, a second circuit for, at times, rendering said first mentioned circuit ineffective to prevent the operation of said means, and means whereby said second circuit is governed by the concurrent busy or singly free condition of two other positions of the board.

In testimony whereof, I have signed my name to this specification this fourteenth day of March 1919.

ROBERT W. MORRIS.