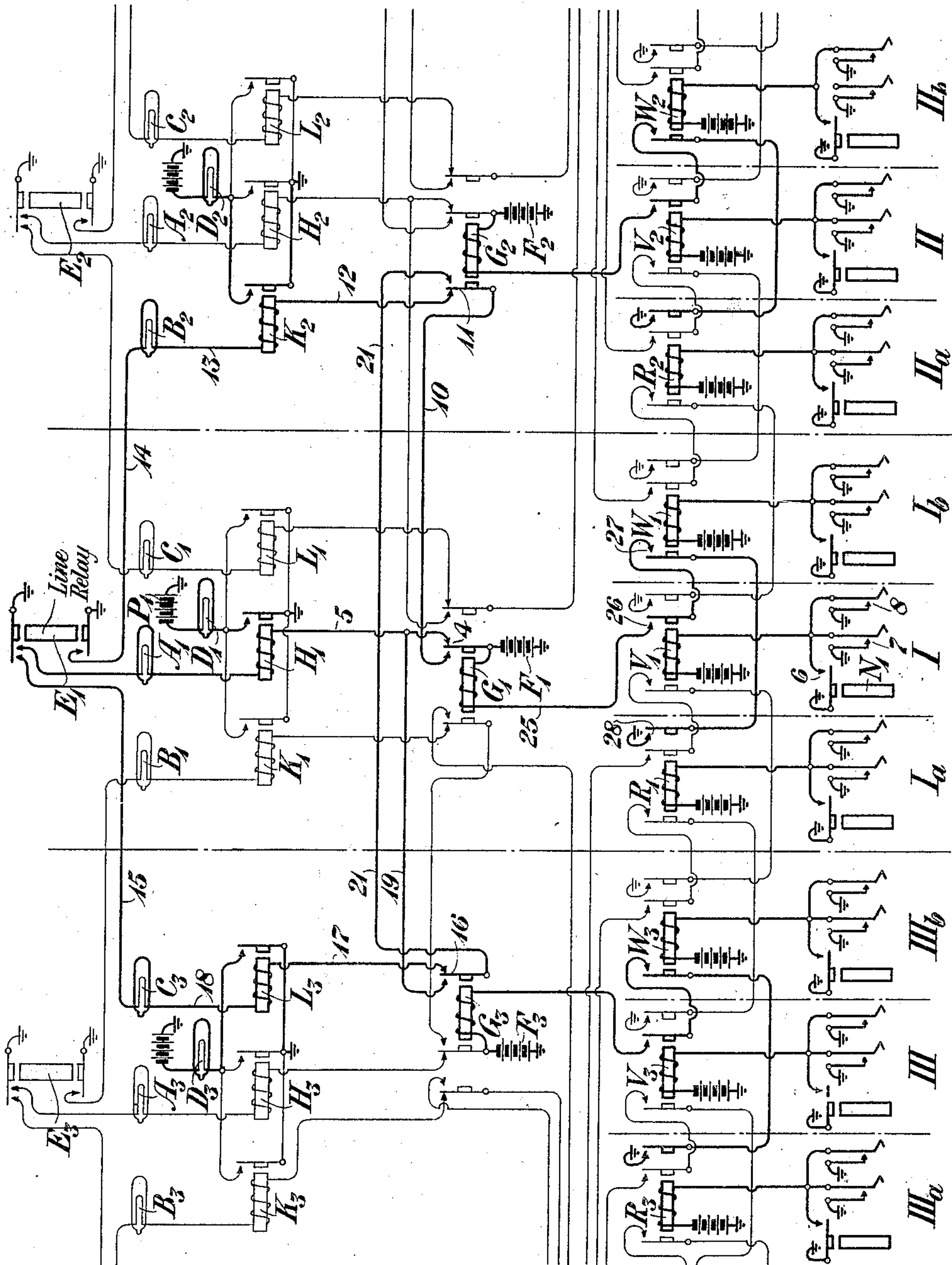


L. W. COOPER.
 SWITCHBOARD CALL SIGNAL APPARATUS AND CIRCUITS.
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SWITCHBOARD CALL-SIGNAL APPARATUS AND CIRCUITS.

1,427,725.

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

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To all whom it may concern:

Be it known that I, LESTER W. COOPER, residing at Brooklyn, in the county of Kings 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.

This invention is related to the invention described in the application of R. W. Morris for switchboard call signal apparatus and circuits, filed of even date herewith.

The said invention provides means, whereby an incoming call is ordinarily indicated only by a corresponding 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 at another position, 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 lamp. In case all three operators 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.

In the present invention cognizance is taken of the fact that each answering jack can ordinarily be attended not only by the corresponding operator, but also by the operators adjacent to her on each side. Accordingly the circuits are so arranged that the secondary answering lamp does not respond to a call, unless all three operators in reach of the primary jack are busy. Similarly, the tertiary lamp does not respond unless also the three operators in reach of the secondary jack, are busy. In case all nine operators are busy the signal may be given either by the primary answering lamp alone or by all three answering lamps simultaneously, similarly as described in the above mentioned co-pending application.

The manner in which the above and other objects and advantages of this invention are obtained is described below, reference being had to the accompanying drawing, in which are indicated nine positions of a multiple switchboard, namely, positions I, II and III and positions I_a, I_b, II_a, II_b and III_a, III_b, the latter positions being, respectively, left and right adjacent to the former positions of like Roman numerals. All positions are provided, preferably, with like apparatus, but on the drawing only such apparatus is illustrated as is necessary for a full and complete understanding of the invention.

Certain apparatus illustrated in the drawing is shown in the above mentioned co-pending application, and reference may be had thereto for a full description thereof. Briefly, this apparatus comprises (reference being had to position I) a line relay E₁, responsive to a subscriber's or other line circuit; primary, secondary and tertiary answering lamps designated respectively A₁, B₁, C₁; an auxiliary signal lamp D₁ responsive to all the answering lamps on the same panel; relays H₁, K₁ and L₁ in series with said answering lamps and controlling the auxiliary signal lamp; and a relay G₁ for controlling the circuits of the answering lamps.

Like apparatus is shown at position II and III, the parts thereon being designated by the same reference characters with subscripts corresponding to the numeral of the position with which the apparatus is associated. Although none of the parts so far described are shown at the positions adjacent I, II and III it is to be understood that these positions are preferably equipped with like apparatus, which, however, has been omitted from the drawing in order to avoid unnecessary complication.

The said co-pending application also describes the manner in which the answering lamps are controlled by the relays G₁, G₂ and G₃. Normally each of these relays is unenergized and holds closed the circuits for the answering lamps of the same position. Thus relay G₁ normally maintains closed the circuit for primary lamp A₁, which circuit includes battery F₁, relay H₁, lamp A₁ and a contact of relay E₁. Similarly, relay G₂ normally closes the circuit for secondary lamp B₁, which circuit comprises battery F₁, front contact 4 of relay G₁, wire 10, back

contact 11 of relay G_2 , wire 12, relay K_2 , wire 13, lamp B_2 , wire 14 and a contact of relay E_1 . Likewise, relay G_3 normally closes the circuit of tertiary lamp C_3 , the circuit of this lamp comprising battery F_1 , front contact 4 of relay G_1 , wire 10, 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 a contact of relay E_1 . The circuits governing the other answering lamps of the board are similar, but not entering the present description, are not traced separately.

From the above circuits it follows that when relay G_1 is not energized the circuit for primary lamp A_1 is closed, so that this lamp responds to an energization of relay E_1 . In case, however, relay G_1 is energized, relay G_2 remaining unenergized, the circuit for the secondary lamp B_2 is closed, so that the secondary lamp responds to an energization of relay E_1 . Finally, if both relays G_1 and G_2 are energized, relay G_3 remaining unenergized, the circuit for tertiary lamp C_3 is closed, so that the tertiary lamp responds to an energization of relay E_1 .

When relay G_3 is energized it closes at front contact 16 a connection 19 to the circuit of the primary lamp A_1 , so that this lamp is supplied with current by battery F , through front contact 4 of relay G_1 , front contact 11 of relay G_2 and front contact 16 of relay G_3 , provided all three relays G_1 , G_2 and G_3 are in an energized condition at the time when relay E_1 is closed. As soon as one of the relays G_1 , G_2 , or G_3 is de-energized it opens the above circuit and closes the circuit of the corresponding answering lamp, causing it to respond to the energization of relay E_1 .

In the present invention the circuit for each of the relays G_1 , G_2 and G_3 is so controlled that each relay is energized only when its position and the positions adjacent thereto are busy simultaneously. (A position is described herein as busy when the operator is not at the position or is engaged with a previous call or other duty.)

To effect this control of relay G_1 there are provided relays R_1 , V_1 and W_1 located respectively in positions I_a , I and I_b , each of these relays being so controlled that it is energized only when its position is busy. For this purpose the positions are provided with contacts 6, 7 and 8 of which contact 6 is on the relay N_1 of the operator's telephone set and closed when she is not at her position, and contacts 7 and 8 are respectively actuated by the listening and call circuit keys, and closed when the operator is talking to a subscriber or another operator. The circuits of the above relays are controlled by contacts 6, 7 and 8 in parallel so that the relays are energized when any one of the contacts is closed, in other words,

when the corresponding positions are busy. It is understood that certain of these contacts may be omitted or others may be added according to the circumstances which are to be met.

The circuit of relay G_1 comprises battery F_1 , relay G_1 , wire 25, contact 26 of relay V_1 , contact 27 of relay W_1 and contact 28 of relay R_1 , so that relay G_1 is not energized unless relays R_1 , V_1 and W_1 are all operated at the same time. It follows, therefore, that relay G_1 does not close its normally open contact 4 until positions I_a and I_b are busy as well as position I . In similar manner relay G_2 is governed by relays R_2 , V_2 and W_2 in positions II_a , II and II_b . Likewise relay G_3 is governed by relays R_3 , V_3 and W_3 located respectively in positions III_a , III and III_b .

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 the contacts of relays R_1 , V_1 and W_1 are open as stated hereinbefore. When, therefore, a call comes in on relay E_1 , it is indicated by primary lamp A_1 , so that the operator at position I may answer the same in the usual manner.

In case this operator is busy, or not at her position, the relay V_1 is energized in the manner described previously. This has no effect on relay G_1 because its circuit remains open at relays R_1 and W_1 in the adjacent positions. Consequently, when a call comes in on relay E_1 it is indicated by lamp A_1 , so that it may be answered by the operator at either of the adjacent positions.

If position I , and one of the adjacent positions, say I_a , are busy simultaneously, both relays V_1 and R_1 are closed. Nevertheless, relay G_1 remains unenergized because its circuit is still open at relay W_1 of position I_b . When a call comes in under these conditions on relay E_1 , it is, therefore, indicated by primary lamp A_1 , so that the operator in the adjacent position I_b may answer the same in the usual manner.

In case, however, position I and both of the adjacent positions are busy simultaneously, the relays R_1 , V_1 and W_1 close the circuit for relay G_1 , so that the latter relay opens at back contact 4 the circuit for the primary answering lamp A_1 and closes at the front contact the circuit for the secondary answering lamp B_2 in position II . Under these conditions, a call coming in on relay E_1 is indicated by the secondary answering lamp B_2 , so that the operator at position II may proceed to answer the call, or if she is busy, one of the operators adjacent to her.

Should, however, positions II , II_a , and II_b be busy simultaneously, the relays V_2 ,

R_2 and W_2 close the circuit for relay G_2 , causing this relay to open at back contact 11 the circuit for lamp B_2 and close at the front contact the circuit for lamp C_3 .

5 When, therefore, a call comes in on relay E_1 and positions I and II and their adjacent positions are busy, the call is indicated by the tertiary lamp at position III, so that the operator at this position may answer
10 the same, or if she is busy one of the operators adjacent to her.

In case position III, III_a and III_b are busy, relays V_3 , R_3 and W_3 close the circuit of relay G_3 which relay then breaks the circuit of the tertiary lamp C_3 at back contact
15 16 and closes at the front contact the connection 19 to the primary lamp. As the result a call coming in on relay E_1 is indicated by primary lamp A_1 if all nine positions are
20 busy at the time when the call comes in.

This indication is but temporary, for, as soon as any one of the nine positions becomes unoccupied, one of the relays G_1 , G_2 or G_3 returns to its normal, i. e., unenergized, condition thus opening the last mentioned circuit of the primary lamp and closing the circuit of the corresponding primary, secondary or tertiary lamp, as the case may be, so that the operator who is free to answer
25 the call may proceed to answer the same without delay. For instance, if it is the operator at position II_a who is first to become free to answer the call her relay R_2 releases the moment she is unoccupied and thus
35 breaks the circuit of relay G_2 , which in turn opens at front contact 11 the circuit of the primary lamp A_1 and closes at the back contact the circuit for secondary lamp B_2 . Primary lamp A_1 is thus extinguished and lamp
40 B_2 is lit, thus indicating to the operator at position II_a that there is a call awaiting her attention.

It is thus seen that the present invention provides for a maximum flexibility in the
45 distribution of calls, while at the same time it causes the signal to be given at only that position of the switchboard where there is an operator ready to answer it, thus avoiding the confusion and delay incident to the common multiple lamp system where several operators often attempt to answer the same call. Furthermore, while the invention selects among nine operators to answer a call, each subscriber's line is brought out at only
50 three positions thus giving not only maximum flexibility, but also relative economy in panel space.

Although only one form of the invention is shown herein, it is understood that various
60 changes and modifications may be made within the scope of the following claims, without departing from the spirit and scope of the invention.

What is claimed is:

65 1. In a multiple telephone switchboard, a

line circuit, means at a plurality of positions of said switchboard responsively associated with said line circuit, means for selectively determining the means at one of said positions to respond to said circuit, devices associated with a greater number of positions than said plurality for governing said selective means, the devices at each of said greater number of positions being like those at the others of such greater number of positions and standing in like relation to said selective means, and apparatus whereby the busy or free condition of the said greater number of positions governs said devices.

2. In a telephone switchboard having a plurality of positions, means at one position of said plurality responsively associated with said line circuit, like devices at said plurality of positions connected alike for controlling said responsive means, and apparatus whereby the busy or free condition of the said plurality of positions govern said like devices.

3. In a multiple telephone switchboard, a plurality of adjacent positions, means at one of said positions for indicating a call and like means responsive in like manner to the simultaneous busy condition of said positions for preventing the operation of said indicating means.

4. In combination, a plurality of adjacent positions of a telephone switchboard, means at one of said positions for indicating a call, and like means at each of said plurality of positions operating automatically and in like manner to prevent the operation of said indicating means when all of said positions are busy.

5. In a multiple telephone switchboard, a number of positions spaced from each other by adjacent intervening positions, means at each position of said number of positions for indicating an incoming call, and like means at one of said positions and at an adjacent position for preventing in like manner the operation of said means for indicating at said position.

6. In a multiple telephone switchboard, a line circuit, an indicating device at one position normally unresponsive to said circuit, a relay for at times causing said device to be responsive to said circuit, and like means at a plurality of positions whereby their simultaneous busy condition causes in like manner said relay to be effective.

7. In a multiple telephone switchboard, an indicating device at one position thereof, a normally open circuit for said device, a relay for governing said circuit, a normally open circuit for governing said relay, contacts for automatically closing said circuit, and like apparatus at a plurality of positions connected in like manner to control said contacts according to the busy condition of those positions.

8. In combination, a plurality of positions

of a telephone switchboard, means at one of said positions for indicating a call, like means at each of said positions automatically operative when the respective positions

5 are busy to prevent the operation of said indicating means, and like means for causing said preventive means to be effective only when the positions are busy simultaneously.

9. In combination, a plurality of positions
10 of a telephone switchboard, a relay at each position automatically energized when the position is busy, an indication circuit, means for closing said circuit in response to a call, and means controlled in like manner by said
15 relays to open said indication circuit when each of the relays is energized.

10. In a switchboard having a plurality of positions, a line circuit, a device at one position normally responsive to said circuit,
20 a device at another position at times responsive to said circuit, a relay for governing said devices, like circuit controllers at said one position and an adjacent position for governing said relay, and apparatus whereby
25 the busy or free condition of the said one position and said adjacent position govern in like manner the said circuit controller.

11. In a multiple telephone switchboard, a line circuit, a primary and a secondary
30 lamp responsive thereto, a relay for normally causing only said primary lamp to respond to said circuit and means for operating said relay to cause said secondary lamp to respond to said circuit, said means
35 comprising contacts automatically governed alike by the busy or free condition of the position corresponding to the primary lamp and a position adjacent thereto.

12. In a multiple telephone switchboard,
40 a line circuit, a primary and a secondary lamp responsive thereto, a relay for normally causing said primary lamp to respond to said circuit, contacts at the position of the primary lamp and like contacts at an adjacent
45 position, like means whereby said contacts are governed by the busy or free condition of their respective positions, and a circuit for said relay governed in like manner by said contacts and responsive to actuate
50 said relay to cause said secondary lamp to respond to said line circuit when both contacts are in the condition corresponding to the busy condition of their respective positions.

55 13. In a telephone switchboard having a plurality of positions, a line circuit, indicating means at one position responsive thereto, a circuit for said indicating means, a first relay for normally closing said circuit, a second
60 relay for the position of said indicating means, a third relay for the position adjacent thereto, said second and third relays being alike, like means for automatically actuating said second and third relays when
65 the corresponding positions are busy, and

means for governing the circuit of said first relay in like manner by said second and third relays.

14. In a multiple telephone switchboard, a primary, a secondary and a tertiary answering lamp, said lamps being located at
70 different positions of the switchboard, means for causing ordinarily the response of only the primary lamp to an incoming call, means for automatically causing the response of
75 only said secondary lamp when the position containing the primary lamp and the adjacent positions are busy, said means being alike for said position and adjacent positions and connected to the rest of the system
80 in like manner, and means for automatically causing the response of only the tertiary lamp if also the position containing said secondary lamp and the adjacent positions are busy, said last mentioned means being
85 alike for the position of the secondary lamp and the said adjacent positions and connected in like manner to the remainder of the system.

15. In a multiple telephone switchboard,
90 a primary, a secondary and a tertiary answering lamp, said lamps being located at different positions of the switchboard, means for causing ordinarily the response of only the primary lamp to an incoming call, means
95 for causing the response of only said secondary lamp when the position containing the primary lamp and the adjacent positions are busy, means for causing the response of only the tertiary lamp, if also the position
100 containing said secondary lamp and the adjacent positions are busy, and means for causing the response of said primary lamp to said call if all of said positions and their adjacent positions are busy.
105

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
110 first branch, a normally open and a normally closed contact in each succeeding branch, means at each position operative when said position is busy, as well as the positions adjacent on each side, for opening
115 the normally closed contact of the corresponding branch and closing the normally open contact of the succeeding branch, and means operative on opening of the normally closed contacts of all of said branches for
120 causing an operation of the indicating means in a predetermined one of said branches.

17. In a multiple telephone switchboard, a circuit comprising a plurality of branches, one for each of a plurality of positions,
125 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
130

when the said position is busy, as well as the positions adjacent on each side, for opening the normally closed contact of the corresponding branch and closing the normally open contact of the succeeding branch, and an electrical connection to the first branch to bridge the normally closed contact therein when all of said normally closed contacts are open.

10 18. In a multiple telephone switchboard, a device for indicating a call, concurrent means for preventing the functioning of said device when certain positions of the board are busy, and means governed concurrently
15 by the busy or free condition of certain oth-

er positions of the board for at times rendering said first mentioned means ineffective to prevent the functioning of said device.

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

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

LESTER W. COOPER.