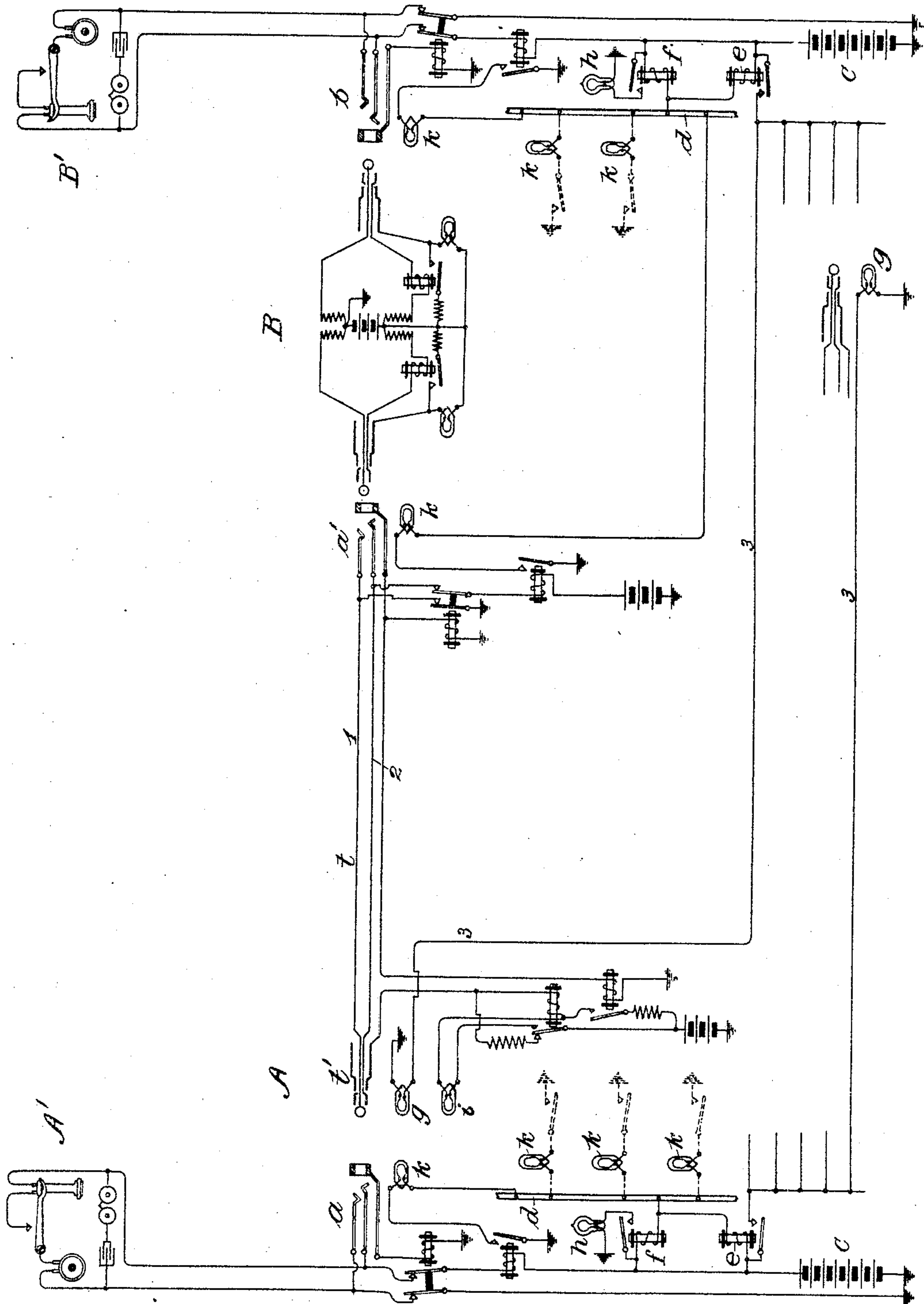


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J. L. McQUARRIE.
TELEPHONE EXCHANGE APPARATUS.

APPLICATION FILED MAY 27, 1901.



WITNESSES:

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TELEPHONE-EXCHANGE APPARATUS.

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To all whom it may concern:

Be it known that I, JAMES L. McQUARRIE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Telephone-Exchange Apparatus, of which the following is a full, clear, concise, and exact description.

This invention relates to telephone-exchange apparatus, and is concerned particularly with what is known as "overflow trunking" between the different sections or "operators' positions" of a multiple switchboard.

The invention contemplates particularly a system of signals by which each operator is automatically informed when the traffic at the other sections of the board increases beyond a certain point.

In the operation of a telephone-exchange it frequently happens that one operator during the busy hour has more calls than she can attend to efficiently and quickly, while another operator at the same switchboard is not busy. Heretofore it has been customary to provide a special section or operator's position, known as the "overflow position," to which calls may be transferred by means of trunk-lines from sections which have an excess of business. This is objectionable in that it necessitates the provision and equipment of switchboard-sections which are in use only during a certain limited portion of each day.

The system of this invention is designed to enable an operator at any busy position to overflow onto any other regular section or operator's position of the same switchboard which is not busy—that is, which has not at the time more unanswered calls awaiting attention than a certain predetermined number. Trunk-lines between the different sections, called "overflow trunks," may be used in transferring calls, and signals are provided by which the operator who desires to transfer a call may determine at a glance which section is not too busy to receive it. By my invention an operator may also be provided with a pilot-signal at her own section, which will be displayed when the traffic at her sec-

tion reaches a certain amount, as when she has a certain predetermined number of unanswered calls awaiting attention, the display of this pilot-signal serving to inform her that she is at liberty to transfer incoming calls to other less-busy sections until her work is caught up.

My invention is illustrated in the accompanying drawing, which is a diagram showing two switchboards, or, more properly, two sections or operators' positions of a multiple switchboard connected by an overflow trunk and equipped with signals in accordance with my invention.

The features or combinations which I regard as new will be pointed out in the accompanying claims.

A telephone-line is shown extending from a substation A' to an answering spring-jack *a* at board A. It is understood, of course, that each line has multiple line-jacks at all the sections of the multiple switchboard. Another line is shown extending from a substation B' to a spring-jack *b* at the board or section B. We may assume that the spring-jack *b* illustrated is a line-jack.

Each line is equipped with the usual line-relay controlling a subsidiary lamp-signal, the line-relay being responsive to the flow of current when the circuit of the line is closed at the substation by the telephone-switch. The several line-signal lamps at each section of the switchboard are connected in multiple branches of a circuit including the common battery *c* of the switchboard. As shown in the drawing, the line-signal lamps are included in multiple grounded conductors extending from the bus-bar *d*, which is connected through two relays *e*, *f* in multiple with the free pole of the battery *c*. Each branch circuit is controlled by the line-relay of the line which the lamp in such circuit designates. It will be understood that all the line-signal lamps should be connected to the bus-bar in this way. The relays *e* and *f* are adjusted to respond to a certain margin of current. For example, the relay *e* will respond when three of the multiple branches containing the line-

signals are closed; but the relay f will not respond until four of the said multiple branches are closed. The relay e at each section controls signal-circuits extending to the several
 5 other sections, the busy-signals g in said circuits being all lighted when the relay e is excited and closes the circuit. The busy-signals g derive their current directly from the battery c instead of from the bus-bar. When-
 10 ever three calls remain unanswered at any section, the corresponding busy-signals g will be lighted at all the other sections to notify the other operators that the section designated by the lighted lamp is too busy to have overflow
 15 calls transferred to it. The relay f at each board controls the circuit of the pilot-lamp h at the same board, so that if the unanswered calls should reach a certain number (in this case we have assumed four) the relay f will
 20 be excited and light the pilot-lamp to inform the operator that she should transfer some of her calls to sections which are less busy.

A trunk-line t , called an "overflow trunk," is shown extending between the boards or sec-
 25 tions A and B. The trunk-line terminates in a plug at board A and in a spring-jack (which may be one of the ordinary answering-jacks) at the other board, B. The equipment of the trunk-line at board B is the same as the equip-
 30 ment of an ordinary subscriber's line—that is, there is the usual line-relay controlling a subsidiary line-signal lamp and a cut-off relay for disconnecting the line-signal apparatus, the cut-off relay being in the usual local circuit,
 35 which is closed in registering contacts of the answering-plug and the spring-jack when the jack is plugged into in answering a call. The spring-jack of the overflow trunk-line is designated by the letter a' . At the board A the
 40 busy-signal g , which corresponds to the board B, is preferably located near the plug t' , which forms the terminal of the overflow trunk-line extending to board B. The plug t' is shown to be an ordinary three-part plug, the tip and
 45 ring contacts which form the terminals of the limbs 1 2 of the trunk-line being adapted to engage the short and long line springs, respectively, of any spring-jack into which it is inserted. At the board B the short and long
 50 line springs of the jack a' are connected with the limbs 1 2, respectively, of the trunk-line. The effect of inserting the plug t' into a spring-jack at board A, then, is simply to extend the line thus plugged into to the spring-
 55 jack a' at board B, the line-signal apparatus connected with said spring-jack a' being automatically operated in the same manner as the regular line-signal apparatus of the calling-line was operated in the first instance. When
 60 a call is extended in this way, the connection will be supervised by the operator who answers it—that is, assuming a call to be transferred from A to B, the operator B would supervise the connection, the work required of her
 65 being no different from that required in an-

swering any ordinary call. The jacks of the overflow trunks may be among the ordinary answering-jacks at her section.

At the board which transfers the call a disconnect-lamp i may be provided for the trunk-
 70 line, this lamp being lighted when the connection is taken down at the board which answers the call. The circuits for displaying this disconnect-lamp are illustrated in the drawing, but since they form no part of the
 75 present invention will not be particularly described.

Supposing that subscriber A' desires a connection with subscriber B', he removes his telephone from its hook, thus closing the line-
 80 circuit and bringing about the illumination of the line-signal lamp k . Ordinarily the operator at the section A would answer the call in the usual manner and the connection would be completed by inserting one plug of a pair
 85 in the jack of the calling-line and the other plug in the multiple jack of the line called for. If, however, she had four calls at that time unanswered and awaiting attention—that is, if four line-signal lamps k were lighted—
 90 the relay f would be excited and her pilot-signal h displayed. She would know from the illumination of this signal that she was at liberty to transfer the call to some other sec-
 95 tion, and she would therefore simply pick up one of the trunk-plugs t' whose corresponding lamp g was not lighted and insert it into the answering-jack of the calling-line, thus extending the connection to the trunk-
 100 jack a' at the distant board. The busy-lamp g , associated with each trunk-plug, serves to inform the operator of the condition of the board to which that trunk-line extends.

If in the case we have assumed three line-lamps were lighted at the section B, the relay
 105 e at that section would be excited and the circuit 3 of the busy-lamp g closed, causing the display of the signal. The operator at board A, who was about to transfer a call, would therefore not use the trunk-plug t' , since she
 110 would know by the lighting of the lamp g corresponding to said plug that the distant board was already too busy to accommodate overflow calls.

Having thus described my invention, I claim
 115 as new, and desire to secure by Letters Patent, the following:

1. The combination with the several sections of a switchboard, of overflow trunk-lines between the sections, busy-signals for each sec-
 120 tion at the other sections, and magnetically-actuated apparatus at each section for controlling the busy-signals thereof at the other sections, whereby each operator is automati-
 125 cally informed which of the other sections is at liberty to receive overflow calls.

2. The combination with two sections of a switchboard, of line-signals for the telephone-
 lines at one of said sections, a busy-signal at the distant section, and means controlled by
 130

the joint operation of a predetermined number of said line-signals, for controlling said busy-signal, whereby the busy-signal is displayed at the distant section when a given number of calls are received.

3. The combination with two switchboards and telephone-lines centering at each board, of line-signals for the telephone-lines, connecting appliances at each board for answering calls, a trunk-line between the boards, a busy-signal for one board located at the other board, and means controlled by the joint operation of a predetermined number of line-signals at the board to which the busy-signal corresponds, for causing the display of said signal, whereby the operator at the board where the busy-signal is located is informed whether or not calls may be trunked to the distant board.

4. The combination with several telephone-lines, of switches for said lines operated from the substations of the lines, circuits controlled by the switches, a device responsive only to current existing simultaneously in several of said circuits, and mechanism controlled by said device.

5. The combination with two switchboards and telephone-lines having multiple connections on both boards, connecting appliances at each board for answering calls, an overflow trunk-line between the boards, means for transmitting call-signals from the substations of the lines, responsive devices, one for each line at one of the switchboards, adapted to be

set by a call-signal transmitted from the substation of such line, means actuated in answering a call, for restoring said responsive devices, and a signal at the distant board controlled by the joint actuation of a predetermined number of said responsive devices.

6. The combination with a switchboard and telephone-lines centering therein, of a source of current, a circuit for the same, multiple branches for said circuit, line-signals for the telephone-lines in the several multiple branches, switches controlling said multiple branches, a magnet included serially in the circuit with all the multiple branches and adjusted to respond when a predetermined number of said branches are closed, and a signal controlled by said magnet, substantially as described.

7. The combination with a switchboard and telephone-lines centering therein, signals for the lines, a source of current, and a circuit therefor adapted to be completed in switch-contacts controlling said signals, of a relay included in said circuit responsive to the joint operation of a predetermined number of said signals, and mechanism controlled by said relay, substantially as described.

In witness whereof I hereunto subscribe my name this 18th day of April, A. D. 1901.

JAMES L. McQUARRIE.

Witnesses:

ELLA EDLER,

EDWIN H. SMYTHE.