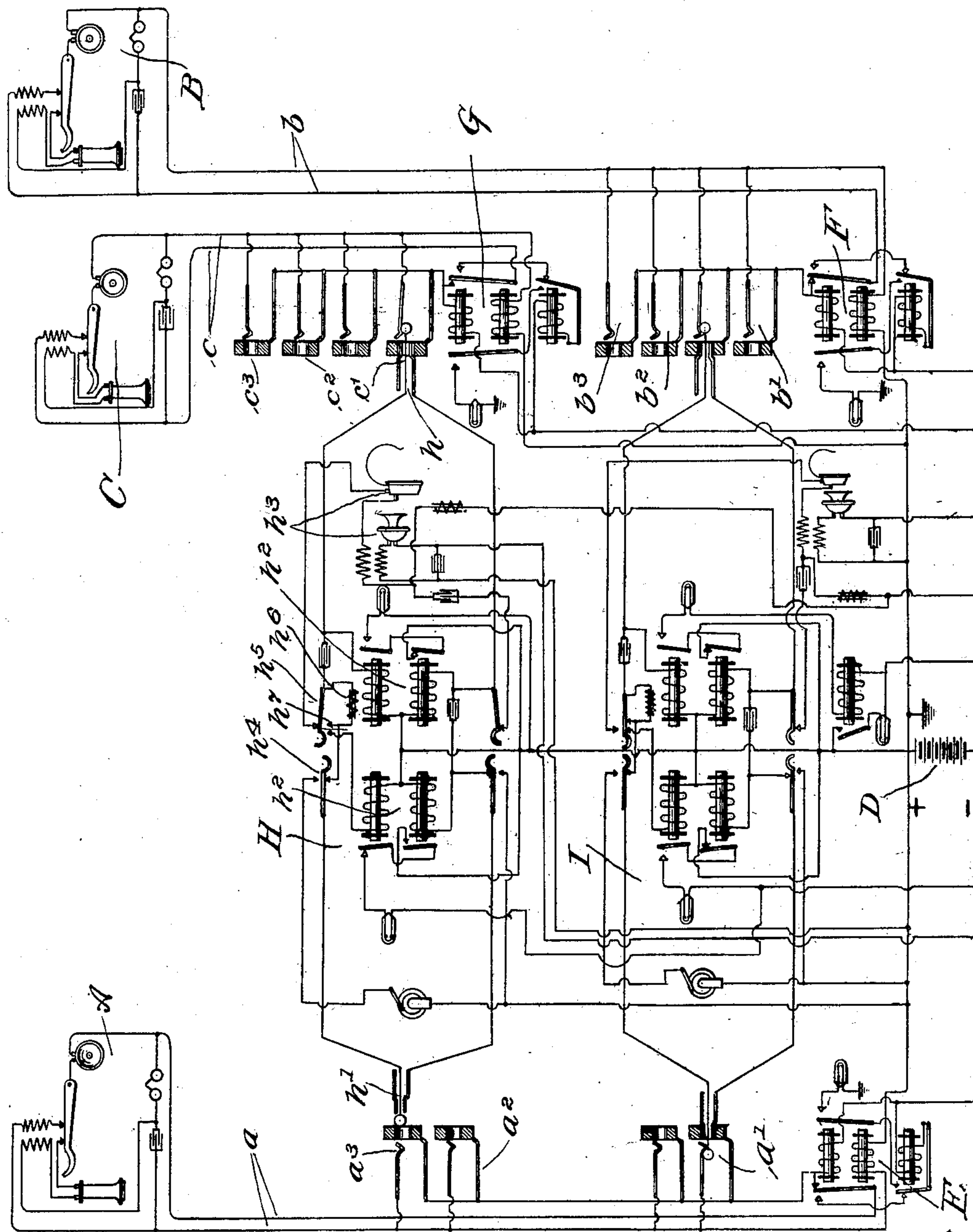


No. 861,809.

PATENTED JULY 30, 1907.

H. P. CLAUSEN.  
TELEPHONE SWITCHBOARD APPARATUS.  
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# UNITED STATES PATENT OFFICE.

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## TELEPHONE SWITCHBOARD APPARATUS.

No. 861,809.

Specification of Letters Patent.

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Application filed November 21, 1903. Serial No. 182,075.

*To all whom it may concern:*

Be it known that I, HENRY P. CLAUSEN, a citizen of the United States of America, and a resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Telephone Switchboard Apparatus, of which the following is a specification.

It is a matter of common knowledge, that in telephone systems, or at least in some systems, that when two subscribers are talking, the testing of either line by the operator at the central station, in response to a call sent in by a third party for connection with one of these lines, is liable to produce derived circuits of such character as to enable this third party to overhear the conversation being carried on between the two subscribers already connected up, and, in addition, to produce noise or undesirable disturbances on one or more of the lines, and perhaps on all three lines. It is for the purpose of overcoming this difficulty, and of providing a multiple switchboard apparatus which will enable the operators to make the busy-test in the usual manner—that is to say, to touch the tip of the calling plug to the ring or test-thimble of the multiple jack connected with the called-for subscriber's line—without any danger or liability of the conversation being carried on over the tested line being heard by the third party, or party in whose behalf the operator has made the test, and without danger of producing annoying disturbances or sounds on any of the lines, that my improved impedance arrangement is employed in the manner shown and described.

In its preferred form, my invention comprises an operator's cord-circuit in which two corresponding contacts of the answering and calling plugs, preferably the tip contacts, are connected through the medium of an impedance coil which is normally short-circuited by the operator's listening key, but which becomes the only available path for the transmission of current between the corresponding contacts of the two plugs when the operator presses the listening key, as, for example, in making the usual and well-known busy-test—that is to say, the busy-test which consists in pressing the listening key and touching the tip of the calling plug to the ring or test-thimble of the multiple jack connected with the called-for subscriber's line—the operator, in such case, hearing nothing if the line is not in use, or, on the other hand, receiving a distinct click or sound in her receiver, if the line is in use. Thus, with the foregoing provision, it is readily apparent that an operator can make the busy-test in the usual and approved manner without any liability of whatever conversation is being carried on over the tested line being heard by the third party or calling subscriber, and, owing to the retarding effect which the impedance coil has on initial flow of calling current without producing

unpleasant sounds or disturbances on the different subscribers' lines; for in thus making the test, the operator opens up the short-circuit which normally extends around the said impedance coil, thereby permitting a sufficient flow of battery current through the cord-circuit to give the test-signal, if a line is busy, but, owing to the presence of the impedance coil in the circuit, preventing a flow of voice currents through the cord-circuit to the calling subscriber's line, and also preventing the quick flow or rush of battery current which, by producing discharges from whatever condensers are employed, usually tends to produce unpleasant sounds in the subscribers' receivers; it being understood, of course, that before thus testing the called-for subscriber's line the operator has already inserted the answering-plug in the jack connected with the calling subscriber's line; and it is the necessity of thus connecting the cord circuit with the calling-subscriber's line before making the test with the calling plug attached to the other end of the cord-circuit, which, with the old arrangements, made it possible for voice currents to be transmitted over the tested line to the calling subscriber's line, and which gives utility to my invention by enabling my improved impedance coil arrangement to preclude all possibility of the conversation between two connected subscribers being overheard by any other subscriber in whose behalf the operator may test one of the two connected lines, and by enabling the operator to make what may be termed a quiet busy-test.

The nature and advantages of my invention will, however, hereinafter more fully appear.

The accompanying drawing is a diagram illustrating a common battery multiple switchboard telephone system, embodying the principles of my invention.

The substation apparatus shown at the substations A, B and C, can be of any suitable known or approved character. These subscribers' or substation telephone sets are connected with the exchange or central station through the medium of the line-wires *a*, *b* and *c*, in any suitable or desired manner. As the exchange is of the common battery and multiple-switchboard type, the current for both signaling and talking purposes is supplied to the subscribers' lines from a common battery D. Each subscriber's line is provided, at the central station, with both answering and multiple-jacks. For example, the line *a* can be provided with an answering-jack *a*<sup>1</sup>, and, on the other sections of the switchboard, with multiple-jacks *a*<sup>2</sup> and *a*<sup>3</sup>. In a similar way, the line *b* can be arranged to terminate in the answering-jacks *b*<sup>1</sup> and the multiple jacks *b*<sup>2</sup> and *b*<sup>3</sup>. The line *c* can terminate in similar jacks *c*<sup>1</sup>, *c*<sup>2</sup> and *c*<sup>3</sup>.

The line-signal apparatus—that is to say, the devices by which the subscribers attract the attention of the operators—can be of any suitable known or approved character. In the diagram, E represents line-signal



apparatus for the line *a*, while the line-signal apparatus at F is allotted to the line *b*, and the line-signal apparatus G to the line *c*. As these devices constitute no portion of my present invention, they need not be further described. It will be understood, however, that the cut-off relays of the line do not operate when the subscribers take down their receivers, as the said relays are suitably adjusted to prevent this. So also in respect to the operators' cord circuits, for establishing and dis-

10 establishing connection between the different subscribers' lines. These operators' cord-circuits H and I located in front of different operators, can be of any suitable known or approved character. The cord-circuit H can be provided with answering and calling

15 plugs *h* and *h*<sup>1</sup>, with suitable supervisory apparatus *h*<sup>2</sup>, and with the usual operator's talking set *h*<sup>3</sup>, consisting of a transmitter and a receiver. The cord-circuit is, of course, also provided in the usual and well-known manner, with ringing and listening keys *h*<sup>4</sup>, *h*<sup>5</sup>. The

20 feature of this cord-circuit which constitutes my invention, consists in the provision of an impedance element, such, for example, as the impedance coil *h*<sup>6</sup> connected normally in parallel with the spring of the listening key *h*<sup>5</sup>, whereby it is normally short-circuited. But

25 when this key is pressed, it will be seen that the spring leaves the contact *h*<sup>7</sup>, thereby removing this short-circuit from around the impedance-coil, thus leaving the said coil to constitute a portion of the conducting path between the tip contacts of the two plugs. In this

30 way, the impedance coil provides a suitable path for the battery current necessary in making the test, but at the same time precludes the passage of voice currents over the tested line to the line of the waiting subscriber. For example, as shown in the diagram, the cord-circuit

35 I has both its plugs inserted in the jacks of the lines *a* and *b*, the subscribers at A and B thereby being connected up for conversation. As illustrated, the subscriber C is supposed to be calling for subscriber A, and the operator provided with the cord-circuit H is supposed to be making the usual busy-test. Such being

40 the case, the answering-plug *h* has been inserted in the answering-jack connected with the line *c*, and the operator is touching the tip of the plug *h*<sup>1</sup> to the ring or testing thimble of the multiple-jack *a*<sup>3</sup>, which latter is connected with the line *a*. At the same time, the operator

45 presses the listening key *h*<sup>5</sup>, thereby removing the short-circuit which normally extends around the impedance coil *h*<sup>6</sup>. This leaves the test-circuit intact—that is to say, leaves a path for battery current to flow over the

50 ring of the jack *a*<sup>3</sup>, through the tip of the plug *h*<sup>1</sup>, thence through the impedance coil *h*<sup>5</sup> and the listening-key *h*<sup>6</sup>, thence through the operator's receiver and back to the other pole of the battery, as shown. This gives the

55 click or sound in the operator's receiver, necessary in order to give the busy signal, and advise her that the called-for subscriber's line is busy; but, at the same time, it will be seen that the tested circuit thus formed includes the impedance coil, and consequently that

60 while battery current can thus flow over the circuit, no voice currents can traverse the circuit. In this way, the cord-circuit normally presents two parallel strands or conducting paths, whereby any two subscribers can be connected up. When the operator presses the listening-key, however, as in making a test, then the im-

65 pedance-coil is introduced into one side of the cord-cir-

cuit, thereby precluding the possibility of any voice-currents traversing the cord-circuit from a busy called-for subscriber's line to the line of the calling subscriber.

It will be readily understood that the resistance of the impedance-coil, as well as other devices in the system, can be adjusted or regulated to suit circumstances or conditions, and in accordance with the requirements of different systems. As previously stated, the impedance coil is of further utility, in this: It prevents a quick rush of battery current through the circuit, thus preventing such a charging of the condenser or condensers as would be likely, when the condensers discharge, to produce unpleasant sounds or disturbances in any of the subscribers' lines.

What I claim as my invention is:—

1. A central-energy multiple switchboard telephone system, provided with operators' cord-circuits having normally short-circuited impedance-coils, together with spring jacks adapted to be connected with the cord-circuits in the establishment of connection between different subscribers, each spring jack having an outer contact constituting a part of both the talking and busy test circuits.
2. A central-energy multiple switchboard telephone system provided with operators' cord-circuits having the usual or suitable listening keys, and having also impedance elements normally short-circuited by said keys, together with spring jacks adapted to be connected with the cord-circuits in the establishment of connection between different subscribers, each spring jack having an outer contact constituting a part of both the talking and busy test circuits.
3. A central-energy multiple switchboard telephone system, provided with operators' cord-circuits equipped for making the usual busy-test, and having also normally short-circuited impedance elements adapted, in each case, to be brought into one side of the cord-circuit when the operator makes a busy-test, together with spring jacks adapted to be connected with the cord-circuits in the establishment of connection between different subscribers, each spring jack having an outer contact constituting a part of both the talking and busy test circuits.
4. A central-energy multiple switchboard telephone system, provided with operators' cord-circuit apparatus having suitable connections for forming the test circuits, and provided also with normally short-circuited impedance-coils adapted to constitute part of said test circuits, together with spring jacks adapted to be connected with the cord-circuits in the establishment of connection between different subscribers, each spring jack having an outer contact constituting a part of both the talking and busy test circuits.
5. A common battery multiple telephone exchange system, having operators' cord-connecting apparatus adapted to provide derived testing circuits, and impedance-coils adapted to constitute part of said test circuits, together with spring jacks adapted to be connected with the cord-circuits in the establishment of connection between different subscribers, each spring jack having an outer contact constituting a part of both the talking and busy test circuits together with normally closed listening-key contacts normally shunting or short-circuiting said coils.
6. A common battery multiple switchboard telephone exchange system having operators' cord-circuits, one side of each cord-circuit being provided with a normally short-circuited impedance-coil, and each cord-circuit being provided with means for opening the short-circuit when the operator desires to make a busy-test, together with spring jacks adapted to be connected with the cord-circuits in the establishment of connection between different subscribers, each spring jack having an outer contact constituting a part of both the talking and busy test circuits.

Signed by me at Chicago, Cook county, Illinois, this 16th day of November, 1903.

HENRY P. CLAUSEN.

Witnesses:

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