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TELEPHONE SYSTEM.

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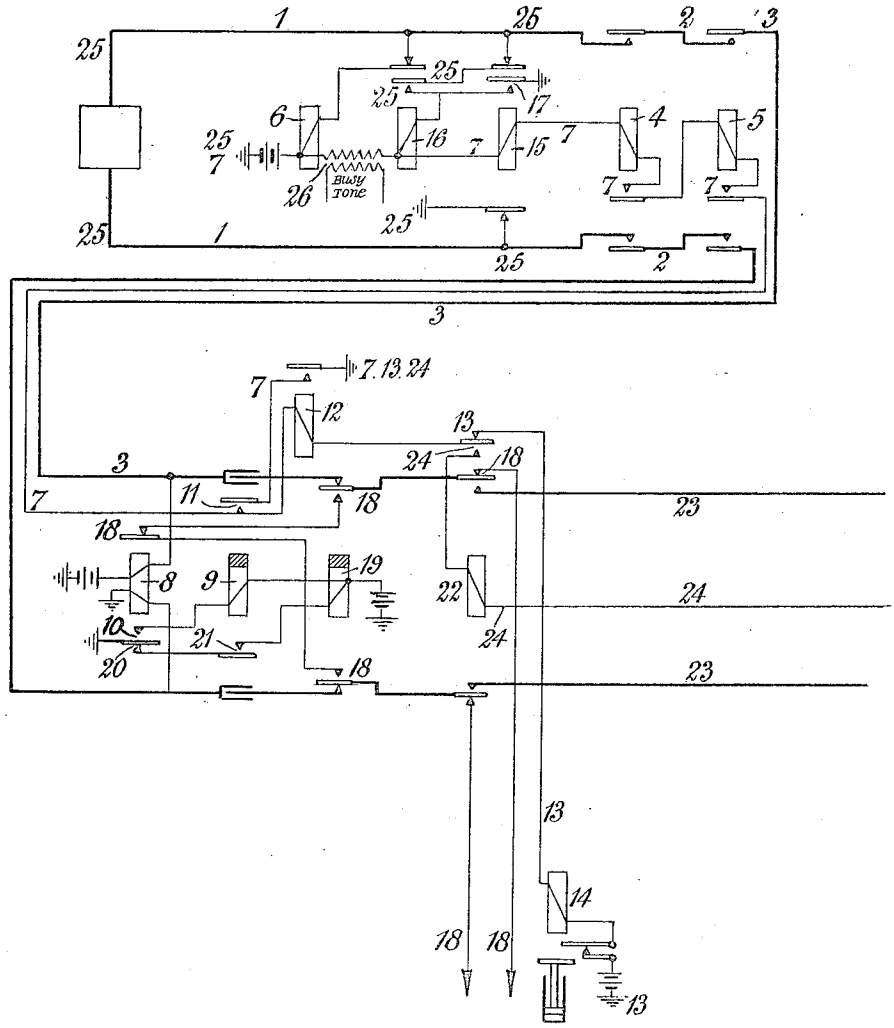
1,225,291. Patented May 8, 1917.



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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

1,225,291. Specification of Letters Patent. Patented May 8, 1917.

Application filed June 5, 1916. Serial No. 101,769.

To all whom it may concern:

Be it known that we, FRANCIS MORLEY WARD, GEORGE HENRY BRYANT, and THOMAS MONTAGU INMAN, subjects of the King of Great Britain, residing at Marconi House, Strand, London, England, have invented new and useful Improvements in Telephone Systems, of which the following is a specification.

The invention relates to telephone systems in which, when a talking circuit is disconnected, the subscriber who still keeps his telephone off, receives an audible signal. According to the present invention, this busy-back signal is connected up by means associated with the subscriber's line and automatically operated upon the release of the connection. The invention is especially applicable to systems having means associated with the subscribers' lines, as described in United States Patent to Leonard Charles Bygrave, No. 1,204,742, dated November 14, 1916, to prevent false calls being made by a subscriber who, upon the disconnection of the talking circuit, still keeps his telephone receiver off. In such systems the means for preventing false calls, which operate upon the release of the connection, may also be utilized for connecting up the busy-back circuit.

The invention is of particular importance to automatic and semi-automatic telephone systems in which it has hitherto been necessary to uphold at least a part of the talking connection till the calling subscriber replaces his receiver for the purpose of preventing false calls and sending the busy-back signal. If the subscriber delays or omits to clear the connection, exchange apparatus is thus uselessly retained. By the application of this invention, all apparatus beyond the subscriber's line may be released without any disturbing effect and the subscriber nevertheless gets the busy-back signal as usual.

The accompanying drawing shows the invention as applied to an automatic telephone system in which the connections are established by means of relays. The invention, however, is not limited to any particular system.

The figure shows part of a talking connection comprising a subscriber's line 1, an intermediate junction line 2 and a trunk line 3, leading to the first group-selecting stage, the connection being established over two connecting relays 4 and 5.

When the subscriber removes his receiver, the line or call-relay 6 operates and in a known manner, as described, for instance, in United States Patent No. 832,471, causes the connection of the subscriber's line to an idle trunk 3 over the contacts of relays 4 and 5, which, together with a relay 12, are first energized over operating circuits not shown here, and are then maintained energized over a circuit 7 which extends over a third wire of the talking connection, and is completed as soon as the connection is extended to the transmission relay set associated with the trunk line. At that moment the line circuit is closed through an impulse relay 8, which operates and cuts in at its contact 10, a guarding relay 9 completing the third wire circuit 7 at contact 11. At the same time a circuit 13 is closed retaining relay 12 and including a time switch 14 associated with a group-selector which is common to a group of trunks 3, and is used in a known manner to establish a connection but not to uphold the same. The time switch may be of the solenoid type and is adapted to interrupt circuit 13 after a predetermined period which is somewhat longer than the normal period for which a group-selector is engaged.

The third wire circuit 7 includes a relay 15 which is associated with the subscriber's line and which, upon operating, energizes a cut-off relay 16 over contact 17 to cut the line relay 6 out of circuit.

The group-selector, which is not shown here, is now operated in the ordinary way by impulses sent over the subscribers' lines and transmitted to the impulse circuit 18 of the selector by means of the impulse relay 8 and a slow-acting change-over relay 19 which is operated over contacts 20 and 21 upon the first deënergization of relay 8. After the group-selector has been set, a testing device associated with the selector is operated in known manner to test the junction lines of the group selected and to energize a connecting relay 22 corresponding to an idle junction 23 in that group. Said relay, upon energizing, cuts off the group selector, extends the connection over junction 23 to the next switching stage and

completes a third wire circuit 24 through itself, relay 12 and a time switch at a selector of the next stage.

Should the subscriber delay or omit to operate the selector, the time switch 14 will operate after a certain period to open circuit 13. Relay 12 then deënergizes and opens circuit 7, whereby the connection is broken down. Relay 15, upon deënergizing, completes a retaining circuit 25 over the subscriber's line through relay 16, which circuit is evidently maintained as long as the subscriber keeps his telephone receiver off. Relay 16, by maintaining the call relay 6 disconnected, prevents the subscriber from reëngaging the selector. The circuit 25 includes a busy-back signal transformer 26, and the subscriber therefore hears a tone in his receiver indicating that the connection has been broken down.

If the called subscriber should be engaged, or if the connection could not be extended for want of a disengaged junction, the connection is likewise severed by the opening of the third-wire circuits and the cut-off relay 16 is retained over the line circuit to send the busy-back signal and to prevent a false call.

When a connection is completed with a wanted subscriber, the third wire circuit is connected up through relay 15 of the called subscriber's line. The disconnection of the talking circuit effected by the calling subscriber replacing his receiver while the called subscriber keeps his telephone off, therefore similarly affects the relays associated with his line to prevent a false call and to send a busy-back signal.

Said means may also be used in any suitable way for supervisory purposes to indicate to the exchange attendant that a subscriber has omitted to replace his receiver.

What we claim is:—

1. In a telephone system, a subscriber's line, a cut-off relay associated therewith, a calling circuit controlled by said relay, a holding circuit for said relay extending over the subscriber's line, means for completing said holding circuit upon the disconnection of the talking circuit and a busy signal circuit controlled by said means and adapted to cause a busy signal to be sent to the subscriber upon the release of the connection.

2. In a telephone system, a subscriber's line, a relay associated therewith, a calling circuit controlled by said relay, a holding circuit for said relay extending over the subscriber's line, a relay operating upon the disconnection of the talking circuit to complete said holding circuit, and a busy signal circuit controlled by said relays and adapted to cause a busy signal to be sent over the subscriber's line.

3. In a telephone system, a plurality of subscribers' lines, automatic switches for interconnecting said lines, a relay associated with each subscriber's line, a holding circuit for said relay extending over the subscriber's line, a time switch operating to disconnect a non-completed talking circuit after a certain period, means for completing the holding circuit of said relay upon the release of the connection and a busy signal circuit controlled by said means and adapted to cause a busy signal to be sent to the subscriber.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."