

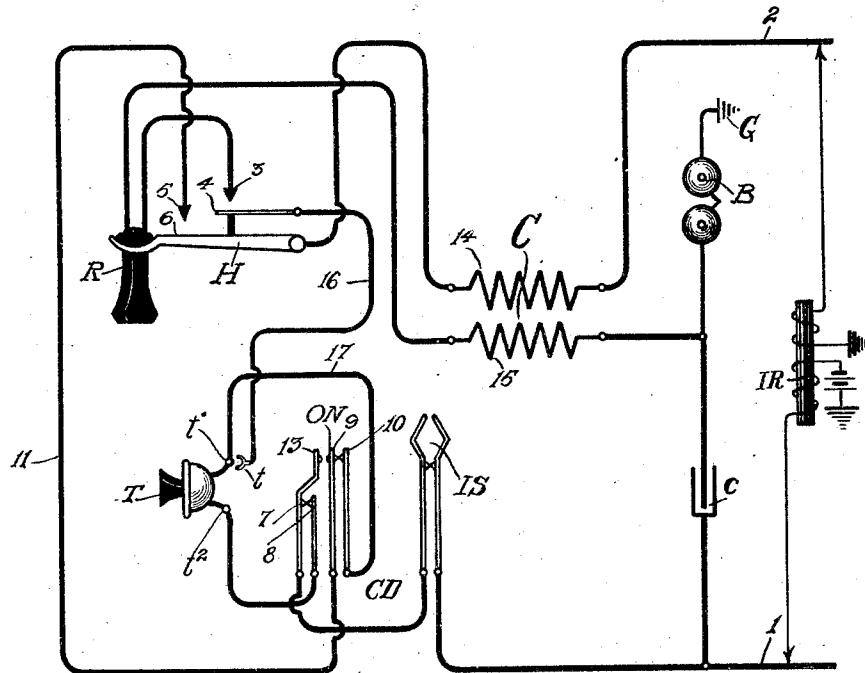
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SUBSTATION CIRCUIT

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SUBSTATION CIRCUIT.

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My invention relates in general to substation telephone circuits, but is more particularly directed to substation circuits for use in connection with automatic telephone systems, and an object of my invention is the provision of a substation circuit as above outlined, having an improved and simplified arrangement, positive and efficient in its operation.

close before their normal contacts open for purposes to be pointed out later. The receiver R is normally connected in circuit with only one winding of the induction coil C but is arranged so that when it is removed from its switch hook H the switch hook H will assume a position, due to spring pressure as is well known, to close normally open contacts to connect the receiver R in circuit with the other winding of the induction coil C through the off-normal contacts ON and also the receiver R in circuit with the transmitter T. A condenser *c* and call bell B are also shown which are connected to one of the line limbs of the telephone line extending to the main exchange and are also connected in circuit with one winding of the induction coil C, said call bell B and condenser *c* as connected, are provided for the usual well known party line purposes.

A feature of my invention is the provision of means whereby both the receiver and transmitter, which are normally connected in circuit with the line limbs of the telephone line extending to the main exchange, are cut out and remain out of circuit with the said telephone line during the functioning and operation of the impulse sender or calling device located at the substation, or when the said impulse sender or calling device is out of its normal position, whereby perfect control is had over the impulse control relay at the main exchange to effect a positive and efficient operation of said relay.

Having described in general the apparatus embodying my invention, a detailed description of its operation will now be given and for an example of a suitable central office arrangement reference is made to Patent Number 1,194,741 issued to Harry H. Ide on August 15, 1916. Relay IR is the impulse control relay and is shown directly bridged across the subscriber's line. This relay responds to an operation of the interrupter springs IS and through its contacts (not shown) controls an automatic switch.

Another feature of my invention lies in the fact that it is adapted to work in connection with a party telephone line where ringing is effected metallically, or a party telephone line where the signalling at the substation from the main exchange is accomplished over one limb of the line through the call bell at the substation to ground.

Upon removal of receiver R from switch hook H to initiate a call, the switch hook H will move upward to close contacts 3 and 4, and 5 and 6 respectively whereby a circuit is closed through the transmitter T traced from battery at the main exchange, line limb 1, normally closed impulse contact springs IS of the calling device or impulse sender CD, normally closed contacts 7 and 8 of off-normal contacts ON, through the transmitter T, conductor 17, normally closed contacts 9 and 10 of off normal contacts ON, conductor 11, the now closed switch hook contacts 5 and 6, winding 14, of the induction coil C, line limb 2 and to the other side of battery at the main exchange. A local circuit is also closed through the transmitter T and receiver R in series which may be traced from line limb 1, impulse contact springs IS of the calling device CD, normally closed contacts 7 and 8 of off-normal

A further feature is the provision of means for overcoming side tone in the receiver.

The novel features above pointed out as well as others of my invention, not specifically pointed out above, will appear from the detailed description taken in connection with the accompanying drawing in which a preferred embodiment is illustrated.

In the drawing I show the impulse contact springs IS of the subscriber's impulse sending or calling device indicated by the reference character CD in circuit with the line limb 1 of the telephone line and the off-normal contact springs ON and transmitter T. The impulse sending or calling device CD may be any approved type known in the art, or such as illustrated and described in an application filed by Harry H. Ide April 6, 1920, Serial No. 372,525. The off-normal contact springs ON are controlled by the impulse sending device CD and are arranged so that their alternate contacts

contacts ON, transmitter T, terminals t and t' , conductor 16, the now closed switch hook contacts 3 and 4, receiver R, winding 15 of the induction coil C, condenser c , and back to line limb 1. Another circuit is closed for receiver R, due to the closing of switch-hook contacts 5 and 6, over which circuit voice currents may pass through said receiver R from the main exchange, said circuit extending from the main exchange, line limb 2, winding 14 of induction coil C, closed contacts 5 and 6, conductor 11, normally closed contacts 9 and 10 of off-normal contacts ON, conductor 17, terminals t and t' , conductor 16, closed contacts 3 and 4, through the receiver R, winding 15 of induction coil C, condenser c , line limb 1 and back to the main exchange. There is also a circuit for the impulse control relay at the main exchange established when the receiver R was removed from the switch hook, traced from battery at the main exchange, winding of the impulse control relay, line limb 1, impulse springs IS, contacts 7 and 8 of off-normal contacts ON, transmitter T, conductor 17, contacts 9 and 10, conductor 11, contacts 5 and 6, winding 14 of induction coil C, line limb 2, winding of said impulse control relay to the other side of battery. Another circuit is also closed for said impulse control relay over the same circuit just traced up to and including transmitter T, and from thereon extends over conductor 16, contacts 3 and 4, receiver R, winding 15 of induction coil C, call bell B to ground at G. The impulse control relay is maintained energized over both of these circuits at this time. The subscriber having removed the receiver R from the switch hook H, is now ready to actuate the finger hold actuating member of the impulse sender or calling device CD to send out the required number of impulses over his line to the main exchange to effect operation of the impulse control relay and other apparatus at the main exchange to accomplish his desires. Upon the movement of the finger hold actuating member from its normal position, contacts 9 and 13 will close, and normally closed contacts 7 and 8 and contacts 9 and 10 of off-normal contacts ON, will open but not before contacts 9 and 13 are closed as said contacts 9 and 13 are arranged to close before contacts 7 and 8 and contacts 9 and 10 open so that a circuit is maintained for the impulse control relay at the main exchange over line limbs 1 and 2. The circuit through the transmitter T is now opened through the opening of the normally closed contacts 7 and 8 and contacts 9 and 10 of off-normal contacts ON, as is also the circuit through the receiver R whereby transmitter T and receiver R are both cut out of circuit with line limbs 1 and 2 as is also the circuit including the call bell B and ground G, and the impulse contact springs IS of the calling device CD are included directly in circuit with line limbs 1 and 2 leading to the main exchange through the now closed contacts 9 and 13 of said off-normal contacts ON. When the fingerhold actuating member of the calling device CD is released, it will restore to normal and, in so doing, will cause the impulse contact springs IS to open and close a predetermined number of times to send current impulses to the main exchange in the well known manner. The circuit for the impulse current may be traced from battery at the main exchange line limb 1, through the impulse contact spring IS, closed contacts 9 and 13 of off-normal contacts ON, conductor 11, the closed switch-hook contacts 5 and 6, winding 14 of induction coil c , line limb 2 to the other side of battery. As soon as the fingerhold actuating member of the calling device CD restores to normal contacts 7 and 8 and contacts 9 and 10 will close and then contacts 9 and 13 will open, thereby restoring the circuit through the transmitter T and the circuit through the receiver R whereby the transmitter T and receiver R are again connected in circuit with the line limbs 1 and 2 and the circuit for the impulse control relay including the call bell B and ground G is also restored. Each time the fingerhold actuating member of the calling device CD is moved from its normal position, the receiver R and transmitter T and the circuit including call bell B and ground G will be cut out of circuit with the line limbs 1 and 2 of the telephone line extending to the main exchange and the impulse contact springs IS will be connected directly in circuit with said telephone line independently of said transmitter and receiver and bell B and ground G whereby impulses of current will be sent over the telephone line to the main exchange to effect a positive operation of the impulse control relay thereat, due to the opening and closing of the impulse contact springs IS through the operation of the calling device CD. By cutting out the receiver R and transmitter T and call bell B and ground G from the telephone line during the operation of the calling device CD a circuit is provided for the impulse current which is free from the interference of the transmitter T and the receiver R and bell B and ground connection G thereby insuring a positive operation of the impulse control relay at the main automatic exchange. In the systems prior to my invention, the ground connection through the call bell remains in circuit with the impulse control relay at the main exchange which greatly impairs the efficiency of the said impulse relay. For metallic party line ringing ground is disconnected and the call bell is connected to line limb 2, thereby bridging

call bell B and condenser *c* across the line limbs 1 and 2.

Reverting now to the tracing of the local circuit for receiver R which circuit includes transmitter T in circuit in series with receiver R, it sometimes occurs that a side tone is set up in the receiver due to noises passing through the transmitter and over this local circuit through the receiver R when the substation containing my circuit is located in a noisy room. This side tone makes it unpleasant for the listener and in order to overcome the side tone, I provide a terminal *t*² to which the terminal *t*, connected to conductor 16 may be connected after being disconnected from the terminal *t*', whereby the transmitter T will be shunted out, and the local circuit for receiver R will be the same as before traced except that the transmitter T will not be included in the circuit in series with receiver R.

Thus from the above, it will be seen that I have provided a substation circuit for use in automatic systems which may be used with a metallic party line ringing system or party line where the subscribers are rung over one limb of the telephone line and to ground without impairing the operation of the impulse relay at the main exchange and also that means are provided for overcoming side tone.

In the drawing I have shown a preferred embodiment of my invention but it is to be understood that I do not wish to be limited to the exact arrangement as shown and described but intend to cover all that which comes within the scope and spirit of the appended claims.

What I claim as new and desire to secure by United States Letters Patent, is:

1. In a telephone system, a telephone line, a substation provided with a transmitter and a receiver for said telephone line, an impulse sender for said substation comprising a pair of contacts adapted to be engaged and disengaged for intermittently interrupting said telephone line, and means including another set of contacts exclusive of said first contacts normally completing circuits for connecting said transmitter and receiver across said telephone line controlled by said impulse sender for disassociating said transmitter and receiver from said telephone line during the operation of said impulse sender, by breaking their respective connecting circuits.

2. In a telephone system, a telephone line, a substation for said telephone line having a transmitter and a receiver, said transmitter and receiver being connected by individual circuits to said line when said substation is in talking position, an impulse sending device having a pair of contacts for said substation, and means comprising a set of contacts exclusive of the contacts of said impulse sending device for operatively discon-

necting said transmitter and receiver from said telephone line by opening their said individual circuits when said impulse sending device is operated to intermittently interrupt said line.

3. In a telephone system, a telephone line normally connected across a battery, a transmitter and a receiver normally connected across said line by individual circuits, an impulse sending device comprising a pair of contacts for intermittently interrupting the battery flowing over said telephone line and means including a set of contacts exclusive of said impulse sending device contacts and controlled by said impulse sending device for operatively disconnecting said transmitter and receiver from said telephone line by opening their respective circuits during the operation of said impulse sending device.

4. A telephone system including a telephone line, a substation for said telephone line having a transmitter and a receiver, an impulse sender having a pair of contacts adapted to be engaged and disengaged, for said substation normally in circuit with said transmitter and receiver when said substation is in its operative position, and means consisting of a set of contacts exclusive of said other contacts controlled by said impulse sender for disassociating said transmitter and receiver from said telephone line when said impulse sender is operated, whereby said telephone line is intermittently interrupted to transmit impulse free from the interference of said transmitter and receiver.

5. A telephone system including a telephone line extending to a main exchange, an impulse control relay at said main exchange, a substation for said telephone line provided with a transmitter and a receiver normally connected across said line, an impulse sender comprising a pair of contacts adapted to be engaged and disengaged for said substation for intermittently interrupting the circuit of said impulse control relay and means including a set of contacts exclusive of said other contacts controlled by said impulse sender for disassociating said transmitter and receiver from said telephone line by opening their respective connecting circuits and to connect said impulse sender directly in circuit with said telephone line independently of said transmitter and receiver to insure a positive operation of said impulse control relay.

6. A telephone system including a substation provided with a transmitter and a receiver, a relay, a calling device having a pair of contacts in circuit with said receiver and transmitter adapted to be engaged and disengaged for intermittently interrupting the circuit of said relay when said substation is in use, and another set of contacts ex-

clusive of said first contacts comprising off-normal contacts controlled by said calling device for cutting said transmitter and receiver out of circuit with said calling device
 5 when said calling device is out of its normal position and for establishing another circuit for said relay whereby current impulses are transmitted independently of said transmitter and receiver.

10 7. A telephone system including a telephone line extending to an automatic exchange, a substation for said telephone line provided with a transmitter and a receiver, said substation adapted to operate on a
 15 party or single party telephone line, a current impulse sending device having a pair of contacts adapted to be engaged and disengaged for sending current impulses over said line to the automatic exchange by intermittently interrupting the circuit of said
 20 telephone line, said device normally in circuit with said transmitter and receiver when said substation is in its operable position, and means, including another set of contacts adapted to normally complete the circuit
 25 for said device and transmitter and receiver, controlled by said device for cutting said transmitter and receiver out of circuit with said device and telephone line and for completing another circuit for said device and
 30 telephone line when said device is out of its normal position.

8. In a telephone system, a telephone line, a substation for said telephone line having
 35 a transmitter and a receiver and a switchhook for supporting the same, a circuit for said transmitter and a circuit for said receiver including said telephone line, an impulse sending device for said circuit, an independent set of off-normal contacts adapted
 40 to normally connect said transmitter and receiver in circuit with said device and to disconnect said receiver and transmitter from said circuit when the said device is operated by opening their respective circuits and closing
 45 another circuit for the said device and telephone line, a local circuit for said receiver including a conductor between one terminal of said transmitter and a contact of said switch hook to include said transmitter in series, and means for changing the
 50 conductor from said one terminal of said transmitter to the other terminal of said transmitter in said local circuit to shunt said transmitter out of said local circuit without rendering the same inoperative whereby side
 55 tone is avoided in said receiver.

9. In a telephone system, a telephone line extending to a main exchange, an impulse
 60 control relay at said main exchange controlled over said telephone line, a substation for said telephone line, circuits for said impulse control relay extending through said substation, one of said circuits including a
 65 ground connection at said substation, a call-

ing device having a pair of contacts adapted to be engaged and disengaged for controlling said impulse control relay by intermittently interrupting said telephone line, and means comprising a set of contacts exclusive
 70 of the contacts of said calling device for opening said circuit including said ground connection when said calling device is in its off normal position to permit a positive operation of said impulse control relay over
 75 another circuit established by the said last means.

10. In a telephone system, a substation adapted to be used on metallic party line ringing lines extending to a main exchange
 80 or on party lines extending to a main exchange where subscribers are signalled over one limb of the telephone line to ground, said substation including a signalling device having its one terminal connected to ground
 85 and its other terminal permanently connected to one side of said line, said device also being connected through an off normal contact to the other side of said line, and means for said substation comprising said off-normal
 90 contacts and exclusive of the contacts of said signalling device for effecting a positive operation of the apparatus at the main exchange.

11. In a telephone system, a telephone line, a substation having a transmitter and a receiver normally connected by respective circuits to said telephone line, a call bell connected to one side of said telephone line and to ground, an impulse sender for said substation for intermittently interrupting said
 100 telephone line, means controlled by said impulse sender for disconnecting said bell and ground from said telephone line during the operation of said impulse sender and for disconnecting said receiver and transmitter from said telephone line by opening their
 105 respective circuits.

12. In a telephone system, a telephone line extending to a main exchange, an impulse
 110 control relay at said main exchange and controlled over said telephone line, a substation for said telephone line, a receiver and a transmitter at said substation normally connected to said telephone line by their respective circuits, a call bell for said substation connected to one side of said telephone line and to ground, an impulse sender for transmitting current impulses over said line to said impulse control relay by interrupting the circuit thereof, and means controlled by said impulse sender for disconnecting said receiver and transmitter from
 115 said telephone line by opening their respective circuits and for cutting out the ground at said call bell during the operation of said impulse sender to permit a positive operation of said impulse control relay.

13. In a telephone system, a telephone line extending to a main exchange, a relay at
 120 130

said main exchange, a substation for said line having a receiver and a transmitter normally connected to said line by their respective circuits, a signal at said substation connected to one side of said telephone line and to ground, a calling device for controlling the operation of said relay by intermittently interrupting the circuit thereof, and means controlled by said calling device for disconnecting said receiver and transmitter from said line by opening their respective connecting circuits and for freeing said telephone line from ground when said calling device is out of its normal position to permit a positive operation of said relay.

14. In a telephone system, a telephone line extending to a main exchange, an impulse control, relay at said main exchange and controllable over said telephone line, a substation for said telephone line including a re-

ceiver and a transmitter normally connected to said telephone line by their respective circuits and a call bell connected to one limb of said telephone line and to ground, circuits for said impulse control relay, one of said circuits including said call bell connected to ground, an impulse sender for controlling said impulse control relay by intermittently interrupting said telephone line, and means controlled by said impulse sender for disconnecting said receiver and transmitter from said line by opening their respective circuits and for opening the circuit including said call bell and ground to insure a positive operation of said impulse control relay.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 21st day of February, 1923.

DANIEL B. ROBISON.