

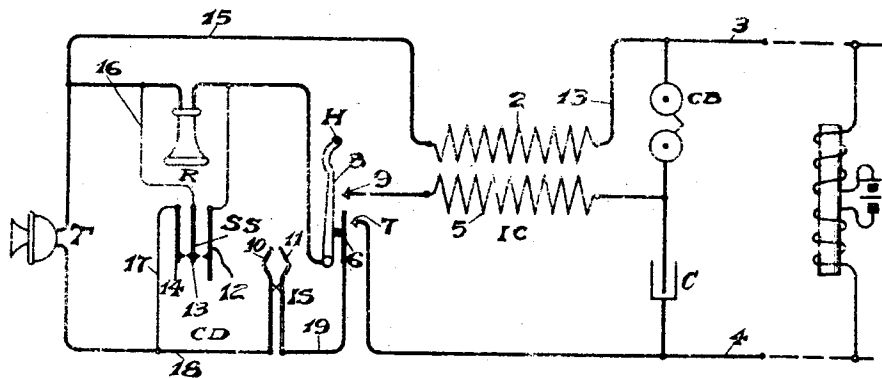
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SUBSTATION CIRCUIT

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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.

10 A feature of my invention is the provision of means in the substation circuit whereby the receiver is shunted while the impulse transmitter is functioning and the secondary winding of the induction coil placed across
15 the line conductors so that upon each interruption of the impulse springs discharge current from the secondary winding of the induction coil flows back over the telephone line in a direction opposite to that of the
20 initial flow of current in the line circuit. The flow of discharge current being in a direction to neutralize the magnetism of the controlling relay of the automatic apparatus at the exchange, it results that each time
25 the impulse springs of the substation circuit are interrupted a snap release of the said controlling relay is produced and any lag of the controlling circuit of the automatic apparatus at the exchange is overcome.

30 The novel features above outlined and the further features of my invention not specifically referred to above will appear from the detailed description taken in connection with the accompanying drawings, in which a preferred embodiment is illustrated.

35 In the drawing I show the transmitter T and the winding 2 of the induction coil IC connected across the line conductors 3 and 4 while the receiver R is in a circuit with
40 the condenser C and the other winding 5 of the induction coil IC. The circuit of the transmitter T and receiver R are normally open when the receiver R is on the switchhook H, and closed when the receiver R is removed. The circuit of the transmitter T
45 includes the switchhook controlled contacts 6 and 7 and the circuit of the receiver R includes the switchhook controlled contacts 8 and 9. A signaling circuit comprising a call bell CB and condenser C are connected
50 across the line conductors 3 and 4, but are not under the control of the receiver switchhook H. The subscriber's impulse sender or calling device indicated by the reference
55 character CD may be of any approved type

known in the art, or such as illustrated and described in an application filed by Harry H. Ide, April 9, 1920, and bearing Serial No. 372,525. It comprises springs 10 and 11 controlled by a suitable rotatable cam
60 through the medium of a finger hold actuating member and gearing. Shunt springs SS are also provided and comprise spring contact members 12, 13 and 14 which are
65 closed whenever the finger hold actuating member of the calling device CD is rotated from its normal position. The impulse springs 10 and 11 are included in series with the line conductor 4 and their function
70 is to produce momentary interruptions of the line circuit for the purpose of operating the central office switching devices in the manner well known in the art. The shunt springs 12, 13 and 14, when closed, short-
75 circuit the receiver R and transmitter circuits in order to reduce the resistance of the line circuit and to prevent the interruptions of the line circuit due to the opening and closing of the impulse springs 10 and 11
80 being heard in the receiver. The mechanics of such a device are so well known that any particular description thereof would be superfluous.

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 to Harry H. Ide issued August 15, 1916, No. 1,194,741.

90 Upon removal of receiver R to initiate a call, the switchhook controlled contacts 6 and 8 come into engagement, respectively, with the contact springs 7 and 9, whereby the circuit of the transmitter T and the circuit of the receiver R are closed. Responsive to the closure of the transmitter circuit, current is supplied to the transmitter from the battery bridged at the central exchange
95 over the following path: over line conductor 3, winding 2 of the induction coil IC, transmitter T, contacts 10 and 11, closed switchhook contacts 6 and 7, to the line conductor 4. The bridge at the central office which includes the battery may also, in accordance with the usual practice, include the
100 controlling or impulse relay of the automatic switch, the circuit of the said impulse relay including, therefore, the transmitter at the substation. The calling subscriber may, by 110

suitably manipulating his calling device finger-hold actuating member, produce a series of interruptions in the circuit of the controlling or impulse relay to bring about the operation of the switch associated with said relay. As soon as the finger-hold actuating member is turned from its normal position, the substation circuit is completed over a new path traced from line conductor 3, winding 2 of the induction coil IC, conductors 15 and 16, closed shunt springs 13 and 14, conductors 17 and 18, closed contacts 10 and 11 of the impulse springs IS, conductor 19, closed contacts 6 and 7 of the substation switchhook E to conductor 4. The closure of springs 12 and 13 shunts the receiver R, and closure of shunt springs 13 and 14 shunts the transmitter T for the purposes as already described. Successive operations of the dial will now result in the operation of successive switches at the exchange until the connection is finally completed to the line of the called subscriber.

When the finger-hold actuating member is turned from normal and the shunt springs 12, 13 and 14 are closed and the substation loop is extended from the line conductor 3 over the path just described to the conductor 4, current flows through the winding 2 of the induction coil IC and upon each momentary interruption of the impulse springs 10 and 11 as the finger actuating member returns to normal, this circuit or loop is opened and closed to bring about the de-energization and energization of the controlling relay at the exchange. At the instant that the impulse springs 10 and 11 are interrupted, the current flow through the winding 2 of the induction coil IC ceases and the magnetic field about the winding 2 collapses and induced current from the secondary winding 5 of the induction coil IC discharges into the telephone line in the opposite direction to that in which current was flowing through the winding 2 and the telephone line when the substation loop was interrupted. The condenser C and winding 5 of the induction coil IC are connected as follows when the actuating member is off normal: from line conductor 4, condenser C, winding 5 of the induction coil IC, closed switchhook controlled contacts 8 and 9, closed shunt springs 12 and 13, conductors 16 and 15, winding 2 of the induction coil IC to the line conductor 3. This circuit just traced connects the condenser C and winding 5 of the induction coil IC across the line conductors and the induced current from the winding 5 (in the opposite direction to the flow of current in the line circuit) decreases the reluctance of the circuit of the impulse relay of the switch at the exchange. This gives the impulse relay a snap release the instant the impulse springs 10 and 11 are interrupted, thereby producing a positive de-energiza-

tion of the impulse relay and a positive actuation of the switch associated with the impulse relay.

While I have illustrated and described a preferred embodiment of my invention, I do not wish to be limited to the exact structure shown as changes and modifications will readily suggest themselves and I, therefore, aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

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

1. A telephone system including a substation provided with a transmitter and a receiver, a substation controlled contact an impulse transmitter with impulse springs and having off-normal contacts for short-circuiting said transmitter and receiver when the impulses are being sent, said impulsing circuit including said first contact, a repeating coil having a winding connected to the line limbs and included in the impulse transmitting circuit at the substation, and a branch circuit, including a condenser and the other winding of the repeating coil, shunting the impulse springs.

2. A telephone system including a substation provided with a transmitter and receiver, an impulse transmitter having off-normal contacts to operatively disassociate said transmitter and receiver of the substation from the impulse transmitting circuit only when said receiver is removed from its switchhook, one winding of an induction coil included in said circuit, impulse springs in said circuit, said springs while transmitting impulses being shunted by a branch including the other winding of the induction coil, said branch being opaque to steady current but transparent to varying current.

3. An impulse transmitting circuit for automatic exchanges including an induction coil, normally open substation receiver switchhook contacts, impulse contacts directly conductively connected with one winding of said induction coil only when said normally open switchhook contacts are closed, the other winding of said coil shunting said contacts while the impulses are being transmitted.

4. A transmitting station for automatic exchanges including a telephone transmitter and a receiver, an induction coil, an impulse sender including impulse contacts connected with one winding of said induction coil, a hookswitch contact, off-normal means of said sender to operatively remove said transmitter from connection with the impulse transmitting circuit, said transmitting circuit including said hookswitch contact, the other winding of said induction coil shunting said contacts while the impulses are being transmitted.

6. An impulse transmitting station for

automatic exchanges including a telephone receiver, an induction coil, an impulse sender including impulse contacts connected with one winding of said induction coil, the other winding of said induction coil shunting said contacts while impulses are being transmitted and only when said receiver is removed from its switchhook, and off-normal means of said sender to operatively dissociate said receiver from the impulse transmitting circuit.

6. An impulse transmitting station for automatic exchanges connected to a telephone line including an impulse sender, an induction coil having one of its windings connected across said line, another winding of said coil and a condenser connected across said line while impulses are being transmitted, an impulse transmitting contact in a portion of said line in shunt of said second winding, a receiver and transmitter for said station and a switch comprised in said sender for altering the circuits of said receiver and transmitter only when said receiver is removed from its switchhook to permit said switchhook to close normally open contacts in said telephone line.

7. A transmitting station for automatic exchanges including an impulse sender connected to a telephone line, normally open contacts in said line, a substation receiver switchhook for closing said normally open contacts, two windings of an induction coil and a condenser in series connection with a limb of said line, a conductive shunt extending about the condenser and one winding, and the impulse transmitting contact of said sender connected in said shunt only when said normally open contacts are closed by said receiver switchhook.

8. A transmitting station for automatic exchanges including an impulse sender connected to a telephone line, two windings of an induction coil and a condenser in series with a limb of said line, a conductive shunt extending about the condenser and one of said windings, the impulse transmitting contact of said sender connected in said shunt, a transmitter and receiver for said substation and a switch automatically actuated while the sender is working to operatively exclude said transmitter and receiver only when said receiver is removed from its switchhook.

9. A sending station for automatic exchanges including an impulse sender connected to a line and adapted to be traversed by current over said line, a receiver and a transmitter for said station, an impulse contact and means for opening and closing it to transmit the impulses, and an induction coil having its one winding in circuit with said contact and its other winding in shunt circuit of said contact only when said receiver is removed from its switch hook for dis-

charging current by each opening of said contact against the previous current in the line.

10. A sending station for automatic exchanges including an impulse sender connected to a line and adapted to receive current thereover, a receiver and a transmitter for said station, an impulse contact and means for opening and closing it to transmit the impulses, a winding and a condenser connected in a shunt about said contact, a second winding connected with said contact and outside said shunt and adapted on closure of said contact to charge said first winding only when said receiver is removed from its switchhook, the subsequent opening of said contact serving to discharge said first winding against the direction of the previous current in the line.

11. A transmitting station for automatic exchanges including an impulse sender, a telephone transmitter and an off-normal contact closed when the sender is operated to short-circuit it, a telephone receiver and a second off-normal contact, said last contact closed when the sender is operated to short-circuit said receiver only when said receiver is moved from its switchhook, an impulse spring of said sender connected to said first contact, the other impulse spring being in connection with a switchhook contact, another switch hook contact connected to said second off-normal contact and said receiver, an induction coil having a winding connected to the transmitter, a condenser adapted to be connected with said receiver by the operation of the switchhook, the other winding of said induction coil being connected between said hook and said condenser, said switchhook contacts and said off-normal contacts jointly controlling the talking and impulse sending circuits.

12. In a telephone system including a substation provided with impulse sending contacts, a receiver and a transmitter for said substation, an induction coil having its one winding in circuit with said impulse sending contacts and its other winding in shunt circuit of said contacts, said shunt circuit including a switchhook contact, a relay bridged across the line limbs of said telephone system, and means for operating said contacts to open the circuit of said first winding to cause current to be induced in said first winding by said shunt winding to effect a positive snap action of said relay.

13. In a telephone system including a substation provided with impulse contacts, a receiver and a transmitter for said substation, an induction coil having its one winding in circuit with said impulse contacts and the other winding in shunt circuit of said contacts, said shunt circuit including a pair of contacts controlled by the substation switchhook, an impulse relay bridged

across the line limbs of said system, and means for operating said contacts to open the circuit of said first winding to cause current to be induced into said first winding to effect a quick action of said relay.

14. In a telephone system including a substation provided with a circuit breaking device, a receiver and a transmitter for said substation, an induction coil having its one winding in circuit with said device and its other winding in shunt circuit of said device, a relay bridged across the line limbs

of said telephone system, and means for operating said device to affect the windings of said induction coil whereby a quick action of said relay is effected, the impulsing circuit for said relay including a pair of normally opened contacts closed only when said substation is in use.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 18th day of December, 1920.

WILLIAM G. SHULL.