

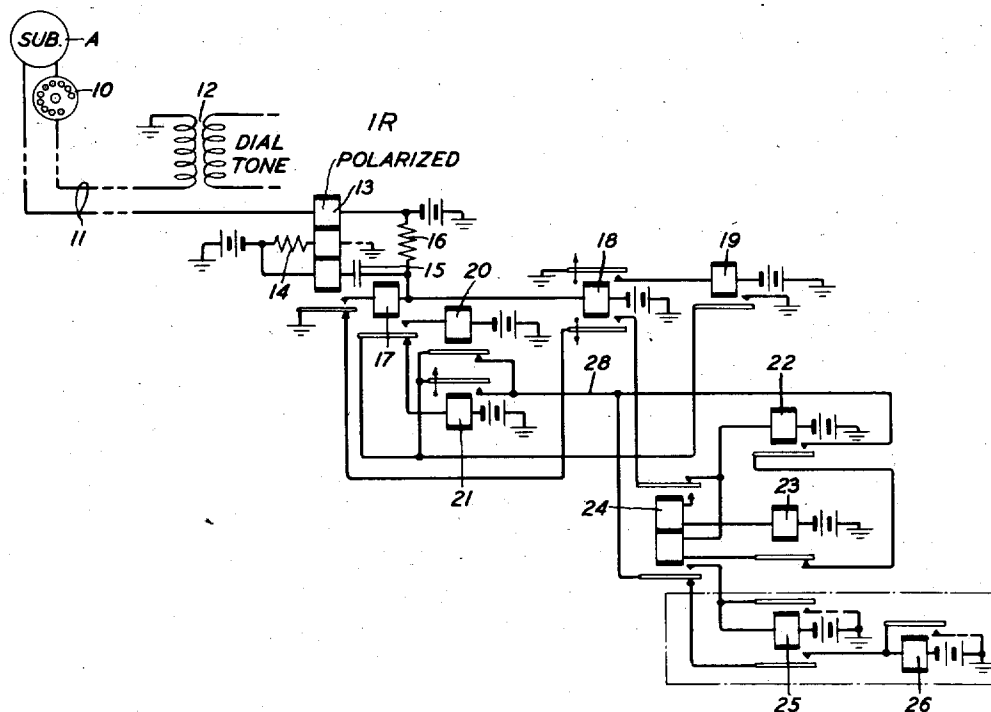
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SIGNALING SYSTEM

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SIGNALING SYSTEM

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This invention relates to signaling systems and particularly to systems comprising electromagnetic signal receiving means.

The object of the invention is to provide a more sensitive electromagnetic signal receiving means and to insure the accurate response of such a means to incoming signals under wider limits of line resistance, line insulation, and line capacity.

In signaling systems in which selective signals are created and transmitted by the alternate opening and closing of a signaling circuit, it is usual to employ an impulse relay for operation upon the closing of the signaling circuit and release in response to the opening of the signaling circuit. In such a system, the lines over which the signaling circuit is closed vary in length, in insulation resistance and in capacity; and the frequency with which the selective impulses are transmitted varies within certain limits.

The present invention is a new and improved circuit arrangement in which the impulse relay is polarized and has a plurality of windings, one winding being connected in combination with a condenser so as to increase the limits of line resistance, line insulation, and line capacity within which the relay will satisfactorily respond to signal impulses.

More specifically this invention is a signal receiving means comprising a polarized signal receiving relay having one winding connected in series with a line and a signal sender, and a second winding connected in series with a condenser and in combination with the windings of an auxiliary signal relay and a slow-to-release relay, the operation of the slow-to-release relay in response to the operation of the signal receiving relay being effective to operatively associate the signal receiving relay with a signal register. When the signal receiving relay operates, a condenser charging circuit is closed through a second winding of the signal receiving relay and the winding of the auxiliary signal relay, the current being effective to hold the signal receiving relay operated for a short interval of time; and when the signal receiving relay releases, the condenser discharges through the second winding of the signal receiving relay and the winding of the slow-to-release relay, the current being effective to hold the signal receiving relay released for a short interval of time.

A better and more complete understanding of the invention may be obtained by considering the specific embodiment of the invention shown in the drawing which forms a part of this specification. The invention is not, however, limited

in its application to this specific arrangement and is, in general, applicable to any signaling system in which selective signals are created by the opening and closing of a signaling circuit.

Referring to the drawing, A represents a subscriber's station in an automatic telephone system and IR represents impulse receiving means.

The apparatus at station A includes a dial 10 or an equivalent impulse sender, and is connected by line 11 to a central office or exchange 10 in which automatic switching equipment is provided for establishing a connection between the line 11 and an idle impulse receiving means IR in response to the removal of receiver at station A to originate a call. The impulse receiving means IR may be used to directly control in succession each of a train of selective switches to complete a desired connection or may be used to operate a register which thereafter controls the various switches through which a desired connection is established. Reference may be had to Chapter III of the second edition of "Automatic Telephony" by Smith and Campbell for a description of an automatic telephone system comprising switches of the well-known Strowger type controlled by the dial impulses when dialed. Reference may be had to Patent No. 1,395,977 granted to F. A. Stearn et al., November 1, 1921 for a description of a system comprising switches of the power-driven panel type which are revertively controlled by a register-controller, set in accordance with trains of impulses created by the operation of the dial at any calling subscriber's station to which the register-controller is connected.

The impulse receiving means IR, shown in the drawing, comprises a polarized impulse receiving relay 13, a condenser 15, auxiliary impulse relays 17 and 20, slow-to-release relays 18 and 21, a set of three impulse distributing relays 22, 23 and 24, and two relays 25 and 26 of an impulse register. The impulse receiving relay 13 has three windings, the upper winding being connected, upon extension of the line 11 to the impulse receiving means IR, in a signaling circuit in series with the conductors of line 11, dial 10 and one winding of a dial tone transformer 12. The middle winding of relay 13 is a biasing winding which, upon extension of a calling line to the impulse receiving means IR, is energized to bias the armature toward the position shown in the drawing. The resistor 14 connected in series with the biasing winding is chosen to afford the desired contact biasing effect. The lower winding of relay 13 is connected in combination with condenser 15 and

the windings of relays 17 and 18 to be effective to aid the complete release of relay 13 as soon as its front contacts are opened and insure the closure of its back contacts for a certain minimum interval of time and to be effective, upon the closing of its front contacts, to insure that these contacts are closed for a certain minimum interval of time. Relay 18 is a slow-to-release relay which operates when relay 13 is operated, upon extension of a calling line to the impulse receiving means IR, and remains operated during the transmission and registering of dial impulses. Relay 19 is auxiliary to relay 18. Relay 21 is a slow-to-release relay which is operated, upon release of relays 13 and 17 in response to the first impulse of each series created by the operation of the dial 10, and remains operated until all of the impulses in the series have been received. The primary function of relay 21 is to distinguish between the end of one series of impulses and the beginning of another so that each series of dial impulses will be directed to the proper registering mechanism. This function is well known in the art, and the contacts of relay 21 necessary for accomplishing this function have been omitted. Relays 22, 23, and 24 constitute a relay combination controlled by the impulse relay 13 for distributing the impulses to the odd and even numbered register relays, only one odd numbered and one even numbered register relay being shown in the drawing.

The closing of the signaling circuit through the upper winding of relay 13, upon extension of line 11 to the impulse receiving means IR, causes the operation of relay 13. The closing of the front contacts of relay 13 causes the operation of the auxiliary impulse relay 17 and the operation of the slow-to-release relay 18. The closing of the front contacts of relay 13 also causes the charging of condenser 15, the charging current being effective to energize the lower winding of relay 13 in a direction which insures that relay 13 remains operated for at least a certain minimum interval of time, although this effect is not needed until dial impulses are being received. The operation of relay 18 causes the operation of relay 19; and, with relays 17 and 19 operated, a circuit is closed for operating relay 20. No further action takes place until the subscriber operates the dial 10.

Upon the opening of the signaling circuit at the dial contacts to transmit the first impulse of a series the upper winding of relay 13 deenergizes; and, as soon as the front contacts of relay 13 are opened, the circuit through the windings of relays 17 and 18 is opened and condenser 15 is discharged through the lower winding of relay 13, the current being in a direction to aid the release of relay 13 and insure that the back contacts of relay 13 are closed for not less than a certain minimum interval of time, which interval is sufficient to cause the operation of relay 22. The circuit for discharging the condenser includes the winding of relay 18 in parallel with the resistor 16, the current being effective to maintain the energization of the winding of relay 18. Resistor 16 being non-inductive hastens the operation of relay 17 when relay 13 operates, and to a certain extent controls the discharge of condenser 15 when relay 13 releases. The circuit for operating relay 22 includes a back contact of relay 24, a front contact of relay 18, and the back contact of relay 13. The release of the auxiliary impulse relay 17 closes a circuit for operating the slow-to-release relay 21 and causes the release of relay

20. As soon as the signaling circuit is again closed at the dial contacts, the upper winding of relay 13 is reenergized and upon the opening of the back contacts of relay 13, relay 24 becomes energized by the current in a circuit from battery through the winding of relay 22, lower winding of relay 24, back contact of relay 23, front contact of relay 22, conductor 28, back contact of relay 20 or front contact of relay 21, to ground at the front contact of relay 19. Relay 24 operates and relay 22 is held operated by the current in this circuit, the operation of relay 24 being effective to cause the operation of the first odd numbered register relay 25; the circuit for operating relay 25 includes the lower front contact of relay 24, conductor 28, back contact of relay 20 or front contact of relay 21, and the front contact of relay 19. Relay 25 closes a locking circuit and operatively connects the winding of the first even numbered register relay 26 to the back contact of relay 24. Upon reoperation of relay 13, the closing of its front contacts is effective to reoperate relay 17 and hold relay 18, relay 18 being slow enough in releasing to remain operated during the response of relay 13 to dial impulses. The closing of the front contacts of relay 13 is also effective to charge condenser 15, the lower winding of relay 13 being energized by the charging current in a direction to insure the closure of its front contacts for a long enough interval of time to reoperate relays 17 and 20 and to reenergize relay 18 to prevent its release during the response of relay 13 to the next succeeding impulse of the series, and to insure the opening of the back contacts of relay 13 for a long enough interval to operate relay 24.

Upon the opening of the signaling circuit at the dial contacts to transmit the second impulse of a series, the upper winding of relay 13 is again deenergized, and as soon as the front contacts of this relay are opened, relays 17 and 20 are released, the winding of relay 21 is reenergized to prevent its release until all of the impulses in the series have been received, and condenser 15 is discharged through the lower winding of relay 13 to insure that this relay will remain released for a long enough interval to register the second impulse. The closing of the back contacts of relay 13 causes the energization of the winding of relay 23 and the upper winding of relay 24 in series to operate relay 23 and hold relay 24 operated. The operation of relay 23 opens the circuit through the winding of relay 22 and lower winding of relay 24, thereby causing the release of relay 22. As soon as the signaling circuit is again closed at the dial contacts, the upper winding of relay 13 is reenergized and upon the opening of the back contacts of this relay, the circuit through the winding of relay 23 is opened to cause the release of relays 23 and 24. The release of relay 24 closes the circuit for operating the first even numbered register relay 26 which thereupon locks and prepares the next register relay (not shown) for operation.

It is apparent that relay 24 is operated in response to each odd numbered impulse of a series to cause the operation of an odd numbered register relay and is released in response to the next succeeding impulse of a series to cause the operation of an even numbered register relay. When all of the impulses in a series have been received, relay 13 remains operated due to the energization of its upper winding, thereby causing the release of relay 21 and preparation of the register for response to the next series of impulses created

by the operation of dial 10. The above described circuit arrangement is one which corrects for too short an opening of the impulse circuit and corrects for too short a closure of the impulse circuit between succeeding impulses of a series.

What is claimed is:

1. In a signaling system, a line, a signal sender, a signal receiving relay, a circuit including said line and sender and one winding of said signal receiving relay, a signal register, an auxiliary signal relay, a slow-to-release relay for operatively connecting the contacts of said signal receiving relay with said register, the auxiliary signal relay and slow-to-release relay being directly controlled by said signal receiving relay, a condenser, and a circuit closed by said signal receiving relay for holding said relay operated for a short interval of time, said holding circuit comprising a second winding of said signal receiving relay, said condenser and the winding of said auxiliary signal relay.

2. In a signaling system, a line, a signal sender, a signal receiving relay, a circuit including said line and sender and one winding of said signal receiving relay, a signal register, an auxiliary signal relay, a slow-to-release relay for operatively connecting the contacts of said signal receiving relay with said register, the auxiliary signal relay and slow-to-release relay being directly controlled by said signal receiving relay, a condenser, and a circuit effective upon release of said signal receiving relay for holding said relay released for a short interval of time, said last-mentioned circuit comprising a second winding of the signal receiving relay, said condenser and the winding of the slow-to-release relay.

3. In a signaling system, a line, a signal sender, a signal receiving relay, a circuit including said line and sender and one winding of said relay, a signal register, an auxiliary signal relay, a slow-to-release relay for operatively connecting the contacts of said signal receiving relay with said register, the operation of said auxiliary and slow-to-release relays being directly controlled by said signal receiving relay, a condenser, a circuit closed by said signal receiving relay for holding said relay operated for a short interval of time, said holding circuit comprising a second winding of said signal receiving relay, said condenser and the winding of said auxiliary relay, and a circuit effective upon release of said signal receiving relay for holding said relay released for a short interval of time, said last-mentioned circuit comprising said second winding of the signal receiving relay, said condenser and the winding of said slow-to-release relay.

4. In a signaling system, a line, a signal sender, an impulse relay having one winding connected in series with said line and sender, an impulse register, a slow-to-release relay for operatively connecting contacts of said impulse relay to said register, a circuit closed by contacts of said impulse relay for operating said slow-to-release relay, a condenser, a circuit closed by the operation of said impulse relay through a second wind-

ing of the impulse relay for charging said condenser, the charging current being effective to hold the impulse relay operated for a short interval of time, and a circuit including said second winding of the impulse relay and the winding of said slow-to-release relay for discharging said condenser, said last-mentioned circuit being rendered effective by the release of said impulse relay to hold said impulse relay released for a short interval of time.

5. In a signaling system, a line, a signal sender, an impulse relay having one winding connected in series with said line and sender, an impulse register, a slow-to-release relay for operatively connecting contacts of said impulse relay to said register, a circuit closed by contacts of said impulse relay for operating said slow-to-release relay, a condenser, and a circuit closed by the operation of said impulse relay through a second winding of the impulse relay for charging said condenser, the charging current being effective to hold the impulse relay operated for a short interval of time.

6. In a signaling system, a line, a signal sender, an impulse relay having one winding connected in series with said line and sender, an impulse register, a slow-to-release relay for operatively connecting contacts of said impulse relay to said register, a circuit closed by contacts of said impulse relay for operating said slow-to-release relay, a condenser, a circuit closed by the operation of said impulse relay through a second winding of the impulse relay for charging said condenser, the charging current being effective to hold the impulse relay operated for a short interval of time, and a circuit including said second winding of the impulse relay and the winding of said slow-to-release relay for discharging said condenser, said last-mentioned circuit being rendered effective by the opening of the front contacts of the impulse relay to aid the complete release of the impulse relay.

7. In a signaling system, a line, a signal sender, an impulse relay having one winding connected in series with said line and sender, an impulse register, a slow-to-release relay for operatively connecting contacts of said impulse relay to said register, a circuit closed by contacts of said impulse relay for operating said slow-to-release relay, a condenser, a circuit closed by the operation of said impulse relay through a second winding of the impulse relay for charging said condenser, the charging current being effective to hold the impulse relay operated for a short interval of time, and a circuit including said second winding of the impulse relay and the winding of said slow-to-release relay for discharging said condenser, said last-mentioned circuit being rendered effective by the opening of the front contacts of the impulse relay to aid the complete release of the impulse relay and to maintain the energization of the winding of the slow-to-release relay.

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