

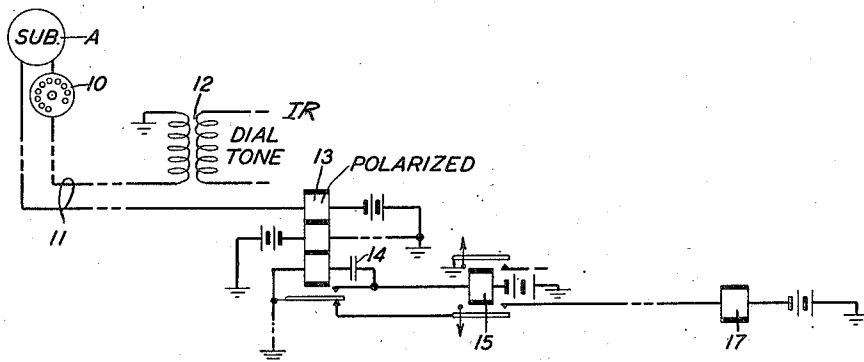
Feb. 16, 1937.

L. H. JOHNSON

2,071,072

SIGNALING SYSTEM

Filed April 27, 1935



INVENTOR
L. H. JOHNSON
BY *M. P. McFenney*
ATTORNEY

UNITED STATES PATENT OFFICE

2,071,072

SIGNALING SYSTEM

Lewis H. Johnson, Madison, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application April 27, 1935, Serial No. 18,507

19 Claims. (Cl. 179—16)

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 and to insure the response of the selective device which is to be set in accordance with the impulses received.

One feature of the invention is a signal receiving means comprising a polarized signal receiving relay having one winding connected in series with a line, for responding to signals constituting the opening and closing of the line by a signal sender, and a second winding connected in series with a condenser and in combination with the winding of a slow-to-release auxiliary relay which operatively associates the signal receiving relay with a signal register. When the signal receiving relay releases, the condenser is charged through the winding of the auxiliary relay and a winding of the signal receiving relay, the charging current being effective to hold the signal receiving relay released for a short interval of time; and when the signal receiving relay operates, the condenser is discharged through the winding of the signal receiving relay, the current being effective to hold the signal receiving relay operated for a short interval of time. The condenser charging current also helps to hold the auxiliary relay operated during the time that the signal receiving relay is released. The contact springs of the polarized signal receiving relay are preferably held in normal position by a biasing winding. A biasing

spring may, however, be used in place of the biasing winding.

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 or an equivalent impulse sender, and is connected by line 11 to a central office or exchange 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 the 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 comprises a polarized impulse receiving relay 13, a condenser 14, a slow-to-release relay 15, and a register or selector 17. The impulse 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, the contacts of dial 10 at the subscriber's station, and in series with one winding of the dial tone transformer 12. The middle winding of relay 13 is a biasing winding for holding its contacts in the position shown in the drawing when the upper winding is deenergized, the biasing circuit being closed upon ex-

tension of a calling line to the impulse receiving means IR. The lower winding of relay 13 is connected in combination with the condenser 14 and slow-to-release relay 15 so as to insure the closure of the front contacts of relay 13, in response to the closing of the signaling circuit between two successive dial impulses, for a long enough interval to prevent the release of relay 15 and allow time for the response of the register or selector.

Upon extension of the line 11 to the impulse receiving means IR, ground is connected to the armature and lower winding of relay 13 thus closing a charging circuit for condenser 14 through the lower winding of relay 13 and the winding of relay 15, the current in this circuit being of no utility at this time. The operation of relay 13, upon the closing of the aforementioned signaling circuit, closes a circuit for operating relay 15 and a circuit through the lower winding of relay 13 for discharging condenser 14. The current through the lower winding of relay 13 is in a direction to insure the closure of its front contacts for at least a certain minimum interval of time; this current is however of no particular utility at this time. No further action occurs until the subscriber at station A operates the dial 10.

Upon the opening of the signaling circuit at the contacts of dial 10 to transmit the first impulse of a series, relay 13 begins to release, the opening of its front contacts causing the charging of condenser 14 through the lower winding of relay 13 and the winding of relay 15. The charging current helps relay 15 to remain operated while relay 13 is released and is in such a direction through the lower winding of relay 13 as to aid its complete release and insure the back contacts of relay 13 remaining closed for an interval of time sufficient to cause the operation of the register, or selector, magnet 17 in response to the dial impulse. When the signaling circuit is again closed at the contacts of dial 10, and the condenser charging current has ceased, relay 13 reoperates to again close the circuit for energizing relay 15 and to open the circuit for operating magnet 17. The closing of the front contacts of relay 13 again causes the discharge of condenser 14 through the lower winding of relay 13, the current through this winding being in a direction to insure that the front contacts of relay 13 remain closed for an interval sufficient to permit the functioning of the register or selector 17 between succeeding impulses of a series.

Due to the effect of the current in the circuits for charging and discharging the condenser, the above described arrangement is one which corrects for too short an opening of the impulse circuit and which corrects for too short a closure of the impulse circuit between succeeding impulses of a series. The arrangement is also one which does not require the use of an auxiliary impulse relay in addition to the usual slow-to-release relay for controlling the register, or selector, operating circuit, the slow-to-release relay being connected so as to cooperate with the condenser 14 and lower winding of relay 13 to insure the accurate operation of the register in response to dial impulses.

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 a winding of said signal receiving relay, an auxiliary relay, a circuit closed by said signal receiving relay for operating said

auxiliary relay, a condenser, and a circuit closed by said signal receiving relay for preventing the release of said signal receiving relay for a short interval of time, said last-mentioned circuit including said condenser and excluding the winding of said auxiliary relay.

2. In a signaling system, a line, a signal sender, a signal receiving relay, a circuit including said line and sender and a winding of said signal receiving relay, an auxiliary relay, a circuit closed by said signal receiving relay for operating said auxiliary relay, a condenser, and a circuit for preventing the reoperation of said signal receiving relay for a short interval of time, said last-mentioned circuit including said condenser and the winding of said auxiliary relay.

3. In a signaling system, a line, a signal sender for said line, a signal receiving relay, a circuit including said line and sender and one winding of said signal receiving relay, a register, an auxiliary relay for operatively connecting the contacts of said signal receiving relay with said register, a circuit closed by said signal receiving relay for operating said auxiliary relay, a condenser, and a circuit including said condenser and excluding the winding of said auxiliary relay and closed by said signal receiving relay for preventing the release of said signal receiving relay for a short interval of time.

4. In a signaling system, a line, a signal sender for said line, a signal receiving relay, a circuit including said line and sender and one winding of said signal receiving relay, a register, an auxiliary relay for operatively connecting the contacts of said signal receiving relay with said register, a circuit closed by said signal receiving relay for operating said auxiliary relay, a condenser, and a circuit including said condenser and including the winding of said auxiliary relay for preventing the reoperation of said signal receiving relay for a short interval of time.

5. 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, an auxiliary slow-to-release relay, a condenser, and a circuit including said condenser, the winding of said auxiliary relay and another winding of said signal receiving relay, the second of the aforementioned circuits being rendered effective upon release of said signal receiving relay to prevent its reoperation for a short interval of time.

6. 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, an auxiliary slow-to-release relay, a condenser, a circuit closed by the front contacts of said impulse receiving relay for operating said auxiliary relay, and a circuit rendered effective upon the opening of the front contacts of said impulse receiving relay for insuring the closing of the back contacts of said impulse receiving relay for not less than a certain minimum interval of time and for helping said auxiliary relay to remain operated.

7. 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, an auxiliary slow-to-release relay, a condenser, a circuit closed by the front contacts of said impulse receiving relay for operating said auxiliary relay, and a circuit rendered effective upon the opening of the front contacts of said impulse receiving relay in response to an impulse from said sender for insuring the closing of the

back contacts of said impulse receiving relay for not less than a certain minimum interval of time and for helping said auxiliary relay to remain operated between succeeding impulses created by the operation of said sender.

8. In a signaling system, a line, a signal sender for said line, a signal receiving relay, a circuit including said line and sender and one winding of said signal receiving relay, a register, an auxiliary relay for operatively connecting the contacts of said signal receiving relay with said register, a circuit closed by said signal receiving relay for operating said auxiliary relay, a condenser, a circuit including said condenser and excluding the winding of said auxiliary relay and closed by said signal receiving relay for preventing the release of said signal receiving relay for a short interval of time, and a circuit including said condenser and the winding of said auxiliary relay rendered effective upon release of said signal receiving relay for preventing the reoperation of said signal receiving relay for a short interval of time.

9. In a signaling system, a line, an impulse relay, means for closing a signaling circuit over said line to operate said relay, a dial for transmitting impulses over said line, each impulse being effective to cause the release of said relay, a register, an auxiliary relay, a circuit closed by the operation of said impulse relay for operating said auxiliary relay, a circuit including front contacts of said auxiliary relay closed by the release of said impulse relay in response to a dial impulse for operating said register, a condenser, and a circuit including said condenser and a winding of said impulse relay and the winding of said auxiliary relay for insuring the closing of the circuit for operating said register for a long enough interval to operate said register in response to each impulse in a series created by the operation of said dial.

10. In a signaling system, a line, an impulse relay, means for closing a signaling circuit over said line to operate said relay, a dial for transmitting impulses over said line, each impulse being effective to cause the release of said relay, a register, an auxiliary relay, a circuit closed by the operation of said impulse relay for operating said auxiliary relay, a circuit including front contacts of said auxiliary relay closed by the release of said impulse relay in response to a dial impulse for operating said register, a condenser, and a circuit including said condenser and a winding of said impulse relay but excluding the winding of said auxiliary relay for insuring that said impulse relay remains operated for a long enough interval between succeeding impulses of a series to prepare said register for response to the next impulse.

11. In a signaling system, a line, an impulse relay, means for closing a signaling circuit over said line to operate said relay, a dial for transmitting impulses over said line, each impulse being effective to cause the release of said relay, a register, an auxiliary relay, a circuit closed by the operation of said impulse relay for operating said auxiliary relay, a circuit including front contacts of said auxiliary relay closed by the release of said impulse relay in response to a dial impulse for operating said register, a condenser, a circuit including said condenser and a winding of said impulse relay and the winding of said auxiliary relay for insuring the closing of the circuit for operating said register for a long enough interval to operate said register in response to each impulse in a series created by the operation of

said dial, and a circuit including said condenser and a winding of said impulse relay but excluding the winding of said auxiliary relay for insuring that said impulse relay remain operated for a long enough interval between succeeding impulses of a series to prepare said register for response to the next impulse.

12. In a signaling system, a line, an impulse sender for transmitting impulses over said line, an impulse relay having one winding connected in series with said line for responding to impulses created by the operation of said sender, an impulse register, a slow-to-release relay for operatively connecting contacts of said impulse relay to said register, a condenser, a circuit including the winding of said slow-to-release relay and another winding of said impulse relay for charging said condenser, and a circuit including said other winding of the impulse relay closed by the operation of said impulse relay for discharging said condenser, the current in said discharge circuit being effective to hold said impulse relay operated for a short interval of time.

13. 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 the contacts of said impulse relay to said register, a circuit closed by the operation 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 said impulse relay and said condenser for holding said impulse relay operated for a short interval of time, and a circuit through the winding of said slow-to-release relay and said condenser and said second winding of the impulse relay for holding said impulse relay released for a short interval of time.

14. In a signaling system, a line, a signal sender for said line, a signal receiving relay, a circuit including said line and sender and one winding of said signal receiving relay, a register, a slow-to-release relay for operatively connecting the contacts of said signal receiving relay with said register, a circuit closed by said signal receiving relay for operating said slow-to-release relay, a condenser, a circuit including said condenser and excluding the winding of said slow-to-release relay and closed by said signal receiving relay for preventing the release of said signal receiving relay for a short interval of time, and a circuit including said condenser and rendered effective upon release of said signal receiving relay for preventing the reoperation of said signal receiving relay and continuing the energization of said slow-to-release relay for a short interval of time after the release of said signal receiving relay.

15. 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 the contacts of said impulse relay to said register, a circuit closed by the operation 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 said impulse relay and said condenser for holding said impulse relay operated for a short interval of time, and a circuit through the winding of said slow-to-release relay and said condenser and said second winding of the impulse relay for holding said impulse relay released for a short interval of time and for

continuing the energization of said slow-to-release relay for a short interval after the release of said signal receiving relay.

16. In a signaling system, a line, an impulse sender for transmitting impulses over said line, an impulse relay having one winding connected in series with said line for responding to impulses created by the operation of said sender, an impulse register, a slow-to-release relay for operatively connecting contacts of said impulse relay to said register, a condenser, a circuit including the winding of said slow-to-release relay and another winding of said impulse relay for charging said condenser.

17. In a signaling system, a line, an impulse sender for transmitting impulses over said line, an impulse relay having one winding connected in series with said line for responding to impulses created by the operation of said sender, an impulse register, a slow-to-release relay for operatively connecting contacts of said impulse relay to said register, a condenser, and a circuit including another winding of the impulse relay closed by the operation of said impulse relay for discharging said condenser.

18. In a signaling system, a line, an impulse sender for transmitting impulses over said line, an impulse relay having one winding connected in series with said line for responding to impulses created by the operation of said sender, an impulse register, a slow-to-release relay for operatively connecting contacts of said impulse relay to said register, a condenser, a circuit including

the winding of said slow-to-release relay and another winding of said impulse relay for charging said condenser, and a circuit including said other winding of the impulse relay closed by the operation of said impulse relay for discharging said condenser, the current in said discharge circuit being effective to hold said impulse relay operated for a short interval of time, and the current in said charging circuit being effective to hold said impulse relay released for a short interval of time.

19. In a signaling system, a line, an impulse sender for transmitting impulses over said line, an impulse relay having one winding connected in series with said line for responding to impulses created by the operation of said sender, an impulse register, a slow-to-release relay for operatively connecting contacts of said impulse relay to said register, a condenser, a circuit including the winding of said slow-to-release relay and another winding of said impulse relay for charging said condenser, the current in said charging circuit being effective to hold said impulse relay released and continue the energization of said slow-to-release relay for a short interval of time, and a circuit including said other winding of the impulse relay closed by the operation of said impulse relay for discharging said condenser, the current in said discharge circuit being effective to hold said impulse relay operated for a short interval of time.

LEWIS H. JOHNSON.