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SIGNALING SYSTEM

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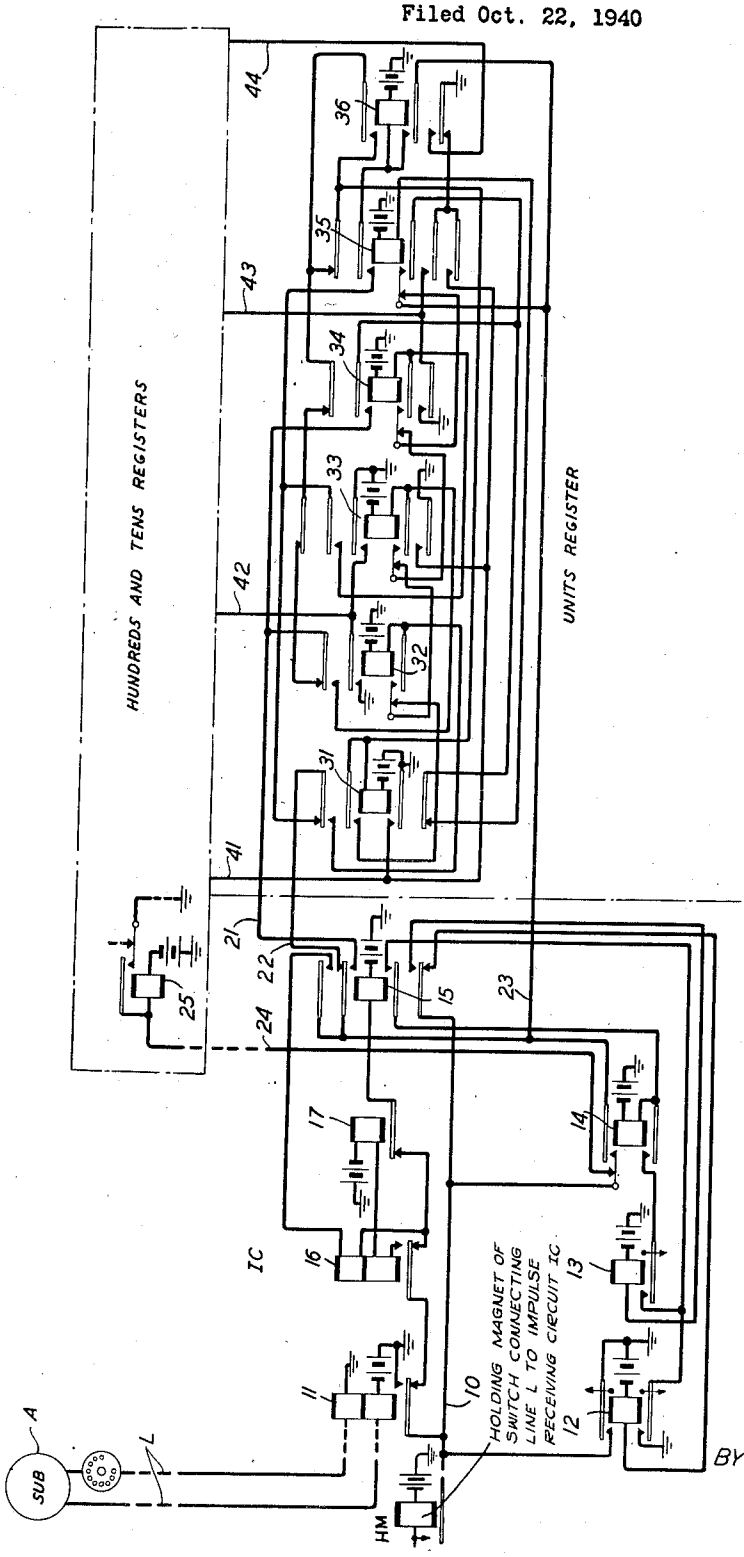

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SIGNALING SYSTEM

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This invention relates to telephone systems and particularly to systems comprising impulse controlled switching mechanism for establishing connections between calling and called lines.

Objects of the invention are the simplification and improvement of impulse receiving and registering means in automatic telephone systems.

In automatic telephone systems, dials or other impulse senders are provided at subscribers' stations for controlling the operation of the switching mechanism through which desired connections are established. The dial impulses may directly control the various switching devices or may be registered in a common control apparatus which in turn controls the operation of the various switching devices. This invention is concerned with a system of the latter type and particularly with means for receiving and registering trains of impulses.

One feature of the invention is an impulse receiving circuit arrangement in which an impulse receiving relay controls the operation of auxiliary relays to effect the operation of impulse counting relays, odd-numbered counting relays being operated over one conductor at the beginning of odd-numbered impulses and even-numbered counting relays being operated over another conductor at the beginning of even-numbered impulses, a slow-to-release holding relay being provided to hold the connection between the impulse relay and the line over which impulses are being received, transfer of the contacts of the counting relays from one set of register relays to another set of register relays being controlled by two register advance relays, one of which is a slow-to-release relay, the holding relay remaining operated and the register advance relays being released at the end of each even-numbered train of impulses and the holding relay being momentarily released at the end of each odd-numbered train of impulses to effect the release of the register advance relays, the impulse relay being effective to maintain the connection between the line and the impulse relay while the holding relay is released between trains of impulses.

Another feature of the invention is an impulse receiving and counting arrangement in which a slow-to-release relay is provided for holding the connection between the impulse relay and the line over which impulses are being received and in which means comprising a slow-to-release relay are provided for effecting the registration of a plurality of trains of impulses in succession, the arrangement being such that the slow-to-release holding relay and the slow-to-release register advance relay are held operated independent of the percentage of the time that the impulse relay is released during response to a train of dial impulses.

A clear and complete understanding of the invention will be facilitated by considering a system and impulse circuit arrangement arranged in accordance with its features, one such system and circuit arrangement being shown schematically in the drawing which forms a part of this specification. The invention is not limited in its application to the specific arrangement shown and is generally applicable to the receiving and registering of trains of impulses.

The drawing consists of a single figure, in which a telephone system is represented schematically by a subscriber's station A and line L connected to an impulse receiving circuit arrangement IC, and hundreds, tens and units registers.

The impulse receiving circuit arrangement IC comprises an impulse relay 11, a slow-to-release holding relay 12, a slow-to-release register advance relay 13, an auxiliary register advance relay 14, and relays 15, 16 and 17 for repeating the impulses to the relays of the units register. The units register comprises relays 31 to 36, inclusive, which are used first as counting relays to set the hundreds and tens registers responsive to the first two trains of impulses incoming to relay 11. Reference may be had to Patent No. 2,244,004 granted June 3, 1941, to E. L. Erwin, for a complete disclosure of means and the manner of connecting a subscriber's line to the impulse receiving circuit, the hundreds, tens and units registers, switching mechanism for establishing connections between calling and called lines, and means controlling the switching mechanism in accordance with the setting of the registers. The impulse relay 11 corresponds to relay 1301 of the Erwin patent; the holding conductor 10 and holding magnet HM correspond to conductor LK and holding magnet 860 of the Erwin patent; the units register relays 31, 32, 33, 34, 35 and 36 correspond to relays 1200, 1201, 1202, 1205, 1204 and 1203 of the Erwin patent; and relay 25 corresponds to relay 1102 of the Erwin patent.

Upon connection of the line L to the impulse relay 11 responsive to the initiation of a call at station A, relay 11 is operated. Relay 11 connects ground potential to conductor 10 to maintain the connection between the line L and relay 11 and to operate the holding relay 12. The circuit for operating relay 12 includes the lower back contact of relay 15. Relay 25 is not normally

connected to conductor 24 so that the aforementioned connection of ground to conductor 10 does not effect the operation of relay 25. At its upper front contact, relay 12 connects ground to conductor 10 so that relay 12 locks independent of relay 11, under the control of relay 15. When the calling subscriber dials the first digit of the number of the subscriber's station with which connection is desired, relay 11 is alternately released and reoperated as many times as there are units in the digit dialed. The release of relay 11 in response to the first impulse closes a circuit for operating relay 15. This circuit includes back contacts of relays 17, 16 and 11, conductor 10, and the upper front contact of relay 12. Relay 15 opens the locking circuit of relay 12, and closes circuits, each including front contacts of relays 15 and 12, for operating relays 13 and 14. Being slow in releasing, relay 12 does not release while relay 11 is responding to a train of dial impulses. Relay 14 locks under control of relays 13 and 12, independent of relay 15, and connects ground at the upper front contact of relay 12, through conductor 10 and the upper front contact of relay 14, to conductor 23. The operation of relays 15 and 14 further connects this ground to conductor 21 to operate relay 31 of the units register, the winding of relay 31 being connected through back contacts of relays 35, 34, 33 and 32 to conductor 21. Relay 31 locks under control of relays 32, 33, 34 and 35 to ground on conductor 23. When relay 11 reoperates at the end of the first impulse incoming over line L, it maintains the connection of ground to conductor 10, and opens the operating circuit of relay 15. After relay 11 reoperates, relay 15 is locked operated in series with the upper winding of relay 16, under the control of relays 17 and 14 to grounded conductor 10. Relay 16 is thereby operatively energized. When relay 11 releases in response to a second impulse of a train, it closes a circuit for operatively energizing the winding of relay 17 in series with the lower, locking winding and front contact of relay 16. The operation of relay 17 causes the release of relay 15, ground being thereby disconnected from conductor 21 and connected to conductor 22, thence through a front contact of relay 31, to operate relay 32. Relay 32 locks under control of relays 33, 34 and 35 to conductor 23 and causes the release of relay 31. The release of relay 15 opens the operating circuits of relays 13 and 14. Since relay 13 is slow in releasing, relays 13 and 14 do not release during the response of relay 11 to a train of dial impulses. When relay 11 reoperates at the end of the second impulse, it reconnects ground to conductor 10 and opens the circuit for operating relay 17 and holding relay 16, thereby causing the release of relays 16 and 17. The release of relay 11 in response to each succeeding odd-numbered impulse of the train causes the connection of ground to conductor 21 to operate an odd-numbered counting relay and the release of relay 11 in response to each succeeding even-numbered impulse of a train causes the connection of ground to conductor 22 to operate an even-numbered counting relay. The operation of each of counting relays 32, 33, 34 and 35 effects the release of the preceding counting relay. Relay 36 is operated by the sixth impulse of a digit and locks to conductor 23 to connect relays 31, 32, 33 and 34 for operation by the seventh, eighth, ninth and tenth impulses of a train. When relay 11 remains energized after the last impulse of the train, relay 15 will be operated if there was an odd number of impulses in the train and will be normal if there was an even number of impulses in the train. If at the end of a train of impulses, relay 15 is operated, the continued operation of relay 15 causes the release of relay 12; the release of relay 12 causes the release of relay 14; the release of relay 14 causes the release of relays 15 and 16; and the release of relay 15 causes the release of relay 13 and the reoperation of relay 12. While relay 12 is released, relay 11 connects ground to conductor 10 to maintain the connection between line L and relay 11. If at the end of a train of impulses relay 15 is normal, relay 13 releases; and the release of relay 13 causes the release of relay 14. In either case, the release of relay 14 disconnects ground from conductor 23 to release the operated counting relays and connects ground to conductor 24 to operate relay 25 and thereby transfer conductors 41, 42, 43 and 44 from the hundreds register to the tens register as explained in detail in the aforementioned patent of E. L. Erwin.

When relay 11 releases in response to the first impulse of the next train, it causes the reoperation of relay 15; and relay 15 causes the reoperation of relays 13 and 14, the operation of relay 14 being effective to again connect ground potential to conductor 23. The second train of impulses is temporarily registered on the counting relays 31 to 35 and transferred to the tens register, the third train of impulses being registered on the counting relays, which remain operated to function as the units register in controlling the completion of the desired connection as described in detail in the aforementioned patent of E. L. Erwin.

It is apparent from the foregoing description that the impulse receiving, holding and register advance functions are performed with ordinary relays, only two of which are slow in releasing; and that each of these slow-to-release relays is designed to remain operated for an interval somewhat longer than one impulse cycle at the lowest allowable dial speed, the relative length of the open and closed periods of an impulse cycle having no effect on the holding of these relays.

What is claimed is:

1. In an impulse receiver for responding to trains of impulses and repeating the impulses to an impulse register, an impulse relay connected to a line over which trains of impulses are transmitted, a holding conductor, said impulse relay having a contact for connecting a holding potential to said conductor to maintain the connection between said line and relay while the relay is operated, a slow-to-release holding relay, a circuit closed by the operation of said impulse relay upon connection of said line and impulse relay for operating said slow-to-release holding relay, said holding relay having a contact for connecting holding potential to said conductor to maintain the connection between said line and impulse relay while the impulse relay is responding to impulses, relay means controlled by said impulse relay for repeating trains of impulses to an impulse register, means including another slow-to-release relay for indicating the end of each train of impulses, a holding circuit for said holding relay closed by said impulse repeating means during each even-numbered impulse cycle and opened by said impulse repeating means during each odd-numbered impulse cycle of a train of impulses, and a circuit for operating said other slow-to-release relay closed by said impulse

repeating means during each odd-numbered impulse cycle and opened by said impulse repeating means during each even-numbered impulse cycle of a train of impulses.

2. In the combination of an impulse receiver and an impulse register adapted to register a plurality of trains of impulses in succession, an impulse receiving relay for responding to each incoming impulse, means comprising an impulse repeating relay and two impulse conductors for repeating the impulses received by said impulse receiving relay to said register, the odd-numbered impulses in a train being repeated over one of said conductors and the even-numbered impulses being repeated over the other of said conductors, means for operating said repeating relay responsive to the beginning of each odd-numbered impulse and for releasing said repeating relay responsive to the beginning of each even-numbered impulse of a train of impulses incoming to said impulse receiving relay, a first slow-to-release relay, a second slow-to-release relay, a circuit including a back contact of said repeating relay and a front contact of said receiving relay for operating said first slow-to-release relay, a circuit closed by each operation of said repeating relay for energizing said second slow-to-release relay to operate said second slow-to-release relay responsive to the first incoming impulse and hold said second relay operated until after the last impulse of a train has been repeated to said register, a circuit closed by each release of said repeating relay for energizing said first slow-to-release relay to hold said first slow-to-release relay during the repeating of a train of impulses to the register, and means controlled by said slow-to-release relays and said repeating relay for indicating to said register the end of each train of impulses.

3. In an impulse receiver for connection to a line over which trains of impulses are transmitted, an impulse receiving relay, a holding conductor for maintaining connections with a line, the operation of said impulse relay being effective to connect a holding potential to said conductor, relay means controlled by said impulse relay to repeat impulses to an impulse register, a slow-to-release holding relay for connecting holding potential to said conductor while said impulse relay is released during response to impulses, means comprising another slow-to-release relay for indicating to the impulse register the end of each train of impulses, a circuit controlled by said impulse repeating means for energizing said holding relay, and a circuit controlled by said impulse repeating means for energizing said other slow-to-release relay, each of said circuits being unaffected by a variation in the percentage of an impulse cycle during which the impulse relay is released.

4. In an impulse received for responding to trains of impulses and repeating the impulses to an impulse register, an impulse relay connected to a line over which trains of impulses are transmitted, means including a holding conductor for maintaining the connection between said line and relay, said impulse relay having a contact for connecting a holding potential to said conductor to maintain the connection between said line and relay while the relay is operated, a slow-to-release holding relay, a circuit closed by the operation of said impulse relay upon connection of said line and impulse relay for operating said slow-to-release holding relay, said holding relay having a contact for connecting holding potential to said conductor to maintain the connection between said line and impulse relay while the impulse relay is responding to impulses, relay means controlled by said impulse relay for repeating trains of impulses to an impulse register, means including another slow-to-release relay for indicating the end of each train of impulses, a holding circuit for said holding relay closed by said impulse repeating means during each even-numbered impulse cycle and opened by said impulse repeating means during each odd-numbered impulse cycle of a train of impulses, and a circuit for operating said other slow-to-release relay closed by said impulse repeating means during each odd-numbered impulse cycle and opened by said impulse repeating means during each even-numbered impulse cycle of a train of impulses.

5. In an impulse receiver for connection to a line over which trains of impulses are transmitted, an impulse receiving relay, means including a holding conductor for maintaining connection with a line, the operation of said impulse relay being effective to connect a holding potential to said conductor, relay means controlled by said impulse relay to repeat impulses to an impulse register, a slow-to-release holding relay for connecting holding potential to said conductor while said impulse relay is released during response to impulses, means comprising another slow-to-release relay for indicating to the impulse register the end of each train of impulses, a circuit controlled by said impulse repeating means for energizing said holding relay, and a circuit controlled by said impulse repeating means for energizing said other slow-to-release relay, each of said circuits being unaffected by a variation in the percentage of an impulse cycle during which the impulse relay is released.

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