

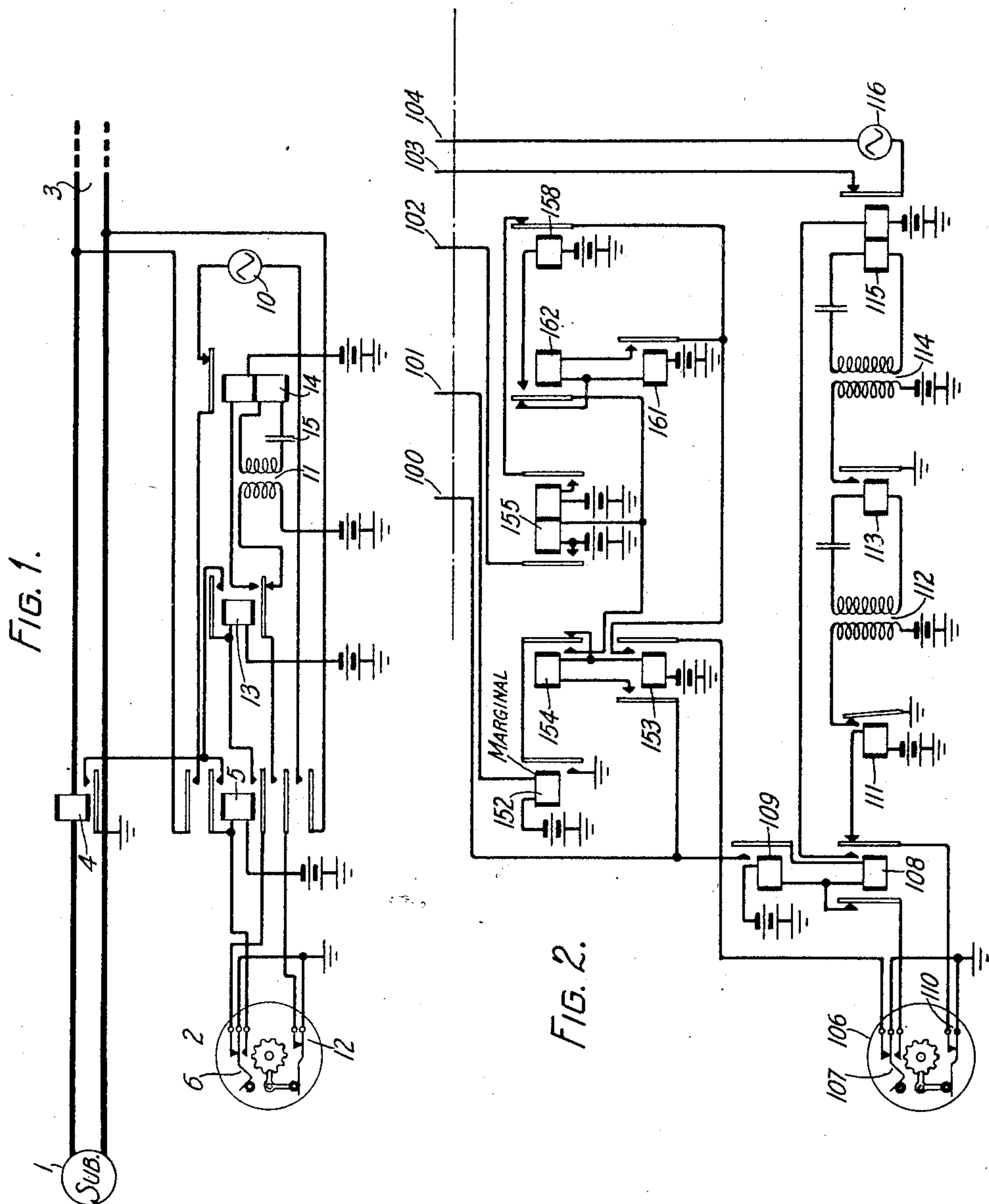
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM

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This invention relates to telephone systems and particularly to improvements in the control of automatic switches over transmission lines.

5 Its object is to simplify the equipment used at one end of a transmission line for conditioning and controlling switching apparatus at the other end of the line.

Heretofore various arrangements have been proposed, such as operators' keys and inter-
10 rupters for sending preliminary signals over a toll line to condition switches at the distant end for the reception of switch operating impulses.

15 According to the present invention these devices are eliminated and an impulse transmitter provided which, on its first operation, sends impulses over the line at a rate differing from the rate of interruption of the impulse
20 contacts to condition the switches at the distant end and which, on subsequent operations, sends impulses at the same rate at which said contacts are interrupted to selectively operate the switches. Where the line is equipped with
25 repeaters or other devices which interfere with the transmission of direct current, a source of relatively high frequency alternating current is used to supply the impulses sent over the line by said impulse transmitter.

30 The invention has been illustrated in the accompanying drawing in which:

Fig. 1 shows it applied to a circuit arrangement at a subscriber's station and in which;

25 Fig. 2 shows it applied to a circuit arrangement at an operator's position.

The operation of the systems shown in these two figures will now be described in detail. In Fig. 1, 1 indicates the usual subscriber's telephone set, 2 a subscriber's dial and 3 a
40 subscriber's line. This line may terminate at an automatic office in switching equipments thereat for establishing connections to wanted subscribers' lines. The equipment at the automatic office may be such that a wanted sub-
45 scriber's line is selected by means of high frequency alternating current impulses along the general character of the system disclosed in my Patent No. 1,573,991, issued February 23, 1926. In this patent a preliminary impulse
50 of high frequency current of 1000 cycles per

second interrupted forty times per second prepares the switching equipment for the reception of and control by regular dialing impulses representing the wanted subscriber's number. The dialing impulses consist of high
55 frequency alternating current of 1000 cycles per second. It should be understood that in Fig. 1 the preliminary impulse for preparing the automatic equipment at the central office may comprise an impulse of 1000 cycle cur-
60 rent interrupted at a rate of twenty interruptions per second and that the system described in the above mentioned patent may readily be modified to respond to such preliminary impulse. As the automatic equipment at the
65 central office does not form any part of this invention, it has not been shown or described. However, in Fig. 2 an arrangement has been shown for the operator at the central office that may actually be substituted for the oper-
70 ator's equipment shown in this patent to dial the preliminary impulse of 1000 cycle current interrupted the forty times per second rate.

Referring now particularly to Fig. 1, to transmit the preliminary impulse and dial the
75 number of the wanted subscriber, the subscriber of set 1; first, lifts his receiver from the hook which causes the operation of the relay 4 through the closure of the subscriber's loop to the central office in a manner well
80 known in the art; second, he actuates dial 2 for a complete revolution and then operates it in accordance with the digits of the wanted subscriber's number. The first operation of the dial in this manner causes the operation
85 of relay 5 on the movement of the dial from normal. The circuit for the operation of relay 5 may be traced from battery, through the winding of relay 5, the operated contacts of off-normal contact 6 to ground. Relay 5 in
90 operating closes a locking circuit for itself from battery through its winding and upper inner armature and front contact to ground at the armature and front contact of relay 4. Relay 5 in operating also connects the 1000
95 cycle alternating current source at 10 across the tip and ring conductors of line 3 at the upper and lower outer armatures and front contacts of this relay.

Another circuit closed by relay 5 is as fol- 100

lows: battery, left hand winding of the transformer 11, lower armature and back contact of relay 13, lower middle armature and front contact of relay 5, through the pulsing contacts of dial 2 to ground. During the return movement to normal, these pulsing contacts 12 are operated in the usual manner causing the current through the primary winding of transformer 11 to be interrupted at the rate of approximately ten times per second. Current of approximately ten cycles per second will therefore be induced in the secondary winding of transformer 11 and through the relay 14. Inasmuch as relay 14 is not polarized it will operate on both halves of the wave from the circuit through its lower winding, right hand winding of transformer 11 and condenser 15. Consequently, relay 14 will operate at twice the rate of operation of the pulsing contacts 12, or twenty times per second. This relay will therefore interrupt the application of current from the 1000 cycle source 10 applied across the conductors of line 3 twenty times per second. This preliminary impulse of 1000 cycle current interrupted at twenty times per second prepares the switches at the central office as hereinbefore mentioned.

When the dial returns to normal after the first operation, it closes a circuit for the operation of relay 13 as follows: battery, winding of relay 13, inner lower armature and front contact of relay 5, upper normally closed contacts of the off-normal contacts 6 to ground. Relay 13 closes a locking circuit for itself as follows: from battery through the winding and upper armature and front contact of relay 13 to ground at the armature and front contact of relay 4. The operation of relay 13 opens the original circuit for the primary winding of the transformer 11 and closes a circuit for the upper winding of relay 14 as follows: battery, upper winding of relay 14, lower armature and front contact of relay 13, middle lower armature and front contact of relay 5, impulsing contacts 12 to ground. Relay 14 is thereby operated and opens the bridge for the 1000 cycle source 10 across the line 3.

When now the dial 2 is operated in accordance with the digits of the wanted subscriber's line, relay 14 will release for each operation of the pulsing contacts 12 and thus connect the 1000 cycle current source 10 across the line 3 to transmit the desired number of impulses for each digit. These impulses select the wanted subscriber's line and connect it through to line 3 in the usual manner. When the calling subscriber at 1 hangs up his receiver to release the connection, relay 4 is released causing the release of relays 5 and 13 and relay 13 in turn releases relay 14 to restore the circuit to normal.

Referring now particularly to Fig. 2, the circuits of this figure may be substituted for

the circuit marked 150 of Fig. 1 in the above mentioned patent. The relays marked 152, 153, 154, 155, 158, 161 and 162 correspond to the correspondingly numbered relays in this patent and their functions will not be described here. These functions merely relate to certain supervisory provisions in this circuit which are identical with those shown in the above mentioned patent and that form no part of this invention. The lead marked 100 corresponds to the lead in the above mentioned patent connected to key 35. The leads 101 and 102 correspond to the leads connected to the left hand armatures of relay 36, while the leads marked 103 and 104 correspond to leads 41 and 42 in the above mentioned patent.

When the operator actuates her dial 106 for a complete revolution to transmit the preliminary impulses, a circuit is closed, as the off-normal contacts 107 are actuated for the operation of relay 109 over a circuit as follows: battery, winding of relay 109, left hand armature and back contact of relay 108, the closed contacts and off-normal contacts 106 to ground. The operation of relay 109 is for the purpose of establishing a connection through lead 100 to ground at the key 35 of Fig. 1 of the above mentioned patent for relay 108. This relay does not operate at this time as its circuit is shortened by the ground at the contacts 107. On the return of the dial 106 to normal the pulsing contacts 110 are interrupted at approximately ten times per second to release and operate relay 111 at the same rate. The operation and release of relay 111 closes and opens an obvious circuit for the left hand winding of transformer 112. These circuit interruptions in turn induce current impulses in the circuit for relay 113 at twice the rate of the interruptions of the circuit for the left hand winding of transformer 112. That is, relay 113 is operated at twenty times per second. The operation and release of relay 113 closes and opens the circuit through the left hand winding of the repeating coil 114 at this rate and consequently causes the circuit for the left hand winding of relay 115 to be energized at forty times per second. That is, relay 115 is operated and released at forty times per second for the complete operation of the dial 106. Current from the 1000 cycle source 116 is therefore alternately applied and removed from the circuit comprising leads 103 and 104 at the corresponding rate. These two leads may be connected as shown in the above mentioned patent to the line for the preparing of the automatic equipment for the reception of dialing impulses.

When the dial 106 returns to normal, the short circuit through the off-normal contacts 107 for relay 108 is removed so that this relay will now operate from battery, through the winding of relay 109, winding of relay 108.

armature and front contact of relay 109 to the ground at the key 35 in the above mentioned patent. This relay in operating opens the normal operating circuit for relay 109 but this relay is held operated in series with relay 108.

On the subsequent operations of the dial 106 for the selection of the wanted subscriber's number, the pulsing contacts 110 which are now connected in a circuit from ground through the right hand armature and front contact of relay 108, and the right hand winding of relay 115 to battery, cause relay 115 to be alternately operated and released in accordance with the setting of the dial. Consequently, current from the 1000 cycle source 116 is now applied to the line in accordance with the wanted subscriber's number. When the dialing equipment shown in Fig. 2 is no further required it will be released from the circuit shown in Fig. 1 of the above mentioned patent by the release of key 35 which causes the release of relays 107 and 108.

It should be understood that while this invention has only been shown in connection with two different circuit arrangements it could readily be applied in a variety of different systems without departing from the spirit thereof.

What is claimed is:

1. In a telephone system, a line, a dial, a source of current, means responsive to one operation of the dial for transmitting impulses of current from said source over said line at a rate different from the rate of interruptions produced by the dial contacts, and means responsive to subsequent operation of the dial for transmitting impulses of current from said source at the same rate at which the dial contacts are interrupted.

2. In a telephone system, a line, a dial, a source of current, means responsive to the movement of the dial from normal for connecting said source to the line, means responsive during the return movement of the dial to normal for interrupting said connection at a rate different from the rate of interruptions of the dial contacts, means responsive on the return of the dial to normal for opening said connection from the source to the line, and means responsive to subsequent operations of the dial for closing said connection each time the dial contacts are interrupted.

3. In a telephone system, a line, a dial, a source of current, and means responsive during an operation of the dial and controlled by the dial contacts for transmitting impulses from said source at a rate differing from but bearing a certain relation to the rate of interruptions of said dial contacts.

4. In a telephone system, a line, a dial, a source of current, and means controlled directly by the contacts of the dial for transmitting impulses of current from said source at a multiple of the number of interruptions

of the dial contacts during one operation of the dial and for transmitting impulses of current from said source at the rate of interruptions of the dial contacts during subsequent operations of the dial.

5. In a telephone system, a line, a dial, a source of current, means responsive to the movement of the dial from normal and controlled by the off-normal contacts of said dial for connecting said source to the line, means responsive during the return movement of the dial to normal and controlled by the pulsing contacts of the said dial for interrupting said connection a number of times which is a multiple of the number of interruptions of said pulsing contacts, and means responsive to the return of the dial to normal and controlled by the pulsing contacts for opening said connection.

6. In a telephone system, a line, a dial, a source of alternating current, means responsive to one operation of the dial for transmitting over said line impulses from said source, each impulse comprising a given number of current alternations, and means responsive to subsequent operation of said dial for transmitting over said line impulses from said source, each such impulse comprising a number of current alternations differing from the number involved in said first impulses.

7. In a telephone system, a line, a dial, a source of alternating current, means responsive to one operation of the dial for transmitting over said line impulses from said source, each impulse comprising a given number of current alternations which bears a definite relation to the rate of interruptions of the dial contacts, and means responsive to subsequent operation of said dial for transmitting over said line impulses from said source, each such impulse comprising a given number of current alternations differing from the number involved in said first impulses.

In witness whereof, I hereunto subscribe my name this 19th day of October, A. D. 1927.

PAUL B. MURPHY.