

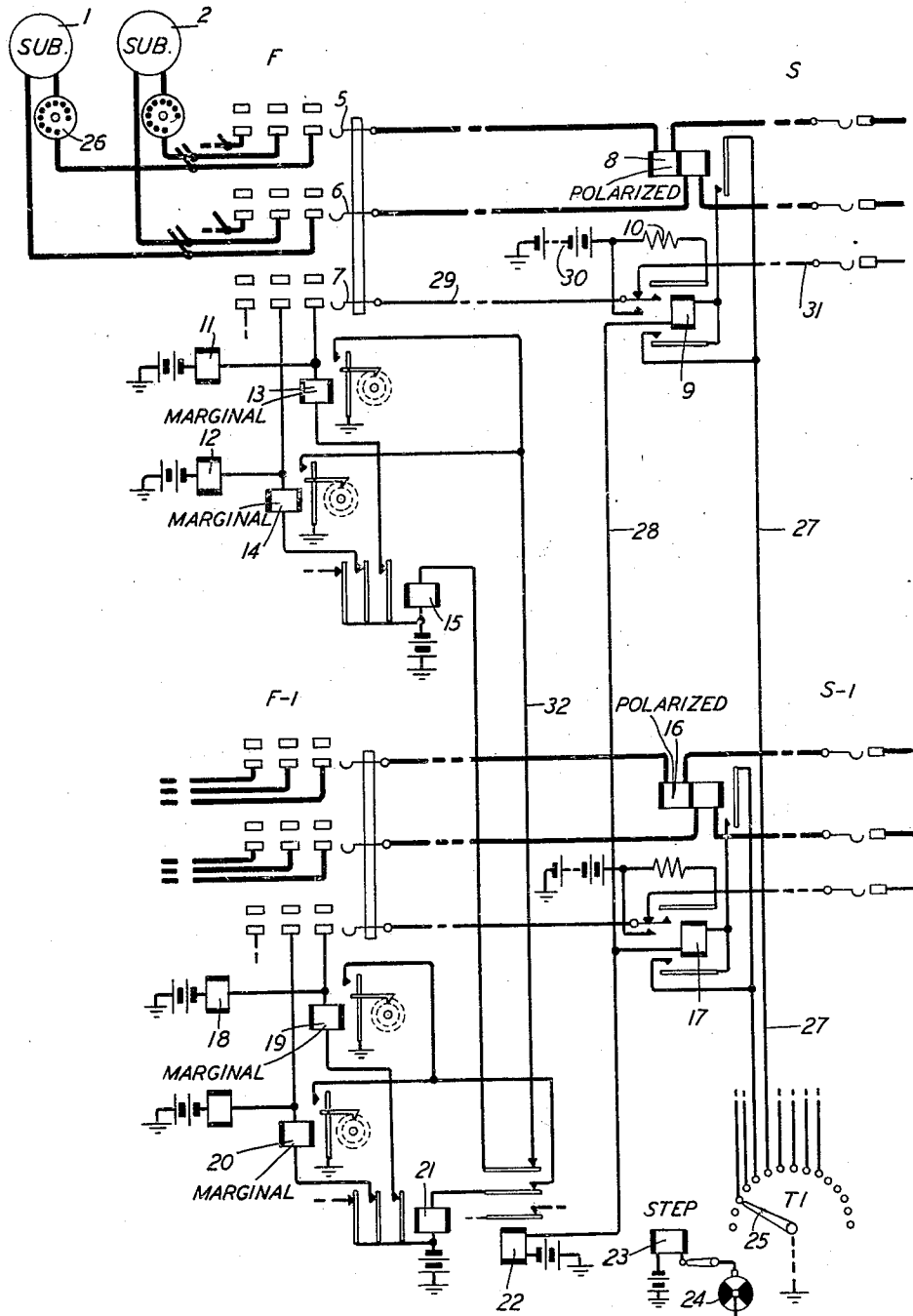
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COMMUNICATION SYSTEM

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COMMUNICATION SYSTEM

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This invention relates to communication systems, such as telephone and telegraph systems, and particularly to service charging arrangements employed therein for making the necessary charges for the service rendered.

The objects are to render more reliable the operation of service meters, to enable them to function positively when used in systems requiring repeated charges, and to otherwise improve and simplify apparatus of this character.

Heretofore telephone systems have been proposed in which the service meter and the cut-off relay for a subscriber's line are connected in parallel to a single conductor, such as the sleeve conductor. Where it is desirable to operate the meter a plurality of times during a single call, during which time the cut-off relay must remain continuously operated, it has been necessary to devise special circuit arrangements to enable the release of the meter after each operation so that it will be ready to record the next successive charge.

According to the present invention, these requirements are fulfilled, and certain advantages are secured by a circuit arrangement in which the operating circuit of the subscriber's meter is opened to insure the positive release of the meter after a charge has been made and without in any way disturbing the holding circuit of the cut-off relay. This is accomplished by leading the operating circuit of the meter through a contact of a relay, which relay is energized as soon as the meter has fully operated and the operating current has been removed from the sleeve conductor.

A feature of the invention is an arrangement in which the circuits of the meters of a group of lines are controlled by a single group relay which energizes in response to the complete operation of any one of the meters, provided each of the meters has received its full operating impulse, and it will not deenergize until all of the meters in the group have released.

The drawing accompanying this specification discloses a portion of an automatic telephone system embodying the principles of the invention. A group of subscribers' lines, including the lines 1 and 2, appear in the sta-

tionary terminals of line finder switches at the central office. It may be assumed, for example, that the group comprises 200 lines, each line having an appearance in each of a number of finders, the number of finders serving the group depending upon the nature of the traffic. Two of these finder switches F and F—1 are illustrated. Each line finder switch is connected by a link circuit to a corresponding first selector switch such as the switches S and S—1.

The total group of 200 lines may be divided into any convenient number of sub-groups. For each sub-group of lines, there is provided a sub-group relay controlling the message register circuits of all lines in the sub-group. For example, the relay 15 is common to the message registers 13 and 14 of lines 1 and 2 respectively and of all other registers in that particular sub-group. Similarly, relay 21 controls all message registers including the registers 19 and 20 in another sub-group of the main group of 200 lines. It may be assumed that lines 1 and 2, appearing in the finder switch F, are also multiplied to appear in the switch F—1 and in other switches not shown in the drawing.

The sub-group relays including the relays 15 and 21 are all controlled by a common group relay 22. This relay operates in conjunction with relays 9, 17, etc. of the line finder-selector link circuits.

The common timing switch TI is provided for causing the application of metering potential to the circuits of the various message registers to operate them repeatedly during the existence of conversational circuits between calling lines and called lines. The switch TI may be an automatic step-by-step selector, comprising a brush 25 and a bank of contacts, driven by a stepping magnet 23 under the control of a constantly rotating interrupter 24. The terminals of the contact bank are connected to individual link circuits to which the device is common. The speed of operation of the brush 25 is such that it makes engagement with any given terminal in the bank once in a predetermined interval, such as once per minute, or once per fraction of a minute, or once in a number of minutes as desired.

The line finders and selectors illustrated in the drawing may be of the ordinary step-by-step type such as those having a primary movement to select groups of terminals and a secondary movement to select individual terminals in a group.

Assume that the subscriber of line 1 wishes to hold conversation with another subscriber. When the call is initiated, a line finder, such as the line finder F having access to the calling subscriber's line, is set in operation and places its brushes 5, 6 and 7 on the terminals of the calling line 1, thus extending the line over the link circuit to the first selector switch S. In the well-known manner, the calling subscriber manipulates his impulse transmitter 26 to operate the selector switch S and succeeding switches to complete the extension of the connection to the called subscriber's line. The connection is held in the usual manner by the presence of ground potential on the sleeve conductors 31 and 29. At the time this ground potential is applied to conductor 29, the cut-off relay 11 of the calling line 1 operates by means of a circuit traceable from battery through the winding of the relay through the sleeve terminal and brush 7 of the line finder F to the grounded sleeve conductor 29. The subscriber's message register 13 is also included in circuit from battery through the contact of relay 15, winding of register 13 and thence to the grounded sleeve conductor 29 as above traced. The register 13, however, being marginal does not operate at this time.

When the called subscriber answers, the polarized relay 8, having a winding in each of the tip and ring conductors, operates as a signal that the connection has been completed and that both parties have their receivers off the switchhooks. As soon after the relay 8 operates as the timing device TI advances its brush to the terminal individual to the link circuit in use, a circuit is completed from ground over the brush 25, conductor 27, contact of relay 8, winding of relay 9, conductor 28, winding of relay 22 to battery. Relay 22 operates and opens the circuits of all sub-group relays 15, 21, etc. to prevent the operation of any of these relays while metering current is being applied to operate the calling subscriber's register. Relay 9 also operates in the circuit traced and first closes its upper make contact to complete a momentary circuit from booster battery 30 through the resistance 10 to the sleeve conductor 29. Upon the complete operation of the armature of relay 9, the resistance 10 is short-circuited and booster battery is directly connected through the contacts of the relay over conductor 29 and thence through the winding of the message register 13, contact of relay 15 to battery and ground. The addition of the booster battery 30 causes sufficient current to flow to operate the message register 13 in parallel with the cut-off relay 11. As soon as re-

lay 9 is fully operated, a substitute holding circuit is completed from ground over conductor 27 through the lower contact and winding of relay 9, to battery through the winding of relay 22. This circuit being independent of the relay 8 insures that a complete operation of the register will take place should the relay 8 release immediately after the closure of the energizing circuit of relay 9.

As soon as the timing switch TI takes its next step, the circuit of relays 9 and 22 is opened. These relays immediately release. Relay 9 first removes the booster battery 30 from the conductor 29 and reconnects said conductor through the resistance 10 to battery. An instant later the battery through resistance 10 is completely disconnected from conductor 29 and grounded conductor 31 is reconnected thereto. The purpose of the resistance 10 is to prevent the sudden application and withdrawal of the full booster battery 30 from the sleeve conductor.

Although the message register 13 is marginal and will not operate when ground is originally connected to the sleeve conductor, this register may obtain sufficient magnetization to hold its armature attracted once it has been operated by the booster battery and said battery has been removed from the sleeve conductor. To prevent the register from remaining operated and thus frustrating further charges, the relay 15 is arranged to operate to completely open the circuit of the register. The operating circuit of relay 15 is closed as soon as the common group relay 22 releases, and may be traced from battery through the winding of relay 15, upper contact of relay 22, conductor 32 to ground at the make contact of the message register 13. Relay 15 severs the circuit of the register 13, permitting the latter to release. The register 13 in turn opens the operating circuit of relay 15. Relay 15 releases, provided no other register in the sub-group, such as the register 14, is energized at the time. So long, however, as any register in the sub-group remains energized, relay 15 will be held over one of the parallel branches of its energizing circuit. Should the register 13 fail to release for any reason the relay 15 will be released the next time the relay 22 operates, thus preventing a disabled register from defeating the operation of other registers.

Each time the timing switch TI advances its brush 25 to the terminal individual to the conductor 27, the relays 9 and 22 are reoperated, and the subscriber's register 13 is energized to register an additional charge.

Should another connection be established between two subscribers' lines over the finder F-1 and selector S-1, the timing switch TI operates the relays 17 and 22 once for each cycle of its rotation by means of a similar circuit including the contact of the polarized relay 16. This causes in a similar manner

the operation of the calling subscriber's message register such as one of the registers 19, 20, etc.

At the end of conversation the subscribers
5 replace their receivers, and, as soon as one party has replaced his receiver, the polarized relay 8 releases to prevent any further operation of the calling subscriber's meter.

Although the invention has been described
10 in connection with a system employing step-by-step switches it will be understood that it is not so limited but may be embodied in other types of systems such as those employing operators or any of the various types of
15 connection extending switches.

What is claimed is:

1. In combination, a line having a service meter and a relay connected in parallel circuits to one of the conductors of said line,
20 means for causing a flow of current over said conductor to operate said meter and said relay, and means for opening the circuit of said meter to cause its release without causing the release of said relay.

25 2. In combination, a line having a service meter and a cut-off relay connected in parallel circuits directly to the sleeve conductor of said line, means for applying a potential to said conductor to operate said cut-off relay,
30 means for applying potential to said conductor to operate said meter and to maintain the operation of said cut-off relay, and means for opening the circuit of said meter to cause its release without disturbing the operated
35 condition of said cut-off relay.

3. The combination in a telephone system of a line having a counting register and a cut-off relay connected to the sleeve conductor of said line, means for applying a potential to said conductor to cause the operation
40 of said relay without operating said register, means for applying another potential to said conductor to cause the operation of said register and to maintain said relay operated, and
45 means for opening the circuit of said register to cause its release without disturbing the operated condition of said relay.

4. The combination in a telephone system of a line having a service meter and a relay
50 connected in parallel circuits to the sleeve conductor thereof, means for operating said relay, means for applying a potential periodically to said sleeve conductor to cause the operation of said meter and to maintain said
55 relay operated, and means for opening the circuit of said meter to cause its release after each successive operation without interfering with the operated condition of said relay.

5. In combination, a group of lines each
60 having a service meter and a cut-off relay connected in parallel circuits to the sleeve conductor, means for operating said cut-off relays, means for operating the meters of said lines and for maintaining the respective cut-
65 off relays operated, and means common to the

group of lines for opening the circuits of all operated meters to cause their release without disturbing the operated condition of the cut-off relays.

6. The combination in a telephone system
70 of a group of lines arranged in sub-groups, each line having a service meter and a cut-off relay connected in parallel circuits to a control conductor, a plurality of link circuits for extending connections from said lines, means
75 for operating the cut-off relays of calling lines, means in said link circuits for applying potential to the sleeve conductors to which said links are connected to cause the operation
80 of the respective service meters and to maintain the corresponding cut-off relays energized, relays, one for each of said sub-groups of lines for opening the circuits of the service meters of said lines, and means
85 common to said link circuits for controlling the operation of said sub-group relays.

In witness whereof, I hereunto subscribe my name this 2d day of October, 1930.

EDWARD E. HINRICHSSEN.

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