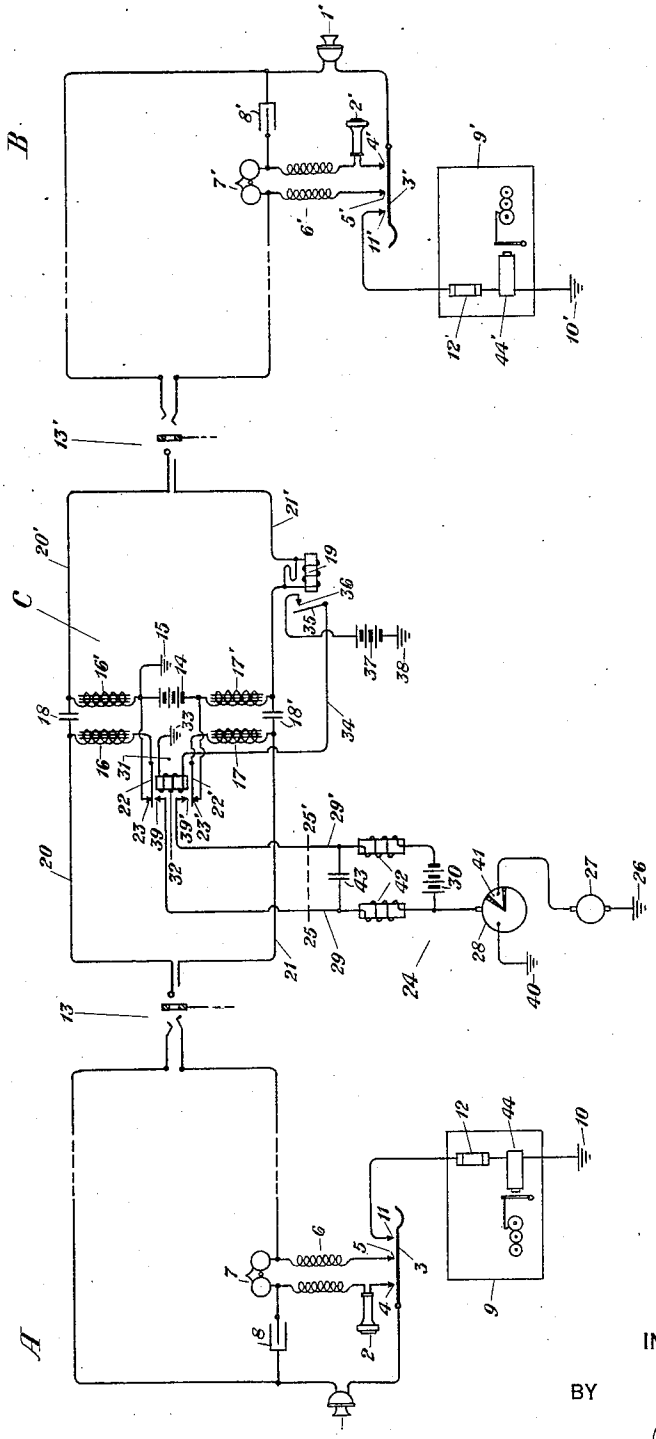
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM.

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This invention relates to telephone systems, and more particularly to telephone metering systems in which the subscriber is charged for the number of calls made or completed, or for the length of each call, or for both the number of calls made and for the length of each call.

It is an object of this invention to provide a novel system in which the subscriber is accurately charged for the actual use of his telephone facilities, without interfering with the efficiency thereof.

In telephone metering systems, a recording meter located either at the substation or at the central office may be operated by transmitting over the circuit direct current impulses of higher voltage than that normally in the circuit. The present invention embodies with this method of meter operation a register bridged from one side of the line to ground, a voltage breakdown valve connected in series with said register, means for impressing on said line direct current impulses of supernormal voltage, and means for modifying the rate of growth of said impulses.

A better understanding of the invention may be had from the detailed description hereinafter following.

The drawing represents diagrammatically a telephone circuit illustrating the invention.

In the drawing there are shown two subscribers' stations A and B, with subscribers' loops extending to the central office and terminating in the jacks 13 and 13′. As shown, A represents the station of the calling subscriber and B that of the called subscriber. The substations comprise the usual transmitters 1 and 1′, the receivers 2 and 2′, the receiver hooks 3 and 3′, the contacts 4 and 4′, and 5 and 5′, respectively, the induction coils 6 and 6′, the ringers 7 and 7′, and the condensers 8 and 8′. In addition, there are located at the substations registers 9 and 9′ bridged from one side of the line to ground at 10 and 10′ through the receiver hook contacts 11 and 11′ and in series with voltage breakdown valves 12 and 12′. The function of the voltage breakdown valve is to prevent the passage of current of normal line voltage, for example, 24 or 48 volts, from the line to ground through the relay 44 of the register when the receiver is off the hook, and to permit the passage of a current when an impulse of supernormal voltage, for example, 120 volts, is impressed on the line. The Schröter tube, forming the subject matter of Patent No. 1,605,001, is particularly adaptable for use as the breakdown voltage valve in this invention.

The cord circuit C of the central office is here illustrated as the impedance coil feed type. Obviously, a cord circuit of the repeating coil feed type may be used, if desired. The cord circuit shown comprises the usual current source 14 grounded at 15, the impedance coils 16, 16′, 17 and 17′, the capacities 18 and 18′, the supervisory relay 19 and the cord conductors 20, 20′, 21 and 21′. The impedance coils 16 and 17 are connected to the source 14 through the armatures 22 and 22′ and the contacts 23 and 23′, respectively. Adapted to be bridged across the cord circuit to ground at 26 is a means 24 (shown in the drawing below the dotted line 25—25′) for impressing on the line direct current impulses of supernormal voltage, for example, 120 volts. This means comprises the direct current source 27 of higher voltage than that of the line battery, the commutator 28 and the connecting leads 29 and 29′. An auxiliary direct current source 30 of line battery voltage is connected in series with the connecting leads 29 and 29′. A switching mechanism 31 is associated with the cord circuit to disconnect the source 14 from the calling subscriber's line and to connect thereto the auxiliary source 30. This switching mechanism comprises the relay 32 connected to ground at 33, the armatures 22 and 22′, the conductor 34, the armature 35, the contact 36 and source 37 connected to ground at 38. The supervisory relay 19 when energized attracts its armature 35 which establishes a connection with the contact 36. The establishment of this connection closes the circuit of the relay 32 and causes its energization. When energized, this relay attracts its armatures 22 and 22′ to break their connection with contacts 23 and 23′, respectively, and to establish their connection with contacts 39 and 39′, respectively. The latter step completes the association of the auxiliary source 30 with the calling subscriber's line in place of the source 14. The auxiliary source 30 is grounded at 40 through the commutator 28. As shown, the commutator 28 has an insulated segment 41 to which is connected one terminal of the source 27. At predetermined intervals of

time, the rotation of the commutator under the influence of clock mechanism or driving means, not shown, removes the ground 40 from the circuit and momentarily connects the current source 27 in the circuit through the segment 41. The removal of the ground 40 from the circuit, when the current source 27 is connected therein, prevents the impulses of relatively higher voltage, generated by the source, from being by-passed to ground. It should be understood that the representation of the commutator shown is merely diagrammatic. Other means may be used to accomplish the same purpose. Choke coils 42 are connected in series with the connecting leads 29 and 29′ to modify the rate of growth of the impulses impressed by the source 27 through the commutator 28. Also, a capacity 43 is connected between the connecting leads 29 and 29′. The choke coils and the high capacity together serve to prevent any objectionable disturbances in the talking circuit, due to the high voltage impulses impressed on the line.

In the drawing, a telephone system is illustrated in which the calling subscriber is charged with the length of time his instrument is used for conversational purposes. However, it is to be understood that this invention may be embodied in systems in which the subscriber is charged for the number of calls made or for both the number of calls made and the length of each call, or in which the charge is made on the multiple basis.

The operation of the system is as follows: When the calling subscriber at station A removes his receiver from its hook to initiate a call, a connection is established to the central office in the well-known manner. At this time, a current of normal line voltage is flowing through the substation circuit. The removal of the receiver also establishes a connection from the line through the receiver hook 3 and the contact 11 to the voltage breakdown valve 12, thus bridging the latter from the line to ground. However, no current flows through the relay 44 of the register, due to the fact that the voltage breakdown tube does not permit the passage therethrough of current of such low voltage as that normally impressed on the line. After the connection has been completed through the cord circuit C to the station B of the called subscriber, and when the called subscriber removes his receiver from the hook, the circuit including the supervisory relay 19 is closed in the manner well known to those familiar with the art. The closure of this circuit and the resulting energization of the supervisory relay 19 causes the latter to attract its armature 35 which establishes a connection with the contact 36. The establishment of this connection closes a circuit of the relay 32, constituting a part of the battery switching mechanism 31. The energization of this relay causes the battery 14 to be disconnected from the calling subscriber's line and the auxiliary battery 30 to be substituted therefor in the manner described above. At predetermined intervals of time, for example, every fifteen seconds, the commutator 28 under the control of clock mechanism or driving means, not shown, disconnects the ground 40 from the circuit and momentarily connects the direct current source 27 in the circuit through the segment 41 whereby an impulse of relatively high voltage, for example, 120 volts, is impressed on the calling line. This impulse of relatively high voltage causes the valve 12 to break down and permit the flow of current across its terminals through the relay 44 of the register 9 to ground at 10. (The valve 12 may be designed so that it will absorb a part of the voltage, thus serving also as a reducing valve to permit only a reduced current to flow therethrough to the relay of the register.) This current energizes the relay of the register which attracts its armature and advances the counter-mechanism one step. As stated above, these impulses are impressed periodically on the line to register permanently in suitable units the length of each conversation. The circuit traversed by these current impulses includes the ground 26, the source 27, the segment 41 of the commutator 28, the choke coils 42, the connecting leads 29 and 29′, the cord conductors 20 and 21, the jack 13, both sides of the calling subscriber's line through the substation circuit to the contact 11, the voltage breakdown valve 12, the relay 44 of register 9 to ground at 10. When the receivers are returned to the hooks, the register, as well as the impulse impressing means, is removed from the circuit.

As shown and described, the impulse impressing means is connected on one side of the cord circuit only, since, in general, it is desirable to charge the call to the calling subscriber only. It is obvious, however, that the same mechanism could be applied on the other side of the cord circuit or on both sides of the cord circuit, if desired. The impulse impressing means, indicated in the drawing below the dotted line 25—25′, may be common to all the cords of the given exchange or to a group of cords or, if desired, may be supplied for each cord separately. Likewise, said impulse impressing means may be associated with the cord circuit through other means in such a manner that the operation of the meter will begin at any desired time during the connection.

While this invention has been illustrated in connection with a typical cord circuit using manual operation, it is apparent that it is equally applicable to machine switching apparatus.

What is claimed is:

1. In combination, a plurality of subscriber's lines, means for establishing connections between two of said lines, registering means connected from said lines to ground, means connected in series with said registering means for preventing the passage therethrough of current of normal voltage and for permitting the passage therethrough of current of supernormal voltage, a current source of normal voltage adapted to supply current to said lines, and means grounded at one terminal thereof for impressing impulses of supernormal voltage on said lines to operate said registering means.

2. In a telephone system, subscribers' lines, connecting circuits for establishing talking connections between said lines, metering apparatus bridged from one side of said lines to ground, a voltage breakdown valve connected in series with said metering apparatus, a current source of normal voltage adapted to supply current to said lines, means grounded at one terminal thereof for impressing impulses of supernormal voltage on both sides of said lines in parallel to operate said metering apparatus, and filtering means located between said impulse impressing means and said connecting circuits.

3. In a telephone system, a calling line and a called line, connecting circuits for establishing talking connections between said lines, measuring apparatus bridged from one side of said calling line to ground, a voltage breakdown valve connected in series with said measuring apparatus for preventing the passage therethrough of current of normal voltage and for permitting the passage therethrough of current of supernormal voltage, a current source of normal voltage adapted to supply current to said lines, a relay adapted to be energized when the circuit of said called line is closed, means grounded at one terminal thereof under the control of said relay for periodically impressing impulses of supernormal voltage on said calling line to operate said measuring apparatus, and filtering means located between said impulse impressing means and said connecting circuits.

4. In a telephone system, a calling line and a called line, connecting circuits for establishing talking connections between said lines, registering means bridged across said calling line and connected to ground, voltage breakdown means connected in series with said registering means for preventing the passage therethrough of current of normal voltage and for permitting the passage therethrough of current of supernormal voltage, a current source of normal voltage adapted to supply current to said called line, a second current source of normal voltage grounded at one terminal thereof and adapted to supply current to said calling line, a third current source grounded at one terminal thereof and adapted to impress impulses of supernormal voltage on both sides of said calling line in parallel to operate said registering means, and means adapted to be operated periodically for disconnecting the ground of said second current source and for connecting said third current source to said calling line.

5. In a telephone system, a calling line and a called line, connecting circuits for establishing talking connections between said lines, measuring apparatus connected from said calling line to ground, means connected in series with said measuring apparatus for preventing the passage therethrough of current of normal voltage and for permitting the passage therethrough of current of supernormal voltage, a current source of normal voltage adapted to supply current to said lines, a second current source of normal voltage, means for disconnecating said calling line from said first current source and for connecting it to said second current source, and means grounded at one terminal thereof for impressing impulses of supernormal voltage on both sides of said calling line in parallel to operate said measuring apparatus.

6. In a telephone system, a calling line and a called line, connecting circuits for establishing talking connections between said lines, a meter bridged from one side of said calling line to ground, a voltage breakdown valve connected in series with said meter for preventing the passage therethrough of current of normal voltage and for permitting the passage therethrough of current of supernormal voltage, a current source of normal voltage adapted to supply current to said lines, a relay adapted to be energized when the circuit of said called line is closed, a second current source of normal voltage grounded at one terminal thereof, filtering means located between said second current source and the connecting circuits, means under the control of said relay for disconnecting said calling line from said first current source and for connecting it to said second current source, a third current source grounded at one terminal thereof and adapted to impress impulses of supernormal voltage on both sides of said calling line in parallel to operate said meter, and means for momentarily and successively disconnecting the ground of said second current source and connecting said third current source to said calling line at predetermined intervals of time.

7. In a telephone system, a calling line and a called line, connecting circuits for establishing talking connections between the said lines, metering apparatus connected from said calling line to ground, means connected in series with said metering apparatus for preventing the passage therethrough of

current of normol voltage and for permitting the passage therethrough of current of supernormal voltage, a current source of normal voltage common to the connecting circuits, a second current source of normal voltage common to the connecting circuits, means individual to each connecting circuit for disconnecting said calling line from said first current source and connecting it to said second current source, and means common to the connecting circuits for impressing impulses of supernormal voltage on both sides of said calling line in parallel to operate said metering apparatus.

In testimony whereof, I have signed my name to this specification this 28th day of May, 1928.

IRVING W. GREEN.