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TELEPHONE SYSTEM

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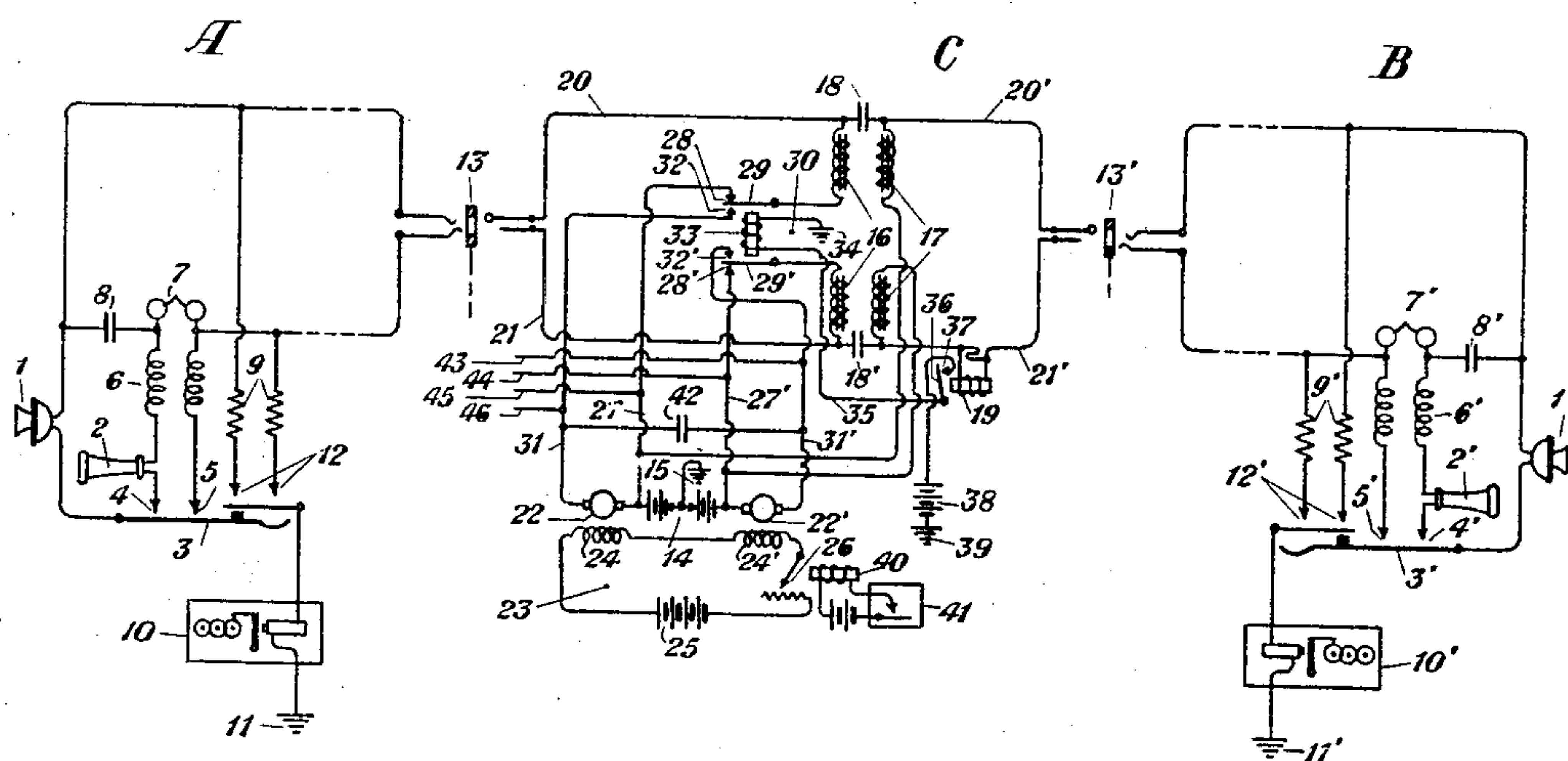


Fig. 1

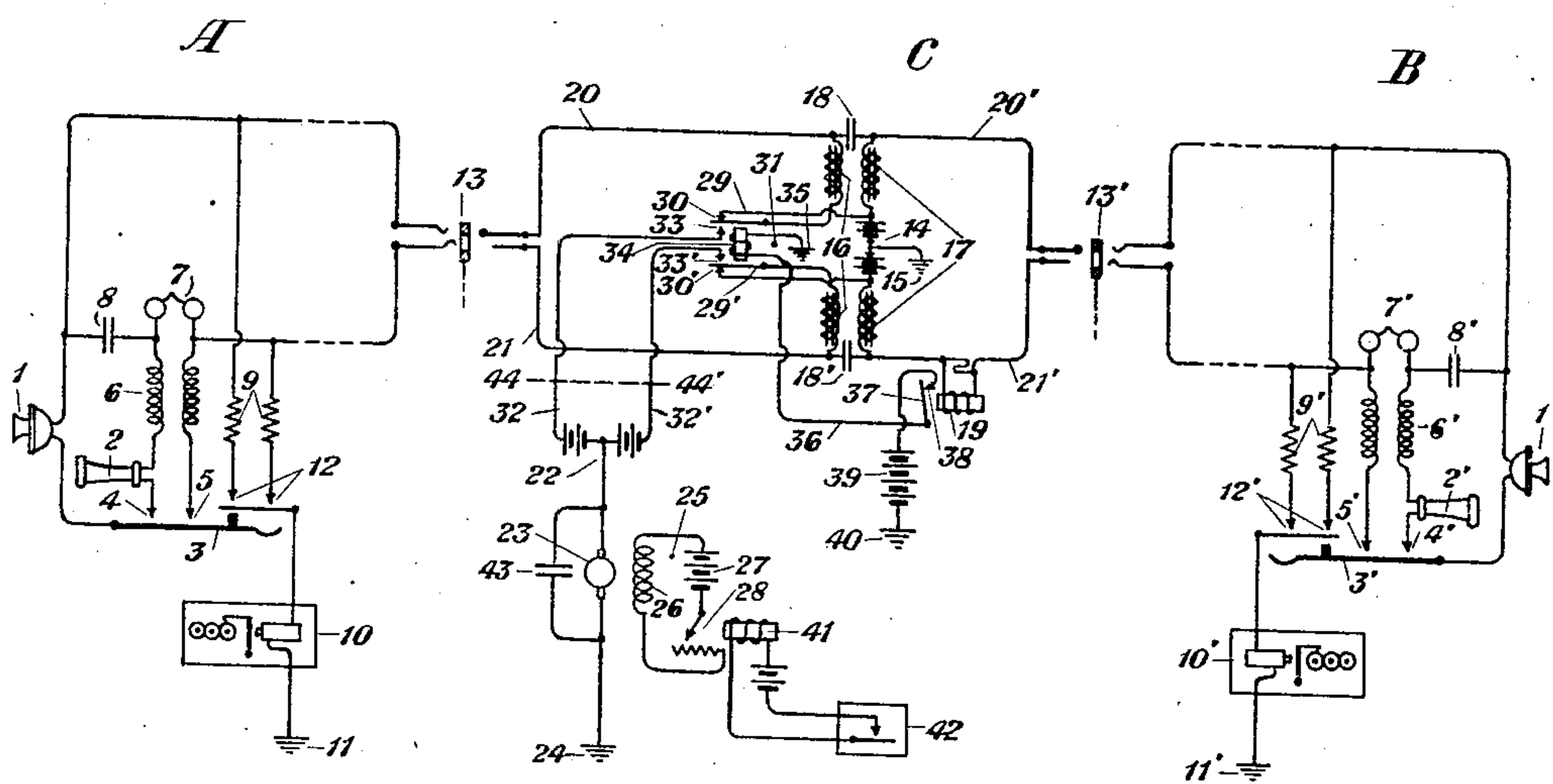


Fig. 2

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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 the length of each call.

In such systems it has been proposed to employ a simplex circuit to operate the recording meter located either at the substation or at the central office. This simplex circuit comprises an impedance bridge across the line of the subscriber to be charged, metering apparatus including a marginal relay connected from the midpoint of said bridge to ground, a second impedance bridge adapted to be connected across the cord circuit at the central office and a grounded direct current source connected to the midpoint of the latter bridge for transmitting impulses over both sides of the subscriber's line in parallel to operate the metering apparatus.

This system, as heretofore employed, was found to have certain objectionable features which interfered with the efficiency of the regular transmission of speech signals. The connection of the second bridge, described above, across the cord circuit when impulses were being transmitted over the subscriber's loop, resulted in the establishment of a local circuit including the bridge, the cord conductors, the talking current battery and the impedance or repeating coils of the battery supply bridge. This local circuit partially shunted the talking current and hence greatly decreased the talking current flowing through the substation circuit. Obviously, this seriously interfered with the efficiency of the transmission of speech signals. Likewise, the sudden decrease in the talking current flowing through the substation circuit produced objectionable disturbances in the talking circuit. Also, the establishment of this local circuit partially shunted the meter operating current and thus substantially reduced the effective meter operating current flowing through the meter relay.

It is an object of this invention to provide an improved telephone metering system embodying a simplex circuit for meter operation in which the objectionable features pointed out above are eliminated and in which a high degree of efficiency is attained. The present invention comprises the com-

bination with a telephone system of an impedance or inductance bridge across the line of the subscriber to be charged, a meter connected from the midpoint of said bridge to ground, a talking current supply bridge across the cord circuit, including a pair of impedance or repeating coils, a talking current source connected to said current supply bridge and means adapted to be connected to the midpoint of said current supply bridge for impressing impulses on both sides of the subscriber's line in parallel to operate said meter.

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

In the drawing, Figure 1 represents diagrammatically a telephone circuit illustrating the preferred embodiment of the invention, and Fig. 2 represents diagrammatically a telephone circuit illustrating another form of the invention.

In Fig. 1 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 impedance or inductance bridges 9 and 9' adapted to be connected across the subscribers' lines. Registers 10 and 10' are adapted to be connected from the midpoints of said bridges through the receiver contacts 12 and 12' to ground at 11 and 11'.

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 its midpoint at 15, the talking current supply bridge 16 of the calling subscriber's line, the talking current supply bridge 17 of the called subscriber's line, each of said supply bridges including a pair of impedance coils, the capacities 18 and 18', supervisory relay 19 and the cord conductors 20, 20', 21 and 21'. Normally, the talking current supply

bridge 16 is connected directly to the source 14 through the leads 27 and 27', the contacts 28 and 28' and the armatures 29 and 29'. A means for impressing impulses on the line is adapted to be connected to the current supply bridge 16 through the leads 31 and 31', the contacts 32 and 32' and the armatures 29 and 29'. This means comprises the direct current induction generators 22 and 22' and the energizing circuit 23, the latter comprising the induction coils 24 and 24', the current source 25 and the switch 26. As shown, the switch 26 is of the rheostat type in order that the building-up and the decay of the generator field may be gradual and smooth to prevent objectionable disturbances in the talking circuit. It is obvious, however, that a simple switch may be used and the generator field itself so designed that the length of time required for the building-up and the length of time required for the decay of the field are approximately equal. A relay circuit 40 under the control of a clock mechanism 41 is provided for periodically closing the switch 26 to energize the generators 22 and 22'. A switching mechanism 30 under the control of the relay 19 is associated with the cord circuit for breaking the direct connection of the bridge 16 with the source 14 and for reconnecting it to said source through the generators 22 and 22'. This switching mechanism comprises the relay 33 grounded at 34, the armatures 29 and 29', the conductor 35, the armature 36, the contact 37 and the source 38 grounded at 39. A filter element 42 is connected across the leads 31 and 31' to prevent any objectionable disturbances in the talking circuit. Leads 43, 44, 45 and 46 are provided for associating source 14 and the impulse impressing means with the other connecting circuits of the central office.

As shown, the current source 14 is grounded at its midpoint at 15. In the systems heretofore employed, the central office battery was grounded at one terminal, which fact necessitated the use of meters having marginal relays in order to prevent false registration due to the ground potential difference between the ground connections of the meters and that of the central office battery. In the present arrangement, as between the ground connections of the meters and that of the source 14, there is no ground potential difference and hence meters having non-marginal relays may be used. However, it should be understood that meters having marginal relays may be used if desired.

The operation of the system is as follows: When the calling subscriber at station A removes his receiver from the 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 cir-

cuit. The removal of the receiver also connects the bridge 9 across the line and establishes a connection from the midpoint of said bridge through the contacts 12 to the relay of the meter 10, thus bridging the latter from the bridge to ground at 11. After the connection has been completed through the cord circuit C to 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 36, which establishes a connection with the contact 37. The establishment of this connection closes the circuit of the relay 33 and causes its energization. When energized, this relay attracts its armatures 29 and 29' to break their connection with the contacts 28 and 28', respectively, and to establish their connection with contacts 32 and 32', respectively. This breaks the direct connection of the bridge 16 with the source 14 and reconnects it to said source through the generators 22 and 22' and the leads 31 and 31'. At predetermined intervals of time the clock mechanism 21 closes the relay circuit 40, which in turn causes the closure of the switch 26 and energizes the induction coils 24 and 24'. The generators 22 and 22' are energized and impress an impulse through the bridge 16 on both sides of the line in parallel through the bridge 9 to operate the meter 10. Thus, the impulse which passes over the simplex circuit does not in any way interfere with the talking current or speech signals. The circuit traversed by these current impulses includes the ground 15, the source 14, the generators 22 and 22', the leads 31 and 31', the contacts 32 and 32', the armatures 29 and 29', the current supply bridge 16, the cord conductors 20 and 21, the jack 13, both sides of the called subscriber's line, the bridge 9, the contacts 12, the relay of the meter 10 and the ground 11. When the receivers are returned to the hooks, the meter, as well as the bridge 9 and the impulse impressing means, is removed from the circuit.

As can be seen from the above description, an improved simplex metering system is provided in which the talking current supply bridge is used for transmitting both the talking current and the meter operating current over the subscriber's loop and in which the talking current source is grounded at its midpoint. This new arrangement eliminates the necessity of using a separate bridge, with its inherent objectionable results, for transmitting the meter operating impulses over the subscriber's loop.

Fig. 2 of the drawing illustrates an embodiment of the invention in which an addi-

tional talking current source 22 is used and in which the impulse impressing means comprises a single direct current induction generator 23 connected to the midpoint of the source 22. When the called subscriber answers, the switching mechanism 31 disconnects the calling line from the source 14 and connects it to the source 22 which is grounded at its midpoint at 24 through the generator 23. At predetermined intervals of time the generator 23 is energized and impresses an impulse on both sides of the calling line in parallel to operate the meter, as shown in Fig. 1 and described above.

In the drawing, a telephone system is illustrated in which the calling subscriber is charged for 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 charges are made on the multiple basis.

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 may be common to all the cords, 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 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 a telephone system, a plurality of subscribers' lines, means including a talking current supply bridge for establishing a talking circuit between two of said lines, means for closing a circuit including said talking current supply bridge and two sides of said talking circuit in parallel, bridging means across said circuit, and a measured service device connected to said bridging means and controlled over said circuit.

2. In a telephone system, subscribers' lines, bridging means across said lines, measuring apparatus connected from said bridging means to ground, connecting circuits for establishing talking connections between said lines, a talking current supply bridge across each of said connecting circuits, and means for impressing impulses through said talk-

ing current supply bridge on two sides of said lines in parallel to operate said measuring apparatus.

3. In a telephone system, subscribers' lines, bridging means across said lines, measuring apparatus connected from said bridging means to ground, connecting circuits for establishing talking connections between said lines, a talking current supply bridge across each of said connecting circuits, each of said talking current supply bridges including a plurality of impedance elements, and means for impressing impulses through said talking current supply bridge on two sides of said lines in parallel to operate said measuring apparatus.

4. In a telephone system, subscribers' lines, bridging means across said lines, non-marginal registering means connected from said bridging means to ground, connecting circuits for establishing talking connections between said lines, a current source grounded at its midpoint and adapted to supply talking current to said lines, and means for impressing impulses on both sides of said lines in parallel to operate said registering means.

5. In a telephone system, subscribers' lines, bridging means across said lines, non-marginal registering means connected from said bridging means to ground, connecting circuits for establishing talking connections between said lines, a talking current supply bridge across each of said connecting circuits, a current source grounded at its midpoint and adapted to supply talking current to said lines, and means for impressing impulses through said talking current supply bridge on both sides of said line in parallel to operate said registering means.

6. In a telephone system, a calling line and a called line, a bridge across said calling line, registering means connected from said bridge to ground, connecting circuits for establishing talking connections between said lines, a current source adapted to supply talking current to said calling line, a talking current supply bridge for said calling line, and means for periodically impressing impulses through said talking current supply bridge on both sides of said calling line in parallel to operate said registering means.

7. In a telephone system, a calling line and a called line, a bridge across said calling line, metering apparatus connected from the midpoint of said bridge to ground, connecting circuits for establishing talking connections between said lines, said connecting circuits including a talking current supply bridge for said calling line and a talking current supply bridge for said called line, a current source normally connected directly to said supply bridges and adapted to supply talking current to said lines, means adapted to impress impulses periodi-

cally on both sides of said calling line in parallel to operate said metering apparatus, and means controlled by the closure of the circuit of said called line for breaking the direct connection of said current source to the talking current supply bridge of said calling line and for reconnecting said current source to the talking current supply bridge of said calling line through said impulse impressing means.

8. In a telephone system, a calling line and a called line, a bridge across said calling line, non-marginal metering apparatus connected from the midpoint of said bridge to ground, connecting circuits for establishing talking connections between said lines, a talking current supply bridge for said calling line, a talking current supply bridge for said called line, a current source grounded at its midpoint and normally connected directly to both of said current supply bridges, means adapted to impress impulses on both sides of said calling line in parallel to operate said metering apparatus, filtering means located between said impulse impressing means and said calling line, means controlled by the closure of the circuit of said called line for breaking the direct connection of said current source to the talking current supply bridge of said calling line and for reconnecting said current source to

the talking current supply bridge of said calling line through said impulse impressing means, and means for operating said impulse impressing means at predetermined intervals of time.

9. In a telephone system, a calling line and a called line, a bridge across said calling line, registering means connected from said bridge to ground, connecting circuits for establishing talking connections between said lines, each of said connecting circuits including a talking current supply bridge for said calling line and a talking current supply bridge for said called line, a current source common to said connecting circuits and normally connected directly to said talking current supply bridges, means common to said connecting circuits for impressing impulses on both sides of said calling line in parallel to operate said registering means, and means individual to each connecting circuit for breaking the direct connection of said current source to the talking current supply bridge of said calling line, and for reconnecting said source to the talking current supply bridge of said calling line through said impulse impressing means.

In testimony whereof, I have signed my name to this specification this 19th day of June, 1928.

HENRY M. BASCOM.