

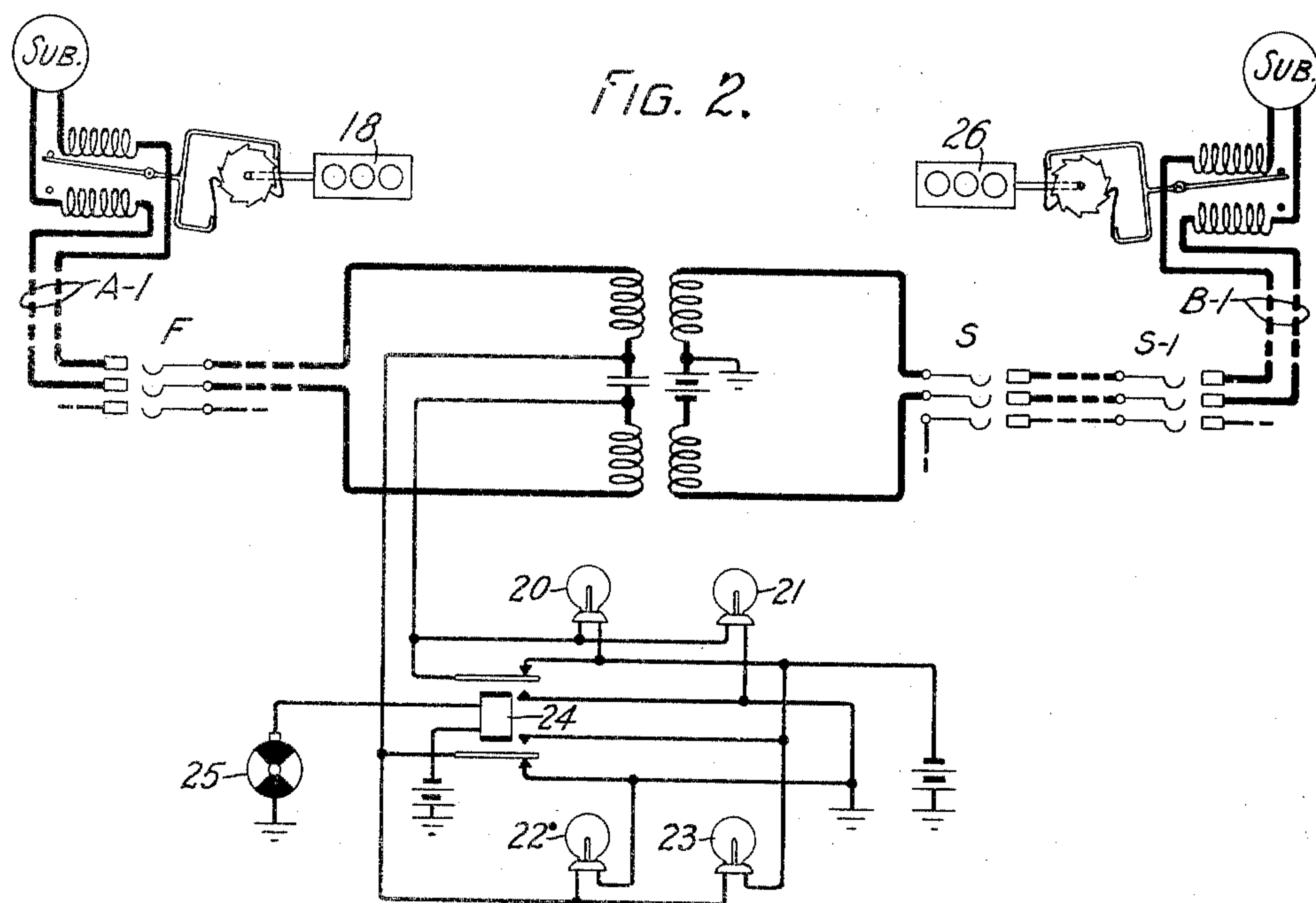
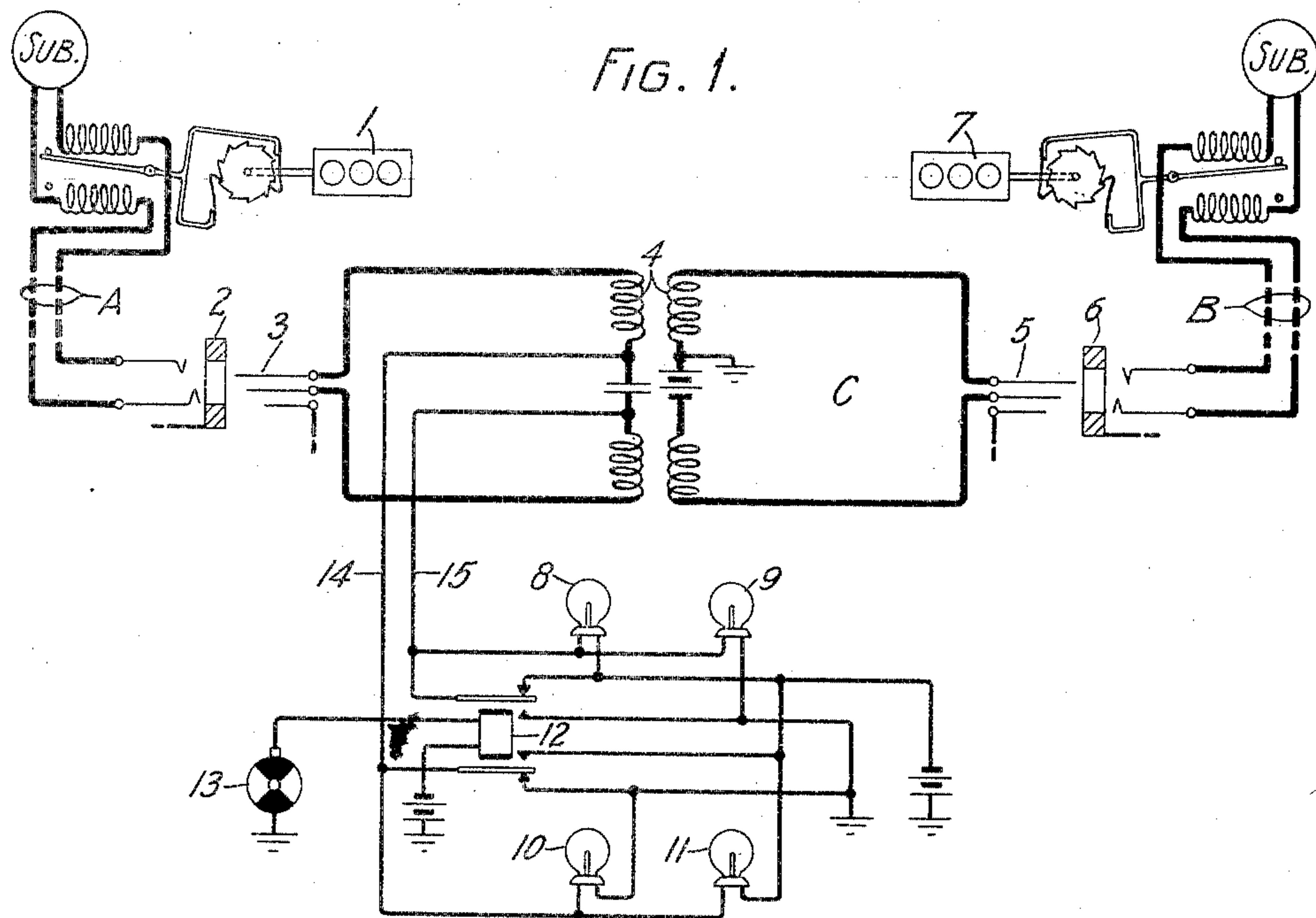
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P. HUSTA

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CURRENT CONTROLLING SYSTEM

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CURRENT-CONTROLLING SYSTEM

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This invention relates to current controlling systems and particularly to current reversing devices for operating the subscriber's meter on a telephone line.

Its object is to simplify and cheapen the equipment used at the central office for reversing the current over the subscriber's line.

Heretofore, reversing devices have been provided at the central office to periodically change the direction of current flow over the calling subscriber's line during conversation to operate a meter located at his substation. In order that the reversals may cause as little disturbance as possible in the subscriber's line, it has been necessary to make these devices of a complicated and expensive nature.

According to the present invention these objections are overcome by the use of tungsten filament lamps, which have a substantially higher resistance when heated than when cold. These lamps are so connected in the reversing circuit that this difference in resistance serves to prevent a sudden change of current in the subscriber's line due to reversal.

In the drawing, Fig. 1 illustrates a manual telephone system in which the invention is applied to the operator's cord circuit at the central office. Fig. 2 illustrates an automatic telephone system in which the invention is applied to a trunk line at the central office.

In electrical control systems involving central stations with lines extending therefrom it is frequently necessary to operate devices located on the lines under the control of mechanisms at the central station by reversing or otherwise changing the flow of current in the lines. In a telephone system where it is desired to actuate periodically, during the conversation interval, a service meter located at the subscriber's station, a convenient way of accomplishing this purpose is to reverse the direction of current in the subscriber's line at the end of each successive charging period. These reversals of current act upon a suitable meter of the polarized type which makes a cumulative record of the conversations on connections originated by the subscriber of the line.

Since this basis of charging the subscriber for his service involves successive reversals of current during the conversational period it is very essential that the disturbance, usually attendant upon such current changes, be reduced as far as possible. It is a known property of the tungsten filament lamp that its resistance is substantially less when the filament is cold than when the filament is heated. The change from minimum resistance to maximum resistance although uniform takes place rapidly when current is applied thereto. In the present system this principle is utilized to bring about a uniform change in the current flowing in the subscriber's line incidental to the reversing operation.

In Fig. 1 of the drawing a calling subscriber's line A is equipped at the substation with a meter 1 which is arranged to operate on reversals of current in the line. The line A terminates in a jack 2 at the central office. A called subscriber's line B, also equipped with a meter 7, terminates in the jack 6 at the central office.

The operator's position, at which these lines appear, is provided with a number of cord circuits such as the cord circuit C. Associated with the cord circuit C is a relay 12 which is repeatedly operated and released by means of an interrupter 13 to reverse the direction and flow of current delivered from the supply source through the windings of the repeating coil 4 to the calling subscriber's line A. These repeated reversals, which may occur, for example, every 15 seconds, cause the operation of the meter 1 during the conversational period. Since the current flow in the called line B undergoes no reversal the called subscriber's meter 7 is not actuated.

When the subscriber of line A initiates the call the usual supervisory signal (not shown) is lighted and the operator responds by inserting the plug 3 in the jack 2. After obtaining the number of the called line she completes the connection by inserting the plug 5 in the jack 6.

Assuming the relay 12 is deenergized the instant the plug 3 is inserted in jack 2, the following circuit may be traced for supplying

current to the calling line. Battery to the upper back contact of relay 12, conductor 15, lower left winding of repeating coil 4, thence over the ring side of the line and returning over the tip side through the upper left winding of coil 4, conductor 14, lower back contact of relay 12, to ground. With the relay 12 in this condition the lamp 8 is shunted at the upper back contact of the relay and accordingly its filament is cold. Similarly the lamp 10 is shunted at the lower back contact of the relay. Lamps 9 and 11 will be lighted in circuits traceable to the back contacts of the relay, but these lamps serve no useful purpose at this time.

As soon as the interrupter 13 closes its metallic segment relay 12 operates moving its armatures away from its back contacts. At the instant the back contacts of the relay open the shunts around lamps 8 and 10 are removed. These lamps are now included directly in series with the calling line and the source of current supply. The circuit may be traced from battery through the filament of lamp 8, conductor 15, and thence over the line as traced returning to conductor 14 through the filament of lamp 10 to ground. As the filaments of lamps 8 and 10 become heated the resistance increases thereby reducing the strength of current flowing in the line in a uniform manner to prevent any sudden change and a consequent click in the subscriber's receiver. An instant later the armatures of the relay 12 close their front contacts and the circuit for supplying current to the calling line may now be traced from battery through the lower front contact of relay 12, conductor 14 and thence over the line in the opposite direction and returning by way of conductor 15, upper front contact of relay 12 to ground. Thus a reversal of the current direction is effected in the calling line to cause the operation of meter 1 without producing a disagreeable sound in the subscriber's telephone receiver.

With the relay 12 energized, lamps 9 and 11 are shunted at the front contacts of the relay and accordingly the filaments of these lamps become cold and assume their minimum resistance values. When the interrupter 13 closes its next insulating segment relay 12 releases and breaks its front contacts. At this instant the lamps 9 and 11 are included directly in series with the calling line and the current supply source. This circuit may be traced from battery through the filament of lamp 11, conductor 14 and thence over the line and returning by way of conductor 15, filament of lamp 9 to ground. Lamps 9 and 11 heat their filaments and correspondingly reduce the value of the current flowing in the line. An instant later when the relay makes its back contacts the current supply source is connected directly to the calling line in the opposite direction

over the circuit originally traced. This produces another operation of the meter 1. The cycle of operations above explained will continue periodically as long as the connection is established.

At the end of conversation the connection is disestablished by removing the plugs of the cord circuit from the jacks of the subscriber's lines.

Fig. 2 shows a similar arrangement applied to an automatic system. The subscribers' lines A—1 and B—1 are equipped respectively with meters 18 and 26. When the subscriber of line A—1 initiates a call a line finder F operates to seize his line. In any well-known manner he causes the operation of selector switches S and S—1 to complete the connection to the called line B—1. During the establishment of the connection the relay 24, controlled by the interrupter 25, operates and releases periodically to reverse the direction of current while the lamps 20 and 22, and 21 and 23 serve to prevent sudden changes of current in the line due to these reversals.

Those parts of the system not pertaining directly to the invention have been illustrated schematically for the sake of simplicity. It will be understood that various types of connecting devices may be employed and that the invention itself may be applied to numerous other systems where it is desirable to prevent sudden changes of current value due to some control operation such as a current interruption or reversal.

The meters at the subscribers' stations are illustrated schematically and may be of any suitable type. For example, a meter of this character is illustrated in the patent to Thomson, No. 1,121,953, granted December 22, 1914.

It will also be understood that the automatic switches shown in Fig. 2 may be of any well-known type.

What is claimed is:

1. In combination, a line, a current operated device for said line, a source for supplying current to said line, means for connecting said source in circuit with the line, a current carrying element the resistance of which varies in response to the flow of current therein, means for changing the character of the connection of the supply source to said line to cause the operation of said device, and means for including said element in circuit with the line to prevent a sudden change of current flow therein.

2. The combination in an electrical system of a line and a current controlled device therefor, a source for supplying current to said line, means for connecting said source in circuit with the line, a current carrying element the resistance of which varies in response to the flow of current therein, means for changing the character of the connection of the

supply source to said line to cause the operation of said device, and means effective due to the change of the connection for including said element in circuit with the line.

3. In combination, a telephone line, a meter therefor, a source for supplying current to said line, means for connecting said source in circuit with the line, a current carrying element the resistance of which varies in response to the flow of current therein, means for altering the connection of the supply source to said line to cause the operation of said meter, and means for including said element in circuit with the line to prevent a sudden change in the flow of current therein.

4. In combination, a telephone line, a meter therefor, a source for supplying current to said line, means for connecting said source in circuit with the line, a current carrying element the resistance of which varies in response to the heating effect of current flowing therein, means for repeatedly altering the connection of the source to said line to cause successive operations of said meter, and means for including said element in circuit with the line at each alteration to prevent a sudden change of current in the line.

5. In combination, a subscriber's line, a meter for said line, a battery for supplying current to said line, means for connecting said battery in circuit with the line, a resistance element the resistance of which varies in response to the flow of current therein, means for periodically reversing the direction of current flowing in said line to cause successive operations of said meter, and circuits controlled by said reversing means for including said element in series with the line to prevent sudden changes of current therein.

6. In a telephone system, a subscriber's line, a meter therefor, a source for supplying current to said line, current carrying elements the resistance of which varies in response to the flow of current therein, a relay, means for alternately operating and releasing said relay to repeatedly reverse the direction of current in the line to cause the operation of said meter, and circuits for connecting one of said elements to said line on operation of the relay and another element to the line on release of the relay to prevent sudden changes of current in said line.

7. In combination, a telephone line and a meter therefor, a battery for supplying current to the line, means for connecting said battery in circuit with said line, an enclosed current carrying element the resistance of which increases as it is heated by the flow of current therein, means for changing the connection of the battery to said line to cause the operation of said meter, and means for including said element in circuit with the line to prevent sudden changes of current in said line.

8. In combination, a subscriber's line and a meter therefor, a source for supplying current to said line for conversation, means for connecting said source to the subscriber's line, means for altering the connection of the supply source to said line to cause the operation of said meter, a tungsten filament surrounded by a closed chamber the resistance of said filament increasing as its temperature rises due to the flow of current therethrough, and means for including said filament in circuit with the line.

9. In a telephone system, a subscriber's line, a meter therefor, a source for supplying current to said line, lamps having filaments the resistance of which varies in response to the flow of current therein, a relay having front and back contacts, means for repeatedly operating and releasing said relay to reverse the direction of current in the line to cause the operation of said meter, and circuits for including certain of said lamps in series with the line when the relay opens its back contacts and other of said lamps in series with the line when the relay opens its front contacts, said lamps causing a gradual change in the current value in said line.

10. In a telephone system, a calling subscriber's line and a meter therefor, a called subscriber's line, means for interconnecting said lines for conversation, a source for supplying talking current to the calling line, an element the resistance of which varies in response to the flow of current therein, means for repeatedly reversing the direction of current flowing in the calling line to actuate said meter, and means for including said element in circuit with the calling line to prevent sudden changes of current due to said reversals.

11. In combination, a line, a source connected to said line for supplying current thereto, a current carrying element the resistance of which varies in response to the flow of current therein, means for repeatedly reversing the connection of said source to said line, and means for including said element in circuit with the line.

12. In combination, a line, a source for supplying current to said line, means for connecting said source in circuit with the line, a current carrying element the impedance of which varies in response to the flow of current therein, means for successively reversing the connection of the supply source to said line, and means for including said element in circuit with the line.

In witness whereof, I hereunto subscribe my name this 24 day of October, A. D. 1927.

PHILIP HUSTA.

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