

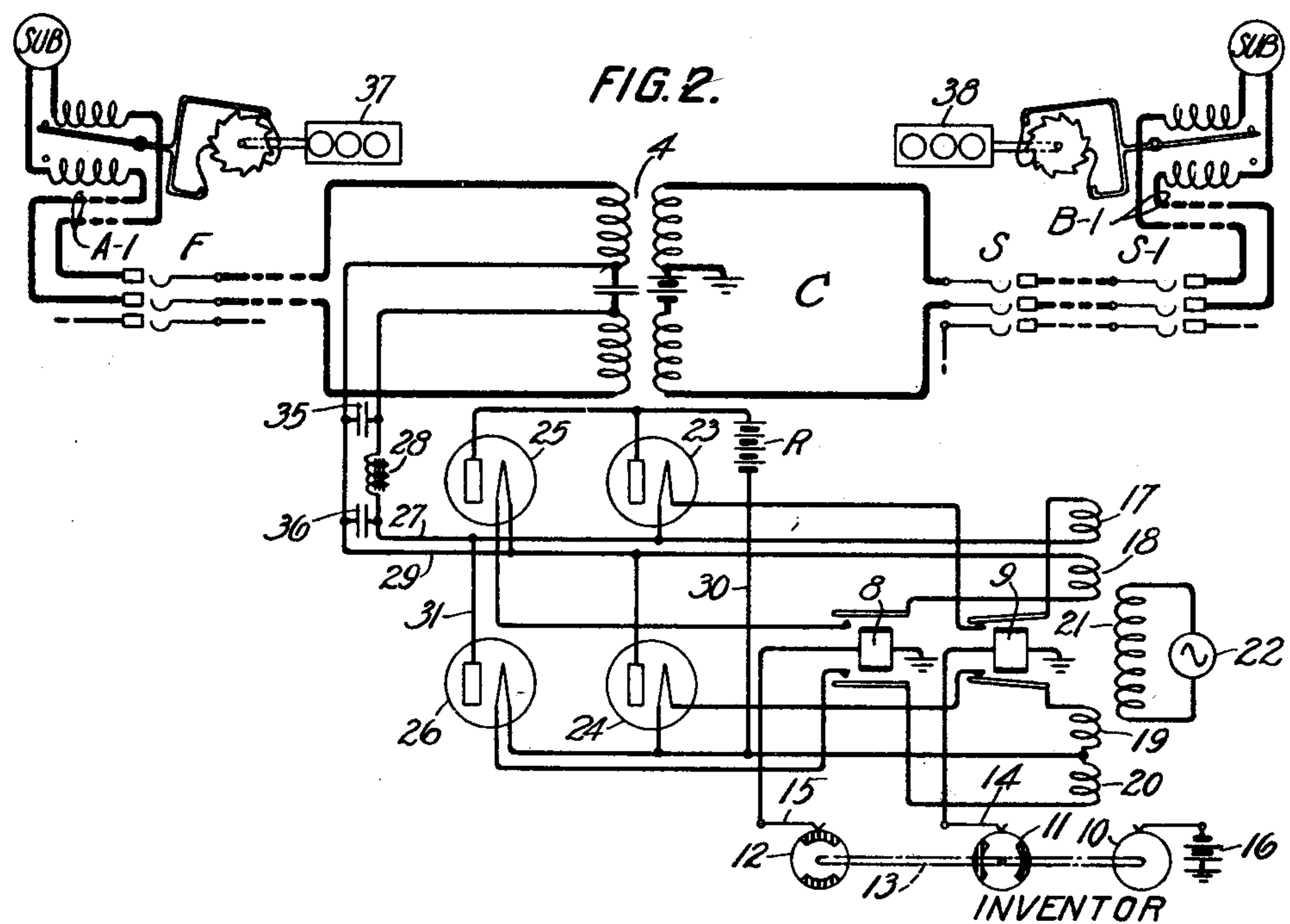
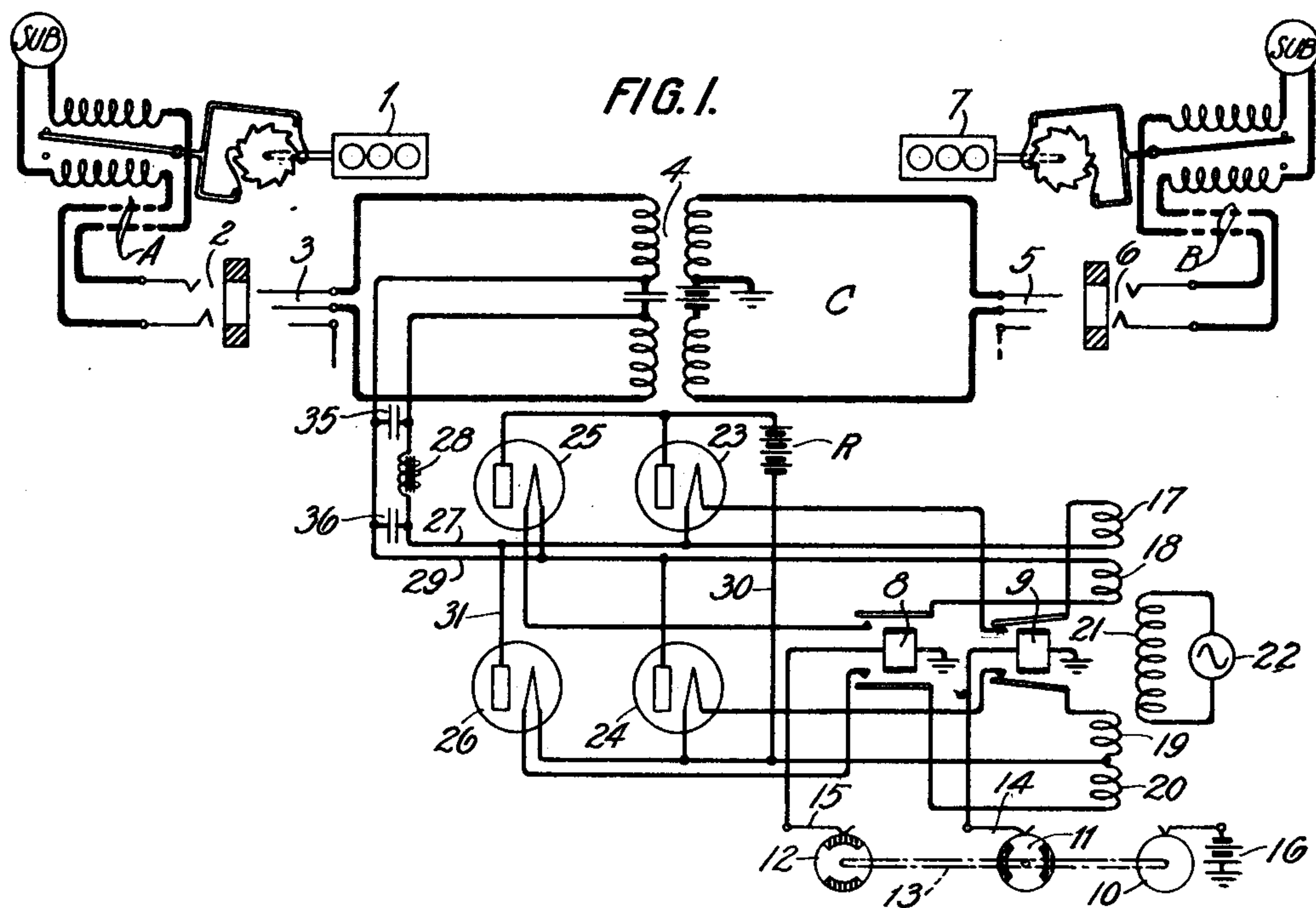
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CURRENT CONTROLLING DEVICE

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CURRENT-CONTROLLING DEVICE.

Application filed April 18, 1928. Serial No. 270,859.

This invention relates in general to current controlling devices and more particularly to current reversing devices as applied to telephone systems for operating metering equipment associated with subscribers' lines.

The object of this invention is to improve the means for effecting current reversals in telephone metering systems.

Heretofore reversing devices have been provided at central offices to periodically change the direction of current flow over a calling subscriber's line during conversation, to operate a meter located at the subscriber's substation. As such reversing devices are in operation during the period of conversation, it is essential that they function noiselessly and with a minimum of disturbance in the line circuit. Simplicity of construction and positiveness of operation are also essential to an efficient system of this type.

According to the present invention these requisites are met by the use of a plurality of electron discharge devices which have their filaments energized from a local source of current in pairs, alternately, so that current from a main supply is periodically reversed and sent out over an associated line circuit to actuate the metering device.

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

Fig. 2 illustrates an automatic telephone system in which the invention is applied to a trunk line at a central office.

In telephone systems where it is desirable to actuate periodically during the conversation period a service meter located at the subscriber's station, a convenient method 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 current reversals act upon a suitable meter of the polarized type which makes a record of the conversations originated by the subscriber of the line. This method is the basis of the operation of applicant's invention which will be readily understood from the following description.

A description of the operation of applicant's current reversing device will first be given in connection with its application to the manual system disclosed, reference being had to Fig. 1 exclusively.

In this figure 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 a 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 are two relays 8 and 9 which are repeatedly and alternately operated and released by means of an interrupter mechanism, to reverse the direction of flow of current delivered from the supply source R 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 a call the usual line signal (not shown) is lighted and the operator responds by inserting the plug 3 of the cord circuit C at her position into jack 2 associated with the lighted line lamp. After obtaining the details of the service desired she completes the connection by inserting plug 5 into jack 6 of the called line B.

The interrupter mechanism hereinbefore mentioned comprises three discs 10, 11 and 12 all rigidly mounted on a shaft 13 which is actuated by any suitable device and preferably at a speed of 1 R. P. M. The disc 10 is made entirely of conducting material whereas the discs 11 and 12 comprise alternate segments of insulating and conducting materials. The insulating segments cut arcs of 90° on the circumference of the discs so that the relays 8 and 9 controlled by the discs 12 and 11 respectively have two operated and two released periods for each revolution of their associated discs. It will be noted that the insulating segments of disc 11 are 90° out of phase with those of disc 12 so that, when the contact finger 14 is in engagement with a conducting segment of disc 11, the contact finger 15 will be in engagement with an insulating segment of disc 12 and vice versa. The three discs 10, 11 and 12 are electrically connected together

in any suitable manner so that the current source 16 serves to supply all three discs. The interrupter mechanism is continuously operating.

5 Assuming the discs 11 and 12 to be in the positions shown at the instant plug 3 is inserted in jack 2 it will be noted that relay 9 will be in its operated position and relay 8 deenergized. It is to be understood that the
10 windings 17, 18, 19 and 20 represent the secondary windings of a transformer, the primary winding of which is shown at 21 connected to the alternating current source 22.

With relay 9 operated as just described
15 the filaments of tubes 23 and 24 are connected across the transformer secondary windings 17 and 19 by way of the upper and lower armatures respectively of relay 9. These filaments are accordingly heated by
20 current from the source 22. At this time the circuit for the filaments of tubes 25 and 26 are opened at the armature contacts of relay 8.

Current from the source R now passes
25 over a circuit extending from the positive plate of battery R, plate to filament of tube 23, conductor 27, choke coil 28, lower left-hand winding of repeating coil 4, ring contacts of plug 3 and jack 2 and thence through
30 the actuating windings of meter 1 and the subscriber's subset, to the tip contacts of jack 2 and plug 3, upper left-hand winding of repeating coil 4, conductor 29, plate to filament of tube 24, conductor 30 to the negative
35 plate of battery R. Meter 1 is actuated in this circuit.

Due to the continued rotation of the interrupter discs the contact finger 14 will eventually engage the next succeeding insulating segment of disc 11 and relay 9 will
40 become deenergized and retract its armatures. The filament circuits of tubes 23 and 24 accordingly are opened.

When the contact finger 14 engages an insulating segment of disc 11 the contact finger 15 of disc 12 will engage a conducting segment and relay 8 will be energized. Under this condition of the control circuit, i. e. with relay 9 deenergized and relay 8 operated it will be noted that the filaments of
50 tubes 25 and 26 are connected across the transformer secondary windings 18 and 19 by way of the upper and lower armatures respectively, of relay 8. Tubes 25 and 26
55 now being actuated a circuit exists which may be traced from the positive plate of battery R, plate to filament of tube 25, conductor 29, through the operator's equipment and subscriber's metering device in a direction reverse to that hereinbefore described,
60 and thence through the choke coil 28, conductor 27, conductor 31, plate to filament of tube 26, conductor 30 to the negative plate of battery R. The meter 1 is again actuated in this circuit.
65

It is apparent from the foregoing description that for each 15 seconds of conversation, assuming the shaft 13 is to be rotated at 1 R. P. M., the meter 1 is actuated and that this actuation is repeated every 15 seconds
70 for the period of conversation. The cycle of operation just explained will continue periodically as long as the connection is established.

The choke coil 9 and associated condensers
75 35 and 36 serve as a filter to smooth out the wave form of the current at periods of reversal. This prevents the transmission of objectionable clicks to the subscriber's receiver.
80

At the end of conversation the connection is disestablished by removing the plugs 3 and 5 of the cord circuit C from jacks 2 and 6 of the subscribers' lines.

Fig. 2 shows a similar arrangement applied to an automatic system. The subscribers' lines A¹ and B¹ are equipped respectively with meters 37 and 38. When the subscriber of line A¹ initiates a call a line
85 finder F operates to seize his line. In any well known manner he causes the operation of selector switches S and S¹ to complete the connection to the called line B¹. It is believed unnecessary to repeat the description
90 of the operation of applicant's invention as applied to the automatic system disclosed since the description made in connection with the manual system disclosed is equally applicable.
95

Thus parts of the system not pertaining directly to the invention have been illustrated schematically for the sake of simplicity. The meters at the subscribers' stations are illustrated schematically and may be of
100 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.
105

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

What is claimed is:

1. In combination, a telephone line, a current operated device for said line, a source of current for said line and means including
115 a plurality of electron discharge devices for periodically reversing the flow of current from said source to actuate said current operated device.

2. In combination, a telephone line, a current operated device for said line, a source of current for said line, a plurality of electron discharge devices, and means for periodically energizing the filaments of said
120 electron discharge devices in pairs to effect the reversal of current from said source and the consequent periodic actuation of said current actuated device.
125

3. In combination, a telephone line, a current operated device for said line, a source
130

of current for said line, a plurality of electron discharge devices, a source of current and means for periodically associating said second source of current with the filaments
 5 of said electron discharge devices in pairs, alternately to effect the reversal of current from said first mentioned source of current and the consequent actuation of said current operated device.

10 4. In combination, a telephone line, a current operated device for said line, a source of current for said line, a plurality of electron discharge devices, a filament control relay for each pair of electron discharge de-
 15 vices and means for alternately actuating said relays to include said pairs of electron discharge devices in active circuit relation with said source of current to effect the periodic actuation of said current operated
 20 device.

5. In combination, a telephone line, a current operated device for said line, a source of current for said line, a plurality of electron discharge devices, a source of alternating current, a transformer having a primary
 25 winding normally bridging said source of alternating current, and a secondary coil for the filament of each of said electron discharge devices and means for alternately
 30 associating the filaments of said electron

discharge devices with their respective transformer coils in pairs to effect the reversal of current from said first mentioned source of current and the consequent actuation of said current operated device. 35

6. In combination, a telephone line, a current operated device for said line, a source of current for said line, a plurality of sets of vacuum tubes, a filament supply circuit for said tubes including a transformer and
 40 means for alternately connecting the filaments of said sets of tubes to the secondary of said transformer to effect the reversal of current from said source and the consequent
 45 actuation of said current operated device.

7. In combination, a telephone line, a link circuit for association therewith in the establishing of telephone connections, a current control device associated with said link
 50 circuit comprising a plurality of two electrode vacuum tubes and a source of current, means for alternately actuating the filaments of said vacuum tubes in pairs to effect the reversal of current from said source
 55 and a meter individual to said line receptive to said current reversals.

In witness whereof, I hereunto subscribe my name this 9th day of April, 1928.

ROBERT P. JUTSON.