

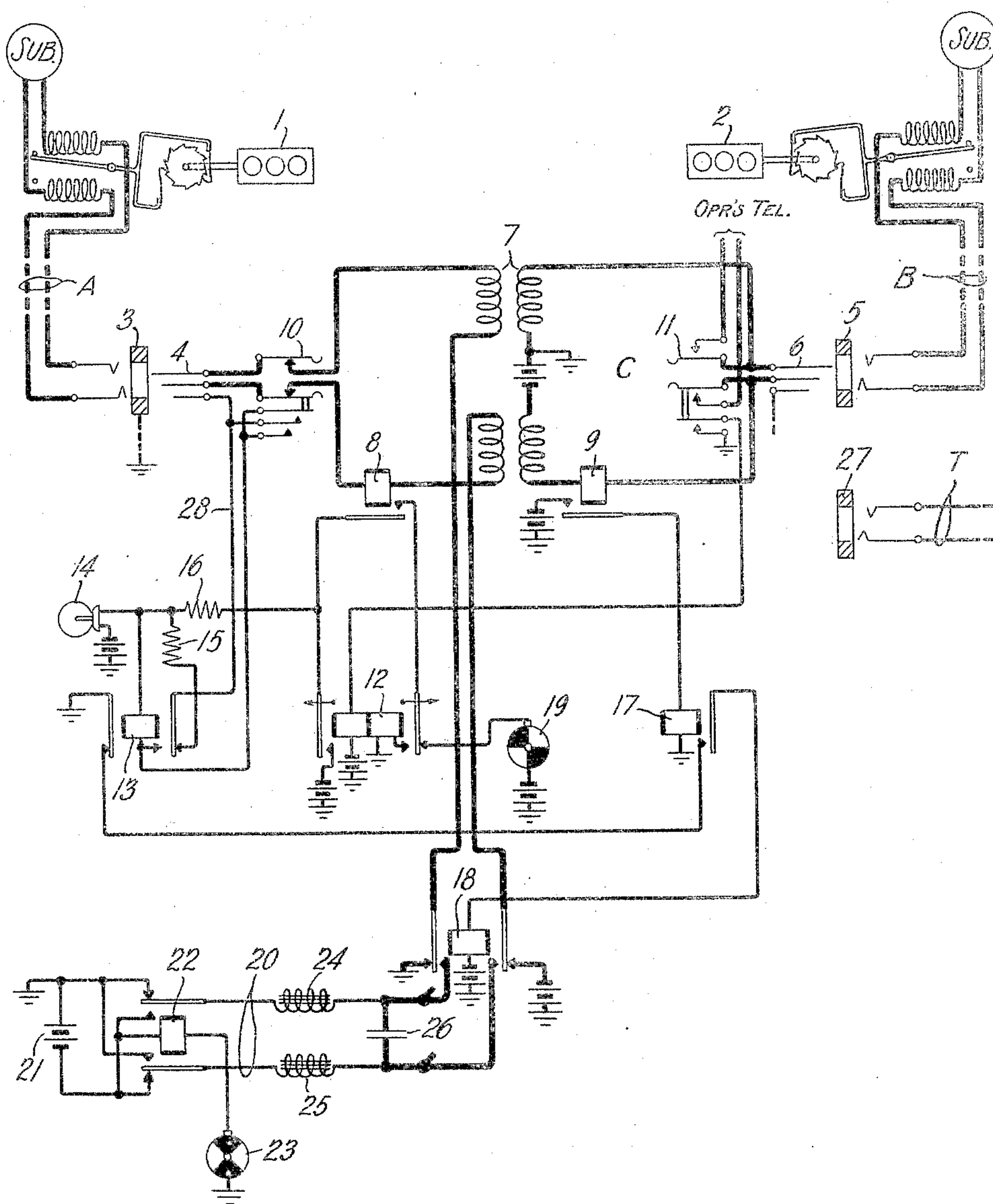
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TELEPHONE EXCHANGE SYSTEM

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TELEPHONE-EXCHANGE SYSTEM

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This invention relates to telephone exchange systems and particularly to systems in which the service charge is based on the duration of conversation.

5 The objects are to improve the service rendered to subscribers on lines equipped with substation meters and to secure greater reliability in the operation of the central office controlling circuits.

10 It has been proposed in the past to charge a calling subscriber for the service rendered by operating a meter, located at his substation, by reversing the current in the calling line at successive intervals during the period the
15 conversational connection is established between his line and the called line. To this end a current reversing device is provided at the central office and is rendered effective either when connection is completed to the
20 calling line, as by the insertion of the answering plug of a cord circuit, or when the called party answers. These prior systems, however, have not taken into account the different classes of called lines.

25 According to the present invention an improvement is secured in the service available to the calling subscriber by the provision of means for discriminating between calls for which the usual periodic charge should be
30 made during conversation and calls for which no charge should be made, such as calls to operators. When this discriminating means is operated the device for periodically reversing current in the calling line is rendered in-
35 effective so that no charge can be made.

A feature of the invention is a circuit arrangement in which the calling subscriber's supervisory relay may release momentarily due to the reversal of current in the line without affecting the supervisory signal.
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The drawing illustrates a portion of a telephone system in which the subscribers' lines appear at an operator's position. Two of these lines, A and B, are shown terminating
45 in jacks 3 and 5 respectively at the operator's position. The lines A and B are equipped respectively with meters 1 and 2 located at the substations. These meters are arranged to operate at successive intervals during the
50 conversation in response to successive re-

versals of current in the line. The central office circuits are so arranged that only the meter of the calling subscriber's line is actuated.

The operator's position is equipped with a
55 number of cord circuits such as the cord circuit C shown partly in detail in the drawing. A current reversing circuit 20 is provided in common to a plurality of cord circuits C. It is arranged to be associated with any particu-
60 lar cord circuit taken in use to supply current to the calling subscriber's line and to automatically reverse the direction of current flow in the line at successive intervals during the conversational period. The supply circuit 20
65 includes a source of current 21, a reversing relay 22, an interrupter 23, impedance coils 24 and 25, and a condenser 26.

The cord circuit C is provided with an individual relay 18 which serves to connect the
70 supply circuit 20 through the left windings of the repeating coil 7 to the tip and ring conductors of the calling line A. Similar relays are provided for the other cord circuits.

A detailed description will now be given
75 of the manner in which the system operates. Assume that the subscriber on the line A wishes to hold conversation with the subscriber of line B. The calling subscriber initiates the call in the usual manner and the operator
80 responds by inserting the plug 4 of the cord circuit in the jack 3. When the plug is inserted in the jack, a circuit is completed from battery through the lamp 14, resistance 15, back contact of relay 13, conductor 28, to
85 ground through the sleeve of the plug and jack. At the same time another circuit is completed from battery through the right back contact of relay 18, lower left winding of repeating coil 7, supervisory relay 8, con-
90 tact of key 10, over the ring side of the subscriber's line, and returning over the tip side through the contact of key 10, upper left winding of coil 7 to ground at the left back contact of relay 18. The relay 8 operates in
95 this circuit and completes a circuit from the interrupter 19, right back contact of relay 12, contact of relay 8, resistances 16 and 15, back contact of relay 13 to the grounded conductor 28. Each time the interrupter closes, the cir-
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cuit just traced is completed to battery and shunts the lamp 14. Therefore, the lamp 14 flashes under the control of the interrupter 19.

Next, the operator manipulates her talking key 11 to connect her telephone set to the cord circuit and converses with the calling subscriber. The depression of the talking key 11 completes an obvious circuit through the left winding of the slow-release relay 12. Relay 12 operates and locks in a circuit from ground through the right winding and contact thereof, contact of relay 8, to battery at the inner left contact of relay 12. Relay 12 at its right back contact opens the circuit to the interrupter 19 to discontinue the flashing of the lamp 14. The lamp 14 is now completely shunted by a circuit from battery through the left contact of relay 12, resistances 16 and 15, back contact of relay 13 to the grounded sleeve conductor 28. The lamp 14 is, therefore, extinguished.

The operator, having obtained the number of the called line, seizes the plug 6 and inserts it in the jack 5. Following this the operator applies ringing current to the called line in the well-known manner. When the called subscriber answers, a circuit is completed from battery through the lower right winding of coil 7, supervisory relay 9, thence over the ring side of the called subscriber's line B, and returning over the tip side through the upper right winding of the coil 7, to ground. The supervisory relay 9 operates and closes an obvious circuit for relay 17. Relay 17 completes a circuit from ground through the left contact of relay 13, contact of relay 17, to battery through the winding of relay 18. The relay 18 operates and connects the battery supply circuit 20 to the calling line. Assuming the relay 22 is deenergized at the time relay 18 operates, the circuit for supplying talking current may be traced from battery 21, lower back contact of relay 22, coil 25, right front contact of relay 18 through the lower left winding of coil 7, thence over the loop of the calling line A, and returning through the upper left winding of coil 7, left front contact of relay 18, coil 24, upper left contact of relay 22 to ground. The connection is now in condition for the subscribers to converse with each other.

At the end of measured intervals during the conversation the interrupter 23 causes the relay 22 to energize and release. For example, relay 22 may operate and remain operated for a 15-second period and then release and remain released for another 15-second period, the cycle being repeated. When the relay 22 operates it reverses the direction of current flowing from the source 21 over the calling subscriber's line, thereby causing the operation of the polarized message meter 1. The choke coils 24 and 25 and the condenser

26 serve to prevent sudden changes of current in the line due to the reversing operation.

At the end of conversation the subscribers replace their receivers on the switchhooks. When the called subscriber hangs up his receiver relay 9 releases, releasing the relay 17 which in turn opens the circuit of relay 18. Relay 18 releases, disconnecting the reversing circuit 20 from the calling line to prevent further operation of the meter 1.

If the calling subscriber hangs up his receiver first, his line is opened at the switchhook contacts to render the meter operating circuit ineffective. The calling subscriber by replacing his receiver on the switchhook opens the circuit of supervisory relay 8 which in turn opens the holding circuit of relay 12. Relay 12 releases and removes the shunt from the lamp 14. The lamp 14 accordingly lights and remains lighted until the operator removes the plug 4 from the jack 3.

It will be noted that the circuit of the calling line is opened momentarily at the contacts of relay 22 on each reversal of current. These interruptions of the line, although brief, are likely to result in corresponding releases by the supervisory relay 8. With the usual controlling circuit for the supervisory lamp, the release of the supervisory relay would be likely to cause the lamp to flicker. This unstandard operation of the lamp would probably confuse the operator and might result in an impairment of the service given the subscriber. According to the present arrangement, however, the momentary release of the supervisory relay 8 has no effect upon the lamp 14. This is due to the fact that the control of the lamp is removed from the relay 8 and placed with the relay 12 as above explained. Although the relay 8 on releasing momentarily opens the holding circuit of relay 12, the relay 12 does not retract its armatures due to its slow-release character.

If the calling subscriber wishes to recall the operator he depresses the switchhook momentarily and then releases it. The depression of the switchhook opens the circuit of relay 8, causing the release of relay 12. When relay 8 again operates a circuit is completed from the interrupter 19, through the right back contact of relay 12, contact of relay 8, resistances 16 and 15, right back contact of relay 13 to the sleeve conductor 28. The interrupter 19 causes the lamp 14 to flash to attract the operator's attention.

Assume next that the calling subscriber wishes to establish a connection with the information operator, or with some line for which no charge should be made. The operator answers the call in the same manner and upon learning the called number inserts the plug 6 in the jack 2 of trunk T. The trunk T may lead to the information operator's position. The operator knowing that

the call is a free one, actuates the key 10 momentarily. Key 10 completes a circuit from battery, through the lamp 14, winding of relay 13, contacts of said key, to ground through the sleeve contacts of the plug and jack. Relay 13 operates and locks through its right front contact to the grounded sleeve conductor 28. When the relay 12 operates as above explained it completes a circuit from battery through its inner left contact, resistance 16, winding and contact of relay 13, to the grounded sleeve conductor 28. This circuit shunts the lamp 14 to extinguish it.

When the called party answers the supervisory relay 9 operates, operating in turn the relay 17. Since the relay 13 is energized, however, relay 17 is ineffective to operate the relay 18. Accordingly the reversing circuit 20 is not connected to the calling subscriber's line during conversation and no actuation of the meter 1 takes place.

While the invention has been illustrated in connection with a manual system it is to be understood that it may be applied to systems employing automatic switches. It is also to be understood that numerous changes and alterations may be made and that the scope of the invention is to be limited only by the appended claims.

The meters at the substations are illustrated in diagrammatic manner and may be of any suitable construction. For example, reference is made to the register shown in the patent to Thomson, No. 1,121,953, granted December 22, 1914.

What is claimed is:

1. In a telephone system, a calling line and a number of called lines, means for interconnecting said calling line and any one of said called lines for conversation, a meter at the substation of the calling line, a device for repeatedly changing the flow of current in the calling line during conversation to actuate said meter, and means for rendering said device ineffective to discriminate between certain of said called lines.

2. In a telephone system, a calling line and a plurality of called lines, means for establishing a connection between the calling line and any one of said called lines, a meter at the substation of the calling line, a device for repeatedly reversing the direction of current flow in the calling line to actuate said meter, and means for rendering said device ineffective to discriminate between certain of said called lines.

3. In a telephone system, a calling line and a number of called lines, means for interconnecting the calling line and any one of said called lines, a message meter individual to the calling line, a device for periodically reversing the flow of current in the calling line to operate said meter during conversation, means controlled by the called subscriber to render said device effective, and means for

rendering said device ineffective to discriminate between certain of said called lines.

4. In combination, a calling line and a plurality of called lines, a meter for the calling line, an operator's position, a cord circuit at said position for establishing connection between the calling line and one of said called lines, a device for repeatedly changing the flow of current in the calling line to actuate said meter, and means controlled at the will of the operator for rendering said device ineffective.

5. In a telephone system, a calling line, two called lines of different classes, a meter for the calling line, means for establishing a connection between the calling line and either of said called lines, a device for reversing the flow of current in the calling line to repeatedly operate said meter, and means for rendering said device ineffective to discriminate between said called lines.

6. In combination, a calling line and a called line, means for interconnecting said lines, a meter at the substation of the calling line, a supervisory relay in circuit with the calling line, a signal controlled by said relay, means for repeatedly changing the flow of current in the calling line to actuate said meter, and means for preventing the momentary release of said relay due to said current change from affecting said signal.

7. In a telephone system, a calling line and a called line, means for interconnecting said lines for conversation, a register at the substation of the calling line, a supervisory relay in circuit with the calling line, a supervisory signal controlled by said relay, means for periodically reversing the flow of current in the calling line to actuate said register, and means for preventing the momentary release of said relay from affecting said signal.

8. In combination, a telephone line, a supervisory relay in circuit with said line, a supervisory signal, a second relay arranged to release in response to a prolonged deenergization of the first relay but not to respond to momentary releases thereof, a mechanism controlled by the second relay for intermittently actuating said signal, and means controlled by said second relay while energized for maintaining the supervisory signal in a given condition.

9. In a telephone system, a calling line and a called line, means for establishing a connection between said lines, a supervisory relay in circuit with the calling line, a supervisory signal, means for operating said signal intermittently, and a second relay for preventing the momentary release of the supervisory relay from affecting said signal.

10. In a telephone system, a calling line and a called line, means for establishing a connection between said lines, a supervisory relay in circuit with the calling line, a supervisory signal, means controlled by said

relay for actuating said signal intermittently, and a second relay controlled by the supervisory relay for preventing the momentary release of the supervisory relay from affecting said signal.

5 11. In a telephone system, a subscriber's line, a supervisory signal for said line, a circuit for said signal including means for actuating the signal intermittently, a supervisory relay for closing said circuit, and
10 means for disabling said circuit, said last means being non-responsive to certain operations of said supervisory relay and responsive to other operations of said relay to again render said signal effective.

15 12. In a telephone system, a telephone line and means for establishing a connection with said line, a supervisory signal for said line, a circuit for said signal, a supervisory relay
20 for closing said circuit to render the signal effective, a second relay effective to remove the control of said signal from the supervisory relay, and a circuit for the second relay controlled by the supervisory relay,
25 said second relay being responsive to certain operations of the supervisory relay to restore the control of said signal to said supervisory relay but non-responsive to other operations of said supervisory relay.

30 In witness whereof I hereunto subscribe my name this 7th day of January, 1928.

CLARENCE B. FOWLER.

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