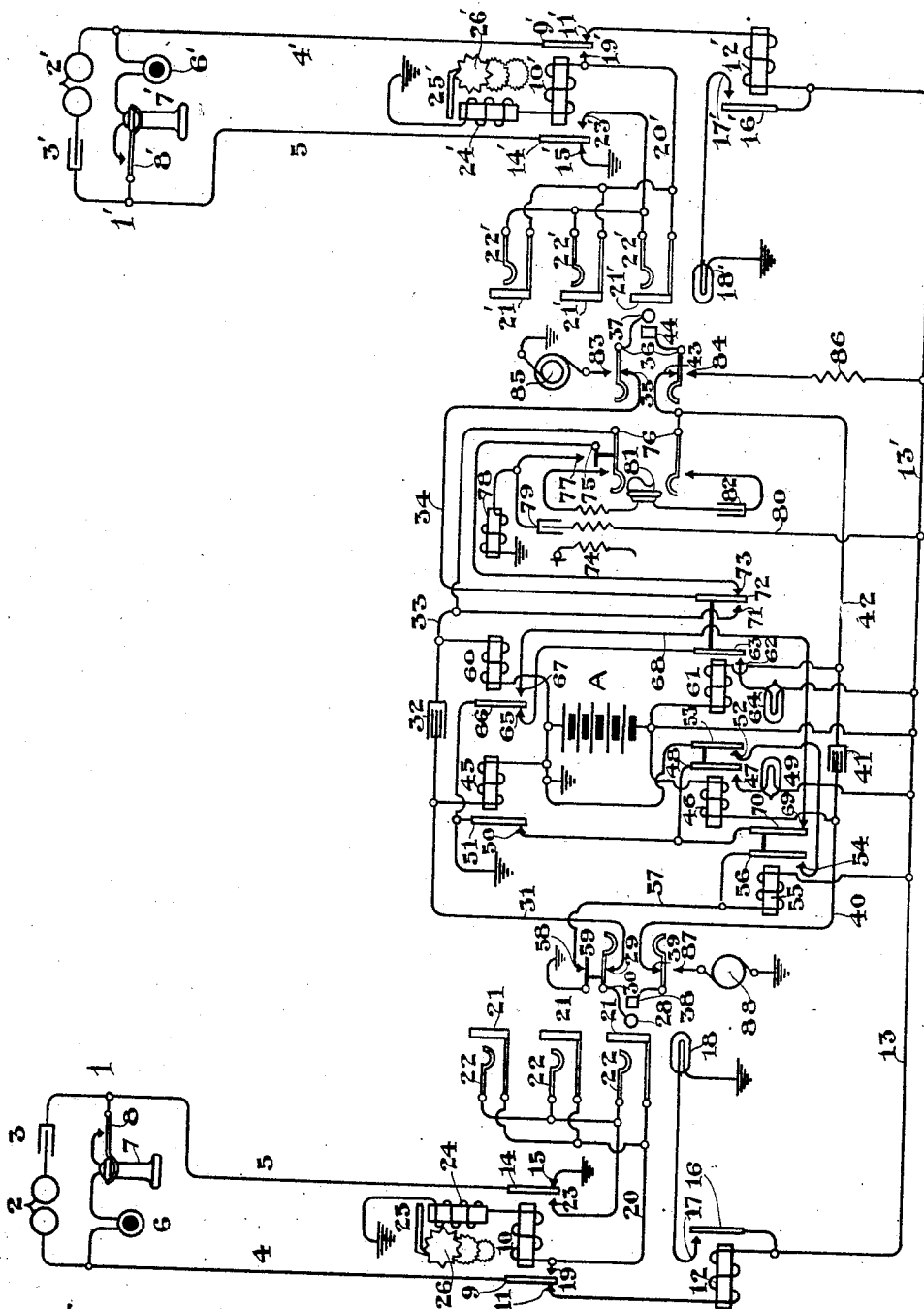


C. S. WINSTON.
SERVICE METER SYSTEM.
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SERVICE-METER SYSTEM.

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To all whom it may concern:

Be it known that I, CHARLES S. WINSTON, a citizen of the United States, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Service-Meter Systems, of which the following is a specification.

My invention relates to telephone service meter systems of the character adapted to two-wire telephone systems of the central energy type.

The object of my invention is to improve the signaling devices by which the operator is informed that it is time to register a call against a calling subscriber.

Another object of my invention is to improve the circuits and apparatus, to simplify them and to lessen the expense of their manufacture and installation.

Other objects of my invention will appear from the following description and claims.

My invention is illustrated in the accompanying drawing which shows all of the apparatus in its normal or unactuated position, and in which the subscriber's station 1 is represented as the calling station, and subscriber's station 1' is represented as the called station. Subscriber's station 1 is equipped with the usual annunciator 2, and condenser 3 in a permanent bridge between the line conductors 4 and 5, and with the transmitter 6 and receiver 7 in a bridge maintained normally open by contacts of the switch hook 8. At the central office the conductor 4 is connected with contact 9 of cut-off relay 10 and thence through contact 11, coil of line relay 12 and conductor 13 with the live pole of battery A. Line conductor 5 is connected with earth at the central office through the contacts 14 and 15 of cut-off relay 10. The line relay 12 controls the normally open contacts 16 and 17 in the circuit of the line lamp 18. One terminal of the coil of relay 10 is connected with contact 19 of that relay and thence through conductor 20 with the sleeve contact 21 of the answering and multiple jacks, the tip contact 22 of the answering and multiple jacks being connected with the inside contact 23 of the cut-off relay 10. The other terminal of the cut-off relay 10 is connected through the coil of the line service meter 24 with earth. This service meter may be of any desired construction but preferably has an

armature 25 adapted by its actuation to move the registering mechanism 26 step by step as the armature is actuated. The called line 1' is equipped with apparatus similar to that of the calling line, the corresponding apparatus of this line being designated by like figures with the suffix "'". The cord circuit for connecting the calling and called lines for conversation is of the two wire type and has the tip and sleeve talking strands extending respectively from the tip 28 of the answering plug through contact 29 of the key 30, conductor 31, condenser 32, conductors 33 and 34, contact 35 of the ringing key 36 to the tip 37 of the calling plug, and from the sleeve contact 38 of the answering plug through contact 39 of the key 30; conductor 40, condenser 41, conductor 42, contact 43 of the operator's ringing key 36 to the sleeve contact 44 of the calling plug.

Supervisory relays 45 and 46 are connected with their coils in series with the battery A in a bridge between the tip and sleeve conductors on the answering end of the cord circuit. Relay 46 controls the normally open contacts 47 and 48 in the circuit of the supervisory signal 49, the circuit of this signal also normally including the contacts 50 and 51 of supervisory relay 45. Relay 46 also has the normally open contacts 52 and 53, contact 53 being connected with earth and contact 52 being connected with the normally open contact 54 of the locking relay 55. Contact 56 of this relay is adapted to make connection with contact 54 when the relay is actuated and is connected with the coil of relay 55 and through conductor 57 with the auxiliary contact 58 of the key 30, this auxiliary contact being adapted to make connection with the contact 59 when the key is actuated, contact 59 being connected with earth. Across the calling end of the cord circuit the supervisory relays 60 and 61 are connected in series with the battery A, relay 61 controlling the normally open contacts 62 and 63 in the circuit of the supervisory signal 64 and the relay 60 controlling the normally closed contacts 65 and 66 in the circuit of that signal. The supervisory relay 60 also has the normally open contact 67 adapted to make connection with the contact 66 when the relay is actuated. The contact 67 is connected through conductor 68 and the normally closed contacts 69 and

70 of locking relay 55 with the contact 48 of relay 43. Supervisory relay 61 has the normally open contacts 71 and 72 maintaining a separation between the portions 33 and 34 of the tip talking conductor. Contact 72 is normally connected through contact 73 and conductor 74 with the auxiliary contact 75 of the operator's key 76. This contact is adapted upon the actuation of the key 76 to connect with the contact 77 and thence with the impedance coil 78 and with the condenser 79. The other terminal of the impedance coil 78 is connected with earth, while the other terminal of the condenser 79 is connected through the tertiary of the operator's induction coil and conductor 80 with the live pole of battery A. The actuation of the listening key 76 connects the secondary of the operator's induction coil, the operator's receiver 81 and the condenser 82 in a bridge between the talking strands of the cord circuit. The operator's ringing key has aside from its series contacts 35 and 43 the contacts 83 and 84, contact 83 being connected through the ringing generator 85 with earth, and the contact 84 being connected through the non-inductive resistance 86, and conductor 13' with the live pole of battery A.

30 Having thus described the connections of the apparatus of my invention in its preferred form, the operation of the system is as follows: The calling subscriber having charge of subscriber's station 1 removes his receiver 7 from the switch-hook 8 and completes a circuit from the live pole of battery A through conductor 13, the coil of line relay 12, contacts 11 and 9 of cut-off relay 10, line conductor 4, transmitter 6, receiver 7, switch-hook 8, line conductor 5 and the contacts 14 and 15 of cut-off relay 10 to earth. The current in this path actuates line relay 12 closing its contacts 16 and 17 in the circuit of the line signal 18. The display of this signal attracts the operator's attention and she therefore inserts her answering plug into the jack designated by the display of the signal, thereby completing the connections between the tip and sleeve contacts 28 and 38 of the plug and the tip and sleeve contacts 22 and 21' of the jack. A circuit is thus completed from the live pole of battery A through the coil of supervisory relay 46, conductor 40, contact 39 of the key 30, sleeve contacts 38 and 21 of the answering plug and jack, conductor 20, the coil of cut-off relay 10 and the coil of the line service meter 24 to earth. The current in this path being sent from a battery of the usual E. M. F. of about 60 24 volts, is not sufficient to actuate the service meter 24 but is sufficient to actuate relays 10 and 46. The actuation of relay 10 moves its contacts 9 and 14 to their inner positions and severs the circuit of the line relay 12, thus effacing the line signal 18. The actua-

tion of relay 46 completes the circuit of the supervisory signal 49 at contacts 47 and 48 of that relay. The operation of cut-off relay 10, however, immediately completes a second circuit from the contact 19 of relay 10 through contact 9 of that relay, line conductor 4, transmitter 6, receiver 7, switch-hook 8, line conductor 5, contacts 14 and 23 of the cut-off relay 10, tip contacts 22 and 28 of the jack and plug, contact 29 of the key 30, conductor 31 and the coil of supervisory relay 45 to earth. The current in this path actuates the relay 45 separating its contacts 50 and 51 and preventing the display of the supervisory signal 49. The operator now throws her listening key 76 and obtains the number of the desired line. She then raises her calling plug and touches its tip contact 37 with the sleeve contact 21' of the jack of the desired line. If the line is busy the sleeve contact of one of the multiple jacks will be connected with the sleeve contact of another cord circuit and will therefore be maintained at a potential higher than that of ground. Current will therefore flow from the sleeve or testing contact over the tip 37 through contact 35 of the ringing key 36, over conductor 34, through contacts 72 and 73 of the supervisory relay 61, over conductor 74, through the now closed auxiliary contacts 75 and 77 of the operator's listening key 76 to earth through the impedance coil 78. This slightly lowers the potential of one terminal of the condenser 79 and causes a partial discharge of that condenser. This discharge current produces a disturbance in the tertiary and an inductive disturbance in the secondary of the operator's induction coil and causes a slight click to be produced in the operator's receiver. If no click is heard, however, the operator knows that the desired line is idle and therefore releases her listening key and inserts her calling plug completely into the jack of the desired line causing its contacts 37 and 44 to register respectively with the contacts 22' and 21' of the jack. The operator now throws her ringing key 36 and immediately completes a circuit from the live pole of battery A over conductor 13' through the non-inductive resistance 86, contact 84 of the ringing key 36, sleeve conductors 44 and 21' of the plug and jack, conductor 20', the coil of cut-off relay 10' and the coil of line service meter 24' to ground. The current in this path is sufficient to actuate the cut-off relay 10' but is not sufficient to actuate the line service meter 24'. The actuation of relay 10' connects its contacts 9' and 14' with the contacts 19' and 23' and thereby completes a circuit from the generator 85 through contact 83 of the ringing key, tip contacts 37 and 22' of the plug and jack, contacts 23' and 14' of the cut-off relay 10', line conductor 5', condenser 3', annunciator 2', line conductor 4', con-

tacts 9' and 19' of cut-off relay 10', conductor 20', sleeve contacts 21' and 44 of the jack and plug, contact 84' of the ringing key 36, non-inductive resistance 86 and conductor 13' to ground through the battery A and thence back to the other pole of the ringing generator 85. The current from the generator 85 being alternating passes through the condenser 3' and sounds the annunciator bell 2'. The operator's ringing key 36 is released after a single signal has been given and immediately upon its release a new circuit is formed from the live pole of battery A through the coil of supervisory relay 61, sleeve conductor 42, contact 43 of the ringing key 36, sleeve contacts 44 and 21' of the plug and jack, conductor 20', the coil of relay 10' and the coil of the line service meter 24' to ground. The current in this path actuates relays 61 and 10' but is not sufficient to actuate the service meter 24'. The actuation of supervisory relay 61 completes the circuit from the live pole of battery A through the supervisory signal 64, contacts 62 and 63 of the supervisory relay 61 and contacts 65 and 66 of supervisory relay 60 to ground, thus displaying the signal 64 and indicating to the operator that the called subscriber has not yet answered his call.

Upon the response of the called subscriber a new circuit is completed from the live pole of battery A through the coil of supervisory relay 61, conductor 42, contact 43 of the ringing key 36, sleeve contacts 44 and 21' of the plug and jack, conductor 20', contacts 19' and 9' of the cut-off relay 10', line conductor 4', transmitter 6', receiver 7', switch-hook 8', line conductor 5', contacts 14' and 23' of cut-off relay 10', tip contacts 22' and 37 of the jack and plug, contact 35 of the key 36, conductor 34, the now closed contacts 72 and 71 of relay 61, conductor 33 and the coil of relay 60 to the ground pole of battery A. Current in this path actuates relay 60 and opens the contacts 65 and 66 of that relay, thus severing the circuit of the supervisory signal 64 and effacing that signal. The actuation of relay 60 completes the circuit between its contacts 66 and 67 and thus completes a path for current from the live pole of battery A through the supervisory signal 49, contacts 47 and 48 of the supervisory relay 46, contacts 70 and 69 of the locking relay 55, conductor 68 and contacts 67 and 66 of relay 60 to earth. This displays the answering supervisory signal 49 which indicates to the operator that the subscribers have received their connection and are in conversation, and that it is now time to register a call against the calling subscriber. The operator now throws her service meter key 30 connecting the sleeve spring of the key with the contact 87 which is connected with the direct current generator 88. The generator 88 being of a higher potential

than the battery A furnishes sufficient current through the sleeve contacts 38 and 21 of the plug and jack, conductor 20, the coil of cut-off relay 10 and the coil of the service meter 24 to actuate the service meter, this generator being preferably of about 50 volts. The actuation of the service meter key also closes the auxiliary contacts 58 and 59 of the service meter key so that the relay 55 will not again be deenergized until its circuit is severed by the deenergization of the supervisory relay 46, whereby the contacts 52 and 53 of that relay will be severed. The actuation of relay 55 separates the contacts 69 and 70 in the circuit of the supervisory signal 49 and therefore effaces that signal and maintains it effaced during the remainder of the conversation. When the conversation is completed the subscribers replace their receivers upon their respective hook switches and again sever the circuits of the supervisory relays 45 and 60, allowing those relays to fall back and complete the connection between their contacts 50 and 51, and 65 and 66. These connections again complete the circuits of supervisory signals 49 and 64 and display these signals indicating to the operator that the conversation has terminated. The operator now removes her answering and calling plugs from their respective jacks and thereby severs the circuits through the cut-off relays 10 and 10' and the supervisory relays 46 and 61. As soon as the supervisory relay 46 falls back to its normal position and severs the contacts 52 and 53 the circuit of locking relay 55 is interrupted and that relay resumes its normal condition. The apparatus is now in normal condition throughout and all of the signals are effaced.

While my invention is shown and described in combination with certain details it is to be understood that these details are not all of them essential to my invention, and that I do not wish to be unduly limited thereto, many variations from the system here shown being possible without departing from the spirit or scope of my invention.

I claim:

1. In a telephone system, the combination with a telephone line, of a service meter having its coil permanently connected between one of the talking conductors and a return conductor, a cord circuit to connect with the line, a source of current associated with the cord circuit and adapted to furnish current to the line during conversation, the current from said source through said service meter being insufficient for the actuation of the service meter, a second source of current of higher potential associated with the cord circuit and adapted to be connected with a limb of the line to actuate the service meter, and means for opening the circuit of the other limb of the line during the connection of said latter source with the line to prevent

an abnormal current from flowing through the subscriber's instrument, substantially as described.

2. In a telephone system, the combination with a telephone line having two conductor jacks at the central office, of a cut-off relay having one of the terminals of its coil connected with one of the contacts of said jacks, a service meter connected between the other terminal of the coil of the cut-off relay and a third conductor, a cord circuit and a source of current associated therewith to furnish current for the actuation of said service meter, substantially as described.

3. In a telephone system, the combination with a telephone line having a two-conductor jack at the central office, of a cut-off relay and a service meter having their coils connected in series between one of the contacts of said jack and a third conductor, a cord circuit to connect with the line, a source of current normally connected with one of the strands of said cord circuit and adapted to be connected with said cut-off relay and service meter when the cord is connected with the line, said source being of insufficient electromotive force to actuate the service meter, a second source associated with the cord circuit adapted to be momentarily connected with the coil of the cut-off relay and service meter, said source being of sufficient electromotive force for the actuation of the service meter, substantially as described.

4. In a telephone system, the combination with a telephone line having a two-conductor jack at the central office, of a cut-off relay and a service meter having their coils connected in series between one of the contacts of said jack and a third conductor, a cord circuit to connect with the line, a source of current normally connected in a bridge between the strands of said cord circuit and adapted to be connected between the limbs of the telephone line when the cord is connected with the line, a service meter key having series contacts in the strands of said cord circuit adapted when actuated to disconnect said source from the limbs of the telephone line, a second source adapted to be connected with one of the limbs of the telephone line when said service meter key is actuated, said source being adapted to furnish current for the actuation of the service meter, substantially as described.

5. In a telephone system, the combination with a telephone line, of a cord circuit to connect therewith, a supervisory signal associated with each end of the cord circuit, the answering supervisory signal being adapted to be displayed when a called sub-

scriber answers his call, a service meter key associated with the cord circuit and adapted when actuated to efface said answering supervisory signal, and means to prevent the re-display of said signal until the calling subscriber terminates his conversation, substantially as described.

6. In a telephone system, the combination with a telephone line, of a service meter for the line, a cord circuit to connect with the line for conversation, an answering supervisory signal associated with the cord circuit adapted to be displayed when a conversation has been established, a key for the control of said service meter, and means to efface said signal by the actuation of said key, substantially as described.

7. In a telephone system, the combination with a telephone line, of a service meter for the line, a cord circuit to connect with the line, an answering supervisory signal associated with the cord circuit and adapted to be displayed when a conversation has been established, and means under the control of the operator for actuating said service meter, the actuation of said means also effacing said signal, substantially as described.

8. In a telephone system, the combination with a telephone line, of a cord circuit to connect therewith, a service meter for the line, an answering supervisory signal associated with the cord circuit, said signal being adapted to be displayed when a conversational connection has been established to indicate to the operator that it is time to actuate the service meter, and means to efface said signal after the service meter has been actuated, substantially as described.

9. In a telephone system, the combination with a telephone line, of a cord circuit to connect therewith, a service meter for the line, an answering supervisory signal associated with the cord circuit, said signal being adapted to be displayed when a conversational connection has been established to indicate to the operator that it is time to actuate the service meter, and means to efface said signal after the service meter has been actuated, said signal being again displayed when the calling subscriber terminates his conversation, substantially as described.

Signed by me at Chicago, county of Cook, and State of Illinois, in the presence of two witnesses.

CHARLES S. WINSTON.

Witnesses:

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