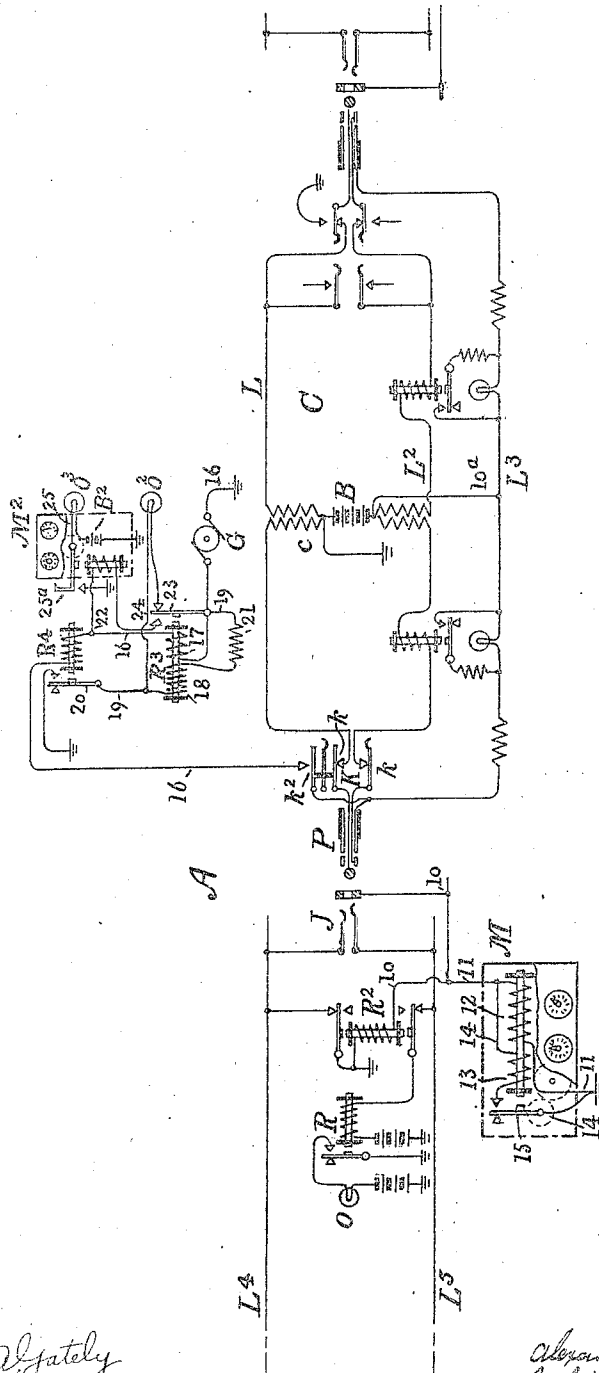


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LOCKING AND SIGNALING SYSTEM FOR TELEPHONE REGISTERS.
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UNITED STATES PATENT OFFICE.

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LOCKING AND SIGNALING SYSTEM FOR TELEPHONE-REGISTERS.

938,026.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ALEXANDER S. SPIEGEL, residing at Chicago, in the county of Cook and State of Illinois, have invented certain Improvements in Locking and Signaling Systems for Telephone-Registers, of which the following is a specification.

Central station meters employed in measuring telephone service are often so arranged that they are caused to register through the depressing of a key by an operator, this being done only after the desired connection is actually made, so that unsuccessful calls may not be recorded. This manner of meter control, however, sometimes proves objectionable because of the tendency of the operators to actuate the key more than once during a single connection, thus leading to an excess charge. The invention herein set forth avoids this difficulty by providing means for rendering each meter incapable of operation a second time during the period of a single insertion of the answering plug of a cord circuit in the jack belonging to the calling subscriber, whether said meter be associated with a line or whether it be common to the cords of an operator's position. Moreover, my invention furnishes a system of signals informing an operator both as to her own acts and their effect upon the meters.

The appended drawing shows diagrammatically an embodiment of the invention in connection with a single cord circuit and a pair of substation lines, of which only that calling need be considered here.

The connecting or cord circuit C, forming one of a group belonging to an operator at a central station A, is a standard form having talking strands L L² containing the usual repeating coil c, between the windings of which is bridged the office battery B with one pole grounded and with the free pole joined to the third conductor L³ of the cord by a conductor 10^a. The answering plug P of the cord coöperates with answering jacks J, of which one is illustrated, this having joined to its tip and ring contacts the two limbs L⁴ and L⁵ of a substation line and furnishing with said plug a connecting switch. The customary line relay R governs the local circuit of the line lamp O. Connected to the thimble of the jack by a third conductor 10 is the usual cut-off relay R², and in a conductor 11 extending between

conductor 10 and ground is the high resistance winding 12 of a line meter M, which, as to its registering mechanism, may be of any convenient type and upon which are to be recorded the connections secured from the substation of the line to which it is united. This meter also has a low resistance winding 13 included in a conductor 14, normally open at the meter armature 15 but placed in parallel with the winding 12 when the meter is energized.

Included in the answering side of the cord is a register key or circuit closer K, serving upon its depression to bring the proper meters into play. Contacts k k of this key then separate the answering plug from the talking strands L L², and a contact k² completes the circuit between the conductor L³ of the cord and a conductor 16, leading through controlling relays R³ and R⁴ associated with a suitable position meter M² to the free pole of a grounded generator G or some other source of electrical energy of considerably higher potential than the source B. The position meter furnishes a record of the total number of connections registered by the operator with whose cords it is connected. The relay R³ is differentially wound, having one winding 17 in the conductor 16 in series with the generator and relay R⁴, while the opposite winding 18, preferably having a greater number of turns than 17, is connected to ground by a conductor 19 extending from conductor 16 at a point between the generator and winding 17, and comprising the normally open front contact of the armature 20 of relay R⁴. A resistance 21 is shown in the conductor 19 in series with the winding 18, this resistance 21 and the resistance of the other elements of the circuit having such values and the two windings of relay R³ being so arranged, that when the armatures 15 and 20 of the line meter and relay R⁴, respectively, are both attracted the ampere-turns of said windings will be approximately equal, and since they are oppositely wound their effect upon the relay will be neutralized. But before the armature 15 brings in the low resistance winding 13 of the line meter there will be an excess of current through winding 18 of the differential relay, which is therefore unbalanced and free to operate.

As an example of conditions which have proved successful in practice, it may be said

that the cut-off relay may have a resistance of 30 ohms; relay R^4 , 0.5 of an ohm; the windings 17 and 18 of the relay R^3 , 8 ohms and 2.5 ohms, respectively, the latter having twice as many turns as the former; the resistance 21, 45 ohms; the high resistance winding 12 of the line meter M , 500 ohms, its low resistance winding, 40 ohms; and the position meter M^2 , 0.25 of an ohm. The potential of the office battery may be approximately 24 volts and the potential of the generator G , 34 to 38 volts.

The energizing coil of the position meter is in a branch conductor 22 joined to the conductor 16 in parallel with the winding 17 of relay R^3 , this portion of the circuit being normally open at the front contact of armature 23 of relay R^3 . Upon its back contact this armature completes a conductor 24 leading to conductor 19 between said relay and the armature 20 of relay R^4 and containing some such signal device as a lamp O^2 of distinctive color, as, for example, green. Meter M^2 when energized completes by its armature 25 a local circuit 25, containing a battery B^2 and a second lamp or signal device O^3 of a different color from the lamp O^2 , say red.

When in response to the illumination of the line lamp O the operator inserts the plug P in the jack J , current flows from the battery B through the third conductor of the cord, sleeve of the plug and thimble of the jack and conductors 10 and 11 to ground through both the cut-off relay R^2 and the winding 12 of the line meter M . The relay is thereby energized to disconnect relay R from the line, but on account of the resistance of the winding 12 the current delivered by the office battery is insufficient to cause the line meter to attract its armature. After securing the line wanted, to produce a registration of the connection, the operator depresses the key K . This completes a circuit from the generator G to ground by way of conductor 16, winding 17 of relay R^3 and winding of relay R^4 , conductor L^2 , cooperating contacts of the plug and jack, conductors 10 and 11 and winding 12 of the line meter. In spite of the resistance of the circuit the generator potential gives enough current to energize the line meter and also relays R^3 and R^4 , and the armature of relay R^3 closes the branch 22 containing the position meter, but this does not receive current enough to operate it until the armature 15 of the line meter brings the low resistance winding 13 in parallel with its high resistance winding 12. The consequent reduction in the resistance of the circuit so augments the current through the conductor 22 that the position meter operates, and at the same time closes the circuit 25, lighting the red lamp O^3 . The operator, seeing this is assured that registration has been effected upon

both the line and position meters. It should be noted that the relay R^3 was not dependent upon the winding 17 acting alone to energize it, since if relay R^4 first brought into circuit at its armature 20 the winding 18, R^3 is still unbalanced and acts as previously described until armature 15 of the line meter has also been attracted.

After the operator has released the key, opening the contact k^2 , the line meter remains locked up as long as the answering plug is in the jack by current from battery B over conductors 10^a, L^3 , 10 and 11, for while this was not great enough to cause the drawing up of the armature, it will retain it when once attracted. The position meter, however, together with the relays R^3 and R^4 are deenergized, so that this meter could again be operated upon the same connection by a second depression of the key were it not for the fact that the reduction of resistance of the circuit produced and maintained at the line meter now makes the windings 17 and 18 equivalent to one another, and in consequence of their differential relation the armature 23 is not attracted and the position meter also remains unaffected. Therefore both meters are temporarily locked out of service, or until the operator has withdrawn the answering plug. Then the opening of the third conductor of the cord circuit at the plug and jack deprives the line meter of current from the office battery and it also is released, restoring all of the registering apparatus to its initial condition. In this way all possibility of the duplicating through error of the registration of a single connection is obviated. Furthermore, if the operator does subsequently press key K for the same call she will be made aware of the mistake by the lighting of the green lamp O^2 . This, since relay R^3 remains inert while R^4 is again actuated, receives current from the generator G through conductor 16, armature 23 and its back contact in relay R^3 , conductors 24 and 19 and armature 20 and its front contact in relay R^4 to ground. This is of especial utility in such cases as rapidly succeeding calls coming from the same substation. If the operator, upon properly seeking to register a second call, sees the illumination of the green instead of the red lamp, she will know that she has not produced the desired effect and that the answering cord must first be withdrawn to release the meters. Having done this and again pressed the key K the display of the red signal would, as before, indicate the operation of both meters.

In addition to its use for measured service, this invention may be employed as an accurate check upon collections from substation coin-in-the-slot apparatus, the operator causing a single registration by a meter or meters when each coin is deposited.

Having thus described my invention, I claim:

1. The combination with telephone lines and a connecting circuit therefor, of a plurality of meters operable during the connection of said circuit with a line, means associated with the connecting circuit for starting the operation of the meters, and means separate for each meter acting independently of the starting means for temporarily rendering inoperative all of the meters involved in the registration of the connection.

2. In a telephone circuit, the combination with a registering apparatus, of controlling means provided with differential windings by which it may be energized to effect the operation of said registering apparatus, and resistance varying means connected in circuit with one of the windings of the controlling means and rendered effective in registering a connection whereby a second registration of such connection is prevented.

3. In a measured service telephone system, the combination with a plurality of meters, of means having differential windings and being adapted to control one of the meters, and resistance varying means governed by another of the meters and serving to vary the distribution of current in the differential windings.

4. In a telephone circuit, the combination with a registering apparatus, of controlling means provided with differential windings by which it may be energized to effect the operation of said registering apparatus, resistance varying means connected in circuit with one of the windings of the controlling means and operable to prevent the differential windings from operating the registering apparatus, and a switch included in the circuit between the controlling means and the resistance varying means and adapted upon actuation to effect the operation of said resistance-varying means.

5. A measured service telephone circuit comprising a registering apparatus provided with a high and a low resistance winding, sources of electrical energy of relatively high and low potential, means for connecting the high potential source to the high resistance winding to operate the registering apparatus, a second registering apparatus adapted to be operated by current from the high potential source, and means for connecting the source of low potential to the low resistance winding of the first-named registering apparatus, thereby establishing conditions to temporarily maintain both registering apparatus against further operation, substantially as described.

6. A measured service telephone circuit comprising a registering apparatus provided with a high and a low resistance winding,

sources of electrical energy of relatively high and low potential, means for connecting the high potential source to the registering apparatus to effect its operation, a second registering apparatus adapted to be operated by current from the high potential source, and means for connecting the source of low potential to the high and low resistance windings in parallel of the first-named registering apparatus to temporarily maintain both registering apparatus against further operation.

7. A telephone system comprising a central station and substation lines terminating thereat, a cord circuit at the central station, a meter associated with the cord circuit, a relay having differential windings and being adapted to control said meter, a meter associated with a line and being provided with a plurality of windings, said line meter being in circuit with a winding of the relay when the line and cord are connected, and means for joining windings of the line meter in parallel.

8. The combination with a central station and telephone lines extending thereto, of apparatus for registering connections between said lines, a signal device, and means for displaying the signal only upon an attempt to produce a second registration for a single connection.

9. In a central station telephone system, the combination with telephone lines and connecting means therefor, of registering apparatus under the control of an operator, a signal device, means for displaying said signal upon the first actuation of the registering apparatus, a second signal device, and means for displaying said second signal upon an attempt to again actuate the registering apparatus during the same connection.

10. The combination with a conducting circuit, of two relays, a meter controlled at the front contact of the first relay and the actuation of which meter is dependent upon coöperative action of both relays, a circuit closer upon the first actuation of which both relays are operated and the meter actuated, means for preventing operation of the first relay upon a second actuation of the circuit closer, and a signal device controlled at the back of said first relay and the front contact of the second relay, as and for the purpose set forth.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses, this sixth day of June 1907.

ALEXANDER S. SPIEGEL.

Witnesses:

LEWIS S. EATON,
IVOR JEFFREYS.