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TELEPHONE SYSTEM.

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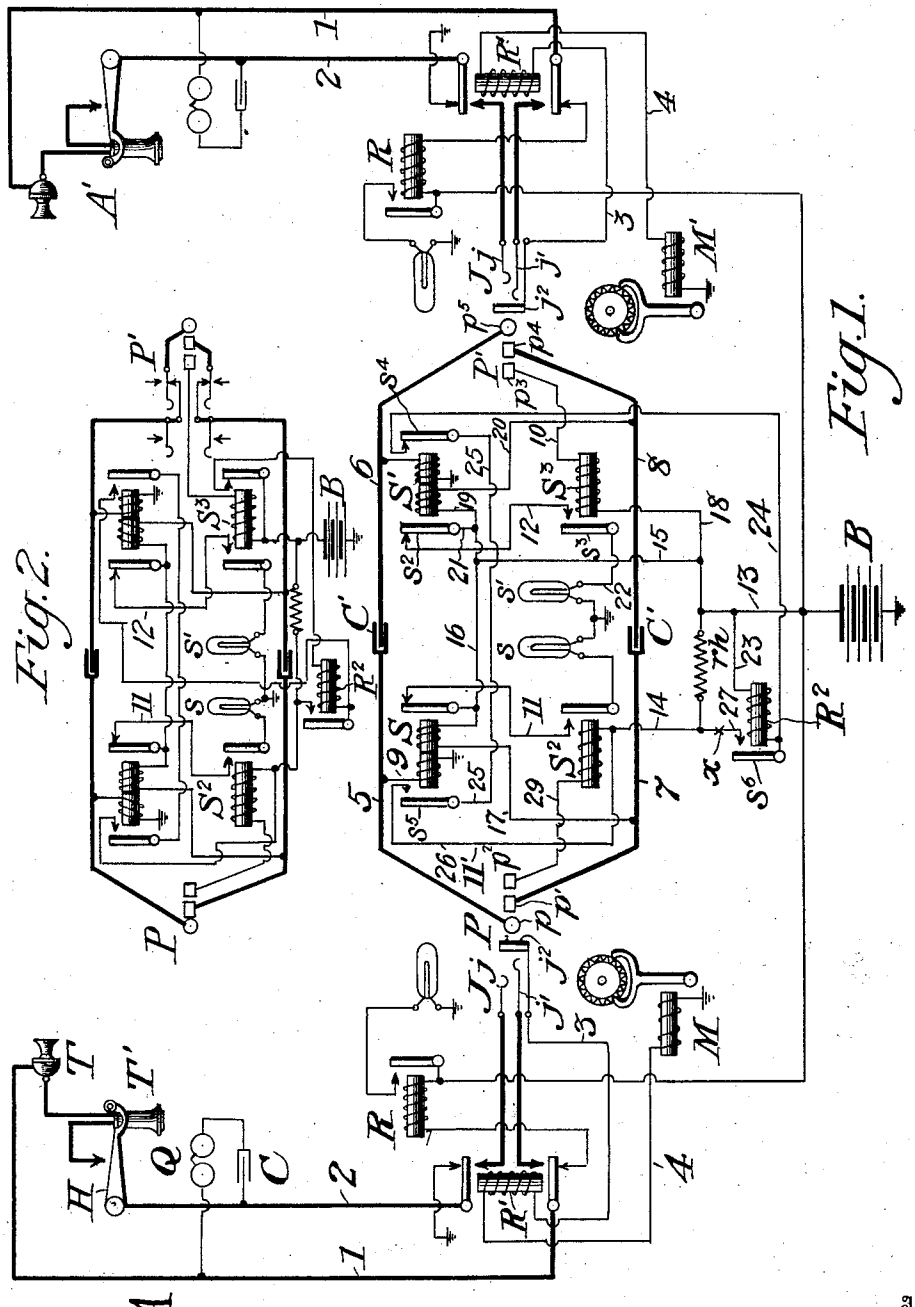

Fig. 1.

Fig. 2.

Witnesses

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TELEPHONE SYSTEM.

1,010,505. Specification of Letters Patent. Patented Dec. 5, 1911.

Application filed October 9, 1907. Serial No. 396,534.

To all whom it may concern:

Be it known that I, RAY H. MANSON, citizen of the United States, residing at Elyria, in the county of Lorain and State of Ohio, have invented a certain new and useful Improvement in Telephone Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to telephone systems, and has for its object the provision of means for metering line calls automatically and without the possibility of registering twice for any one call.

In some of the systems heretofore in use, especially where the metering is controlled by the operators, double registration has occurred either through accidental displacement of the subscriber's hook switch, or through accidental pressure on the operator's controlling key. In all systems controlled by the operators, moreover, time is consumed and the efficiency of the system is lowered by the extra work involved.

According to my present invention, I cause the circuit of a line meter to be completed when a connection is initiated by the operator, and the meter to be automatically actuated when the called subscriber has answered, the calling subscriber in the meantime keeping his line closed for conversation. There is no special act to be performed by the operator, and after the meter has once been actuated, I cause the controlling device which brings about its actuation to be locked so that a second actuation is impossible until the answering plug is withdrawn from the line jack and replaced therein.

More specifically stated, the embodiment of my invention hereinafter described comprises a meter for each subscriber's line having its motor-magnet in series with the cut-off relay of the line, the circuit being normally incomplete at the line jack. When an answering plug is inserted in response to a call, this circuit is completed through a resistance to the main battery, but the meter does not operate. When the called subscriber answers, the calling subscriber's supervisory relay in the meantime remaining energized, a circuit is closed by both supervisory relays through a self-locking controlling relay, which shunts the high resistance in the meter circuit, and causes the actuation of the latter. This controlling relay remains locked until the answering plug of the pair has been withdrawn from the calling line jack.

My invention is illustrated in the accompanying drawing wherein—

Figure 1 is a diagram showing two subscribers' lines and an operator's cord circuit for interconnecting them, together with line meters and controlling apparatus therefor. Fig. 2 is a similar diagram showing a modified arrangement of the cord circuit.

Referring to the drawing and especially to Fig. 1, A and A′ are two subscribers' stations each connected by line wires 1 and 2 to a central office, wherein the connective apparatus is typified by a single cord circuit marked 5—6—7—8 with terminal plugs P and P′. Each subscriber's equipment contains the ordinary elements, comprising a transmitter T and receiver T′, hook H, ringer Q and condenser C. At the central office each line has the usual line relay R controlling a lamp signal, and the cut-off relay R′, which when a plug is inserted in a jack J, removes the line terminals from contact with terminals of the relay and ground return thereof, and places the line directly in connection with the spring jack, which may be multiplied if desired. In fact, this system is especially useful in connection with multiple boards although not necessarily limited thereto. In such a multiple equipment, the answering jack J is provided with three contacts, while the multiple or calling jacks may have only two. The three contacts are marked in the drawing j, j' and j^2. Of these j and j' are talking contacts and j^2 is connected by wires 3 and 4 to the cut-off relay R′ and then to the motor magnet of the meter M and so to ground. Coöperating with the line jacks are the answering plug P and the calling plug P′. The latter performs no function whatever in connection with the meters, only those meters being operated which belong to the calling lines. Each answering plug P, therefore, is provided with means for completing the meter circuits so that the same may be operated in due sequence.

The cord circuit may be briefly designated as a six-relay circuit, although by double winding, the actually separate relay units only number four. These are S, S′ S^2, S^3, of which S and S′ are double wound

with their windings serially included in the battery bridge of each end of the cord. The double windings of these relays are used merely to balance the circuits, since the coöperating supervisory control relays S^2 and S^3 cannot be included in the bridge but are in the separate local battery branches 29 and 10. The relays S and S^2 jointly control the flow of current from the battery B to the supervisory lamp s associated with the answering plug P, while the relays S' and S^3 jointly control the circuit from the battery B to the supervisory lamp s' associated with the calling plug P'. The single wound control relays S^2 and S^3 become active as soon as the plugs P and P' are inserted in the answering and calling jacks respectively, the circuit of each being completed through contacts p^2, j^2, 3, R', 4, M and ground. The energization of these control relays S^2 and S^3 cause the lamps s and s' to be connected to their respective branch wires 11—12, the battery supply to which is controlled by the double wound relays S and S' which respond to current flow from the main battery B in the respective subscribers' lines with which they are connected.

The relay S^2 associated with the answering plug P is connected to battery B through a resistance r^h, and since the magnets S^a, R' and M are in series with the resistance, it is easy to adjust the same so that with no other path provided for the flow of current, the latter will be too small to produce any effect on the comparatively low wound magnet M which, moreover, has a certain amount of mechanical work to perform, calling for a larger current flow. The relays S^2 and R', however, will function on the initial current flow through the resistance r^h. In order to operate the motor magnets M I provide a normally open shunt around the resistance r^h which closes in series two normally open contacts controlled by the relays S and S' respectively, and the self-locking relay R^2. This latter relay is of low resistance, and owing to its serial connection aforesaid, can only become excited when both supervisory relays are energized, that is to say, when current is flowing from the main battery B through the cord circuit to both subscribers' lines. It will be observed that as soon as the relay R^2 has pulled up, however, it closes a short circuit through itself around the resistance r^h and in parallel with the branch circuit controlled by the supervisory relays S and S'. By this means I prevent any false or double registration, for since the relay R^2 is locked as soon as the called subscriber A' has answered (the subscriber A in the meantime keeping his receiver T' off the hook) the meter circuit will remain closed that the motor magnet M will remain energized until the plug P is removed from the jack J. As an alternative and in order to permit recalling on the part of the subscriber A without the necessity of pulling the plug P with each recall, I may provide the operator with a key at the point indicated by a cross marked "x" in Fig. 1, so that the locking circuit may be broken and the apparatus set for another operation. I do not consider this advisable, however, since the underlying invention in the present case is to make the entire operation automatic and independent of the volition of the operator.

Fig. 2 shows a modification in which the relay S^3 not only controls the connection of the supervisory lamp s' to its branch wire 12, but also controls the connection of the battery B to the relay R^2 and its locking circuit as well as the circuit of the controlling relay S^2, the cut-off relay R' and the meter magnet M. The idea in this is that since the plug P must remain in the answering jack J for recalls, and the plug P' must be pulled in such cases for insertion in another wanted jack, the relay S^3 can, therefore, be employed to advantage to perform the same function as the special key x previously mentioned. In other words, if the operator gets a recall from the subscriber A, she merely pulls the calling plug P' and having ascertained the new number wanted she sticks that plug in the jack of the line called for and thus resets the meter circuit ready for a second operation. Except for this operation, the shunt circuit around the resistance r^h is controlled in the same manner as before by both supervisories, with their contacts in series.

The operation of my invention thus described may be stated as follows: In the circuit of Fig. 1, assuming subscriber A is calling and has removed his receiver T' from the hook H, which thereupon completes the line circuit 1—2, current flows through the line from the main battery B, energizing the relay R and lighting the signal lamp associated with the line jack J. The operator, perceiving this signal, inserts the answering plug P and by means of the usual listening key (which is not illustrated) ascertains the number wanted. When the plug P is inserted in the jack J, a circuit is immediately completed, from the battery as follows: B, 13, r^h, 14, S^2, 29, p^2, j^2, 3, R', 4, M and ground back to battery. This brings the resistance r^h and the three magnets S^2, R', and M in series with each other, whereby the magnet M will not be operated but the other two will become effectively energized. The energization of the relay S^2 connects its lamp s to the branch 11, and the energization of the relay R' connects the line wires 1—2 to the jack springs j and j' respectively, at the same time disconnecting the relay R and its ground re-

turn, whereby said relay is deënergized and its lamp signal is extinguished. The lamp *s* does not glow at this step of the operation for the reason that the relay S becomes energized by current over the following path: B, 13, 15, 16, S, 17, 7, *p'*, *j'*, 1, A, 2, *j*, *p*, 5, 9, S and ground back to battery. Having ascertained the number wanted (which we will assume to be that of subscriber A') the operator inserts the plug P' in the jack J of the wanted line. This causes the energization of the relay S^3 and the cut-off relay R' of the wanted line, over the following circuit: B, 13, 18, S^3, 10, p^3, j^2, 3, R', 4, M', and ground back to battery. In order to prevent the operation of the meter magnet M' by the closure of this circuit, I either make the resistance of the relay S^3 sufficiently high or I insert a limiting resistance the same as r^h. Other means may be resorted to such as polarizing the magnets M and reversing the current supply through the calling and called ends, but I prefer the arrangement shown herein.

Having completed the connection, the operator proceeds to throw ringing current on the line leading to station A' in any ordinary or desired manner. In Fig. 1 I have not shown a ringing key as this is a matter of common knowledge and necessity but in Fig. 2 I have indicated such a key. In practice, of course, every cord circuit must be provided with such a key or its equivalent, and we will assume the operator uses the ringing key to call the subscriber A'. When the subscriber answers, current will immediately flow through the supervisory relay S' through the following path: B, 13, 15, 19, S', 20, 8, p^4, j', 1, A', 2, *j*, p^5, 6, S' and ground back to battery. Relay S' then becoming energized, opens the battery connection with the branch wire 12 thereby depriving the lamp *s'* of battery current and causing it to become extinguished, the lamp circuit thus broken being traceable as follows: B, 13, 15, 21, s^2, 12, s^3, 22, *s'* and ground back to battery. At the same time the relays S and S' both being energized act jointly in closing the following shunt circuit for the resistance r^h: B, 13, 23, R^2, 24, s^4, 25, s^5, 26, 14. This provides a path of reduced resistance for passage of current from the battery B to the meter circuit, which is extended from the wire 14 as follows: S^2, 29, p^2, j^2, 3, R', 4, M and ground. The two magnets R^2 and M become effectively energized and the relays S^2 and R' remain in that condition. The energization of the meter magnet steps forward the indicating device of the meter to register the call, and the energization of the magnet R^2 remains permanent and independent of the supervisory relays S and S' because of the closure of the following locking circuit: B, 13, 23, R^2, s^6, 27, 14, S^2, 29, p^2, j^2, 3, R', 4, M and ground back to battery. The relay R^2 will therefore remain locked, and the condition of the meter motor circuit will remain constant without regard to the condition of the supervisory relays until the plug P is finally withdrawn from the jack J.

When the subscribers have finished their conversation they hang up their respective receivers, thereby breaking their line circuits and thereby permitting the respective relays S and S' to fall back, supplying current to the lamps *s* and *s'* which by their joint glow indicate to the operator a desire for disconnection. The operator thereupon pulls the plugs P and P' breaking the local circuits 3—4 at the contacts j^2. The cut-off relays R' thereupon disconnect the lines from the jacks and reconnects the line relays R. The meter magnet M becomes deenergized, the cord circuit relays all lose current, including the locking relay R^2, which lets go its armature; and so all parts are restored to normal condition of disuse, ready for another operation.

The cord circuit of Fig. 2 may be substituted for that of Fig. 1 without change, and the operation is identical except that the relay R^2 may be restored by merely pulling the plug P', so that if the subscriber A wishes to make a number of calls, he may do so and each call will be automatically registered, the relay R^2 being restored each time and prepared for the next call by the act of the operator in pulling the plug P'.

I am aware that many changes and substitutions may be made in the circuits I have described, and many changes may be made in the apparatus, without departing from the spirit of the invention. The foregoing description and the illustration accompanying it are therefore to be taken as specific for purposes of explanation but not of illustration. The ordinary four relay cord circuit may be employed if desired, although I consider the arrangement herein shown as preferable. All minor and non-essential changes and modifications are to be considered as clearly within the scope of the claims appended hereto.

While I have shown my invention in the particular embodiment herein disclosed, I do not, however, limit myself to this construction, but desire to claim any equivalent modification that will suggest itself to those skilled in the art.

Having thus described my invention what I claim and desire to secure by Letters Patent is:

1. In a measured service telephone system, subscribers' lines, registering means at the central station connected therewith, an operator's cord circuit, a source of current connected to said cord, a device controlled by the subscribers and associated with said

cord circuit for controlling the actuation of said meters, and means in circuit with the actuating winding of the registering means for preventing the accidental manipulation of said means.

2. In a measured service telephone system, subscribers' lines, registering meters connected therewith, an operator's 3-wire cord circuit, a battery connected with said cord circuit, a high resistance in circuit with the actuating winding of one of the meters and in series with said battery, a normally open shunt circuit around said high resistance, and a winding means in said shunt circuit for automatically closing said shunt circuit in the use of the lines thereby operating said meter.

3. In a measured service telephone system, subscribers' lines, registering meters connected therewith, an operator's cord circuit including a battery, a high resistance in circuit with the actuating winding of one of the meters and in series with said battery, a normally opened shunt circuit around said high resistance, relays automatically actuated in the use of the lines for closing said shunt circuit thereby causing said meter to register, and a locking winding in said shunt circuit for keeping said shunt circuit closed.

4. In a measured service telephone system, subscribers' lines, registering meters connected therewith, an operator's cord circuit for interconnecting said lines having calling and answering plugs and provided with a battery, a high resistance in series with said battery, a normally open shunt circuit around said high resistance, means controlled in the use of the subscribers' lines for closing said circuit to actuate said meter, and a low resistance locking relay in said shunt circuit adapted to maintain said shunt circuit closed until released by the withdrawal of the answering plug.

5. In a measured service telephone system, subscribers' 3-wire circuits provided with cut-off relays, call registering meters in series with said cut-off relays, an operator's cord circuit for interconnecting said subscribers' lines comprising a battery, a high resistance in series with said battery, a normally open shunt circuit around said high resistance, a low resistance locking relay in said shunt circuit, and relays controlled by the subscribers for closing said shunt circuit to actuate said meter, said shunt circuit being kept closed by the actuation of said locking relay.

6. In a measured service telephone system, subscribers' lines, registering meters connected therewith, an operator's cord circuit provided with a supervisory control relay, a high resistance and a battery in series with the winding of said supervisory control relay, a normally open low resistance shunt around said high resistance, means for automatically closing said shunt circuit to operate said meter, and means for maintaining said shunt circuit closed.

7. In a telephone system, the combination of a calling and a called subscriber's line, a meter associated with the calling line, an operator's cord circuit for interconnecting said lines, a circuit for said meter, a pair of supervisory relays in said cord circuit, initially directly controlling contacts in said meter circuit and a self locking relay thereafter maintaining said meter irresponsive to further control by said supervisory relays.

8. In a telephone system, a plurality of subscribers' lines and operators' cord circuits for interconnecting them, supervisory relays and meters associated with the lines, and locking means in the actuating circuits of such meters and associated with said cord circuits, together with means whereby said meters are initially controlled by the supervisory relays for single registering, and thereafter are available for further operation by said locking relays.

9. In a telephone system, a plurality of subscribers' lines, meters independent of the talking circuit at an exchange associated therewith, means for interconnecting such lines for conversation, a supervisory relay associated with such connecting means for each of the lines connected thereby, and means jointly directly controlled by the supervisory relays associated with the connected lines for bringing about the automatic actuation of the said meters.

In witness whereof, I hereunto subscribe my name this 14th day of September A. D., 1907.

RAY H. MANSON.

Witnesses:
T. A. CORNELL,
A. J. ROBERTS.