

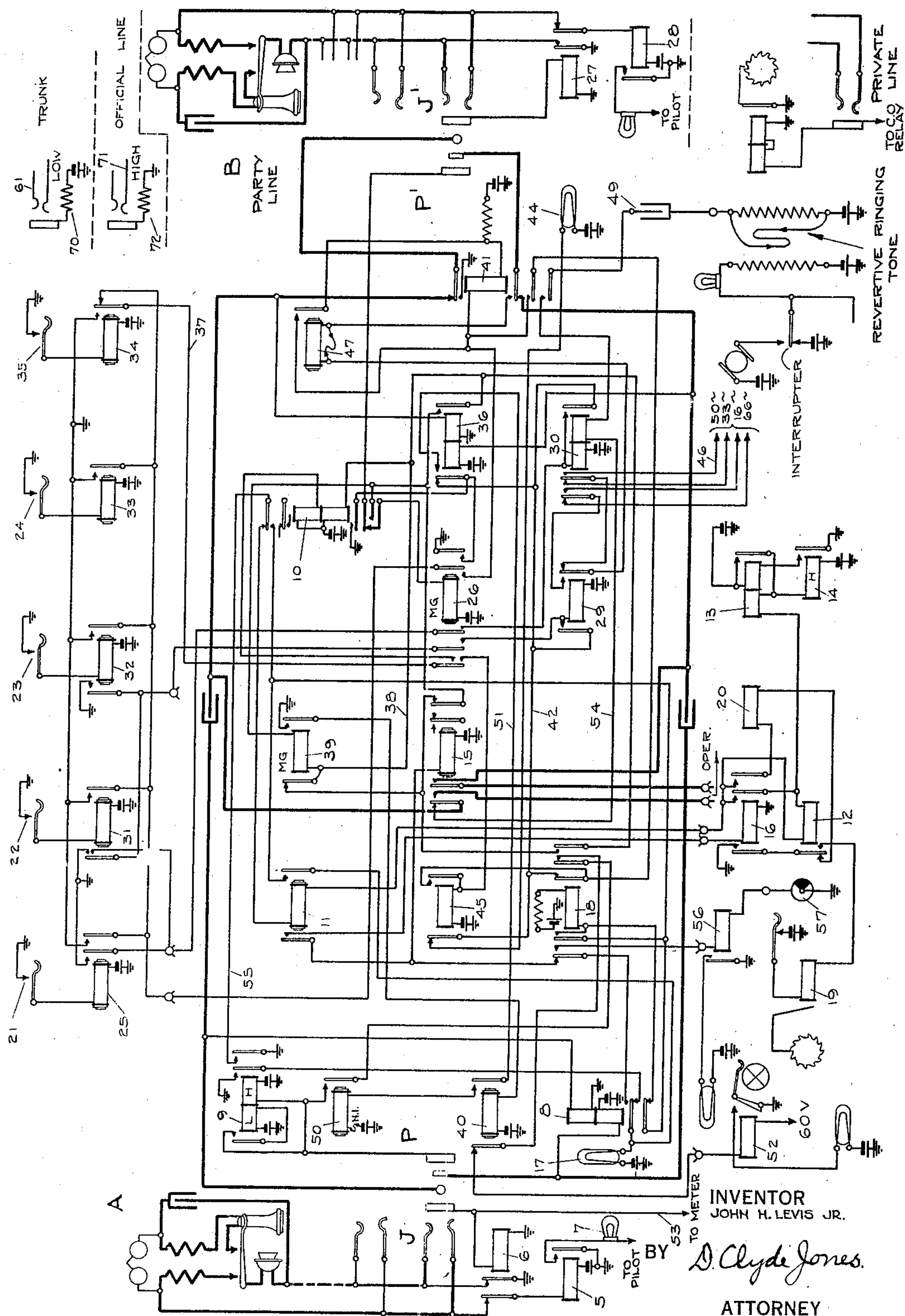
Aug. 23, 1932.

J. H. LEVIS, JR

1,873,772

METERING SYSTEM

Filed Sept. 4, 1925



UNITED STATES PATENT OFFICE

JOHN H. LEVIS, JR., OF ROCHESTER, NEW YORK, ASSIGNOR TO THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK

METERING SYSTEM

Application filed September 4, 1925. Serial No. 54,573.

This invention relates to telephone systems, and more particularly to manual telephone systems.

In such telephone systems it is frequently desirable to provide means for charging for all calls of a certain character originating on certain of said telephone lines. It has been proposed in former telephone systems to provide means for automatically charging calls as soon as they have been completed by the response of the called parties. Such systems, however, have not fully met practical requirements, because they have failed to provide certain very necessary means for preventing the charging of calls to official lines such as "Trouble" or "Information calls". Such systems have also failed to provide means to prevent the charging of a call when the operator disregards a busy signal and connects a calling telephone line to a line already in use. Such systems have further failed to meter calls properly in the case of recalls when a subscriber abandons one connection before its completion and then immediately initiates a second connection. Another failure in previous systems has been that they fail to prevent the operation of the meter when a flash-back busy signal is transmitted from a distant office in the case of an inter-office call.

It is the purpose of the present invention to provide metering means which overcome the failures mentioned in previous telephone systems.

Other features of the invention will appear from the detailed description and the appended claims.

The drawing diagrammatically represents a portion of a manual telephone system in which a calling telephone line is shown at the left. In the center of the figure there is shown an operator's cord circuit, representative of several cord circuits, together with certain equipment common to all the cord circuits at an operator's position. At the right of the drawing there is shown a called telephone line.

It is believed that the invention will best be understood by describing the method of establishing a telephone connection from a

calling substation such as A to the substation of a wanted telephone line such as B. When the subscriber at A initiates a call by removing his receiver from its switch-hook, the line relay 5 is energized in the well known manner in a circuit extending from grounded battery through the back contacts of the cut-off relay 6 and the two sides of the subscriber's line in series, to ground. The energization of the line relay 5 closes a circuit for lighting the line lamp 7. The operator at the position where the cord circuit of this drawing is located, on noting that the lamp 7 is lighted, inserts the plug P into the jack J of this line. This operation effects the energization of the supervisory relay 8 from grounded battery and its lower winding, through the ring contacts of the plug P and jack J over the two sides in series of the calling line, tip contacts of the jack J and plug P and thence to ground through the upper winding of relay 8. At the same time the sleeve relay 9 is operated from grounded battery through the sleeve contacts of the plug P and jack J winding of the cut-off relay 6 to ground. These relays are energized in this circuit and the cut-off relay disconnects the line relay 5 from the control of its telephone line to extinguish the line lamp 7. The sleeve relay 9 on operating closes a locking circuit for itself through its left-hand low resistance winding, its left-hand armature and front contact and thence to ground through the winding of the cut-off relay 6. The design of the windings of the sleeve relay 9 is such that in the event that an operator either at the position in question or at another position inserts the answering jack of a second cord circuit into a multiple jack of this line, the high resistance winding of the sleeve relay at the second cord circuit will not be energized in multiple with the low resistance winding 9 at the first cord circuit. This arrangement is known as the operator's bar feature.

Also when the sleeve relay 9 is operated it closes a circuit which controls the connection of the operator's telephone set to the cord circuit selected for use. This circuit extends from ground, outer armature and

front contact of the relay 9, uppermost armature and back contact of relay 10, winding of the slow releasing relay 11, windings of the relays 12, 13 and 14 in series to grounded battery. The resistances of the relays 13 and 14 are such that the relays 12 and 11 will not operate in series therewith. The relay 14, however, is energized in this mentioned circuit and attracts its armature to close a circuit through the right-hand winding of the relay 13 for operating this last named relay. The operation of the relay 13 closes a circuit from grounded battery, front contact and armature of the relay 13, left-hand winding of this relay and thence through the windings of relays 12 and 11 over the remainder of the circuit previously described. The relays 11 and 12 are thus operated and the operation of the relay 11 causes the energization of the slow releasing relay 15 which is effective to connect the operator's telephone set to the cord circuit taken for use. The operating circuit of the relay 15 is traceable from grounded battery, winding of this relay, front contact and armature of the relay 11, winding of the relay 16, to ground. In order to indicate that the operator's telephone set is connected to a particular circuit, the answering supervisory lamp 17 thereof is dimly lighted in a circuit extending from grounded battery through the lamp 17, inner armature and front contact of the supervisory relay 8, outer armature and back contact of relay 18, armature and front contact of relay 11 through the winding of relay 16 to ground in multiple with the operating circuit of the relay 15. The resistance of the relay 16 is of sufficient value that the answering supervisory relay 17 is dimly lighted and indicates to the operator to which cord circuit her telephone set is connected. Such an arrangement is necessary where an operator answers several calls at about the same time, instead of completing a call before answering a second one. The relay 16 is energized in this multiple circuit and at its left-hand armature closes a circuit from ground, armature and front contact of relay 12, winding of the peg count or meter magnet 19 to grounded battery, which circuit energizes the meter preparatory to recording the call being completed at this position. At the inner armature and front contact of the relay 16 a short circuit is closed about the relay 12, causing this relay to retract its armature slowly and thereby effect the deenergization of the magnet 19 which in turn completes the registration on the peg-count meter. At this time an impedance 20 is included in a circuit from ground, front contact and armature of relay 16, armature and back contact of relay 12 through the impedance 20, armature and front contact of relay 16 and thence in multiple with the operating circuit of the relay

11 previously described. This arrangement of the impedance 20, while it permits the relay 11 to remain operated, is of such value that a relay similar to 11 at a second cord circuit connected to another telephone line will not be operated. When, however, in the course of completion of the first mentioned call the relay 16 deenergizes and thereby disconnects the impedance 20, the relay similar to 11 at a second cord circuit is operated in the manner already described to effect the connection of the operator's telephone set to the second cord circuit. The values of impedance 20, and relays 13 and 14 are such that if an operator partially completes more than two calls simultaneously, all calls are prevented from being completed, thus insuring that the operator will not attempt to answer more than two connections at the same time.

As soon as the relay 15 has extended the operator's telephone set to the cord circuit connected to the calling telephone line, the operator inquires from the calling party thereon the number of the wanted telephone line, and then after the usual testing by touching the tip of the calling plug P' to the sleeve of jack J' of the wanted telephone line, inserts this plug into jack J'. If the wanted line is a party line the operator proceeds to select the proper ringing current to signal the wanted substation thereon. This is accomplished by depressing some one of the common ringing keys 21, 22, 23 and 24 which are common to all the cord circuits at an operator's position. Let it be assumed that the ringing key 21 controls the selection of the proper ringing current for signaling the wanted substation B. On the depression of the key 21 by the operator the slow releasing relay 25 is energized.

At the time when the plug P' is inserted into the jack J', the sleeve relay 26 is energized from grounded battery back contact and continuity spring of relay 10, through the sleeve contacts of plug P' and jack J', winding of the cut-off relay 27 to ground. The relays 26 and 27 are energized in this circuit and the relay 27 disconnects the line relay 28 from the control of its telephone line. The energization of the relay 26 associates the ringing circuit selecting relays 29 and 30 with the relays 25, 31, 32, 33 and 34 controlled by the ringing keys 21 to 24 and with the non-ringing key 35 which is used when the calling end of the cord circuit is connected to a trunk circuit. With the relays 25 and 26 operated, a circuit is closed from ground, inner front contact and armature of relay 25, inner armature and front contact of relay 26, winding of the relay 30 to grounded battery. Relay 30 when operated closes a locking circuit for itself from grounded battery, its right-hand front contact and armature, back contact and armature of relay 36, right-hand front con-

tact and armature of relay 26 to ground. At the same time relay 10 is operated in a circuit traceable from grounded battery, its upper winding, outermost front contact and armature of relay 26, conductor 37, armature and back contact of relay 34, outer armature and front contact of relay 25 to ground. The relay 10 on operating closes a locking circuit for itself from grounded battery through its lower winding, conductor 38, winding of marginal relay 39, armature and continuity spring of relay 10 through the sleeve contacts of the plug P' and jack J', winding of the cut-off relay 27 to ground.

The relay 39 at its right-hand armature and front contact closes an energizing circuit for the slow releasing circuit 40, which functions to control the operation of the meter at the calling line in the manner to be described. The operation of the relay 10 opens the energizing circuit of the slow-releasing relay 26, but before this last-named relay deenergizes the holding ground for the various circuits is applied through the innermost lower front contact armature of the relay 10. At the same time that the relays 10 and 30 are operated the ringing relay 41 is energized from grounded battery, resistance, winding of this relay, inner right-hand front contact and armature of the relay 26, outer armature and front contact of relay 25 to ground. The ringing relay 41 also closes a locking circuit for itself through its front contact and middle armature, innermost right-hand armature and back contact of relay 18, conductor 42, through the back contact and armature of supervisory relay 36 and thence to ground either at the front contact and armature of relay 26 or the armature and front contact of relay 10. Also at this same time the relay 45 is energized to extinguish the calling supervisory lamp 44 which is lighted as soon as the calling plug P' is inserted into the jack of the called line. The operation of the relay 45 opens the lighting circuit of this supervisory lamp as soon as the ringing current is selected, thus providing the feature known in the art as "The dark key shelf". The operating circuit for the relay 45 extends from grounded battery, its winding, outermost front contact and armature of relay 26, conductor 37, through the armature and back contact of relay 34, outer armature and front contact of relay 25 to ground. Relay 45 also closes a locking circuit for itself through its right-hand armature and front contact, armature and back contact to relay 18 and thence to ground over the holding conductor 42.

With the ringing selection relay 30 operated, ringing current from the fifty-cycle source, is applied to the bell at the wanted substation in a circuit including conductor 46, inner front contact and armature of the relay 30, back contact and armature of the re-

lay 29, winding of the ringing trip relay 47, innermost front contact and armature of the ringing relay 41, ring contacts of the plug P' and jack J', through the bell of the wanted substation which is that indicated at B, over the upper side of the called line through the tip contacts of the jack J' and plug P', armature and front contacts of relay 41 to ground. Interrupted ringing current is applied over this circuit in the well known manner until the party at substation B answers by removing his receiver from its switch-hook, at which time the ringing trip relay 47 is instantly operated and at its front contact and armature completes a short circuit about the ringing relay 41 which immediately deenergizes and disconnects the ringing current from the wanted line. Likewise the response of the called party effects the energization of the calling supervisory relay 36, which relay at its armature and back contact disconnects the holding ground which has been holding the various relays locked in an operated condition.

It will be understood that during the application of the ringing current to the called line a reverberative ringing tone or ringing "echo" is applied to the calling line from the source of ringing tone current through the condenser 49, lowermost armature and front contact of relay 41, right-hand winding of relay 30, left-hand back contact and armature of relay 15, and over the answering end of the cord circuit and through the substation circuit of the calling line over the lower side of the cord circuit and thence to grounded battery.

As soon as the called party answers, the calling party is then charged with the call by the operation of the calling line meter which is controlled as follows: The response of the called party actuates the calling supervisory relay 36 which effects the energization of the slow-releasing relay 50 from grounded battery winding of this relay, front contact and armature of the relay 40, conductor 51, left-hand front contact and armature of relay 36, inner armature and front contact of relay 10 to ground. The operation of the relay 50, in turn, closes the metering circuit from the sixty-volt source of metering current, winding of the position meter magnet 52, back contact and armature of the relay 40, which deenergizes as soon as the supervisory relay 36 is actuated, middle back contact and armature of the relay 18, armature and front contact of relay 50, sleeve contacts of the plug P and jack J, conductor 53, and thence to the line meter magnet (not shown). It will be seen that relay 40 deenergizes due to the fact that relay 39, which controls it, is short-circuited at this time by the circuit completed from grounded battery, lower winding of relay 10, right-hand front contact and armature of relay 36, armature and continuity spring of relay 10, and thence to ground

through the sleeve contacts of plug P' and jack J' and winding of cut-off relay 37. The deenergization of the relay 40 opens the operating circuit of the slow-releasing relay 50, which shortly afterwards deenergizes to interrupt the metering circuit just described and thereby register the call on the calling line meter.

At the termination of the conversation the calling subscriber A replaces his receiver on its switch-hook, which opens the circuit of the supervisory relay 8 and thereby completes a circuit for lighting the supervisory lamp 17 from grounded battery, lower armature and back contact of relay 8, inner armature and front contact of relay 9 to ground. Also when the called party at substation B replaces his receiver on its switch-hook, the calling supervisory relay 36 deenergizes and the calling supervisory lamp 44 is lighted from grounded battery, left-hand back contact and armature of relay 45, conductor 42, left-hand back contact and armature of relay 36, armature and front contact of relay 10 to ground. The lighting of the lamps 17 and 44 is a signal to the operator to remove the plugs P and P' from the jacks with which they have been in engagement.

In the event that the subscriber at substation A desires to initiate a recall, he does so by temporarily opening the contacts of the hook-switch at his substation. This is effective to open momentarily the energizing circuit of the supervisory relay 8, which retracts its armature and thereby closes a circuit for the recall relay 18 extending from grounded battery, resistance, winding of this relay, lower back contact and armature of relay 8, conductor 54, upper front contact and armature of relay 10, which is now energized due to the fact that the plug P' is still in engagement with the jack of the line last called, conductor 55, front contact and armature of relay 9 to ground. Relay 18 on operating closes a locking circuit through its innermost front contact and armature and thence over conductor 54 and the remainder of the circuit previously described. This last circuit is independent of the control of the relay 8. When the subscriber again closes the hook-switch contacts the relay 8 remains operated. The answering supervisory lamp is now intermittently lighted in a circuit completed from grounded battery through the lamp 17, inner armature and front contact of relay 8, outer armature and front contact of relay 18, winding of the relay 56 through the interrupter 57 to ground. The intermittent lighting of the supervisory lamp 17 is a signal to the operator that a recall has been initiated, and she thereupon removes the plug P' from the jack J' and ascertains the number that the calling subscriber now desires. The calling party should be charged for the original call and for the

recall. For this reason, the metering circuit extending through the back contact and armature of relay 40 is opened at the right-hand back contact and middle armature of the relay 18.

If the original call has been completed at the time when the calling subscriber initiates the recall, the original call is charged on the calling line meter in the usual manner, and the operator removes the plug P' from the jack of the called line, after which a second line may be selected and signalled in the manner already described. This recall as in the case of the original call is charged on the meter of the calling line.

If, however, the calling subscriber abandons the original call and initiates a recall before the called party has answered, the calling supervisory relay 36, in the cord circuit of the original call, is not operated, with the result that this slow releasing relay 50, at the left of the diagram is not operated to close a break-point in the operating circuit of the calling line meter magnet. The recall, however, is charged to the calling line, if the called party responds, under which conditions the operation of the calling line meter takes place in the manner already described. Of course, if the recall is abandoned before the called supervisory relay 36 is operated, no charge is recorded on the calling line meter, since relay 39 is short-circuited at relay 18.

If the calling subscriber initiates a call to a distant substation, which is completed over a trunk circuit such as 61, the response of the called subscriber effects the energization of the supervisory relay 36, after which the meter is controlled over the cord circuit in the manner already described. It should be noted that a resistance 70 of relatively low value, is included in the sleeve conductor of trunk 61. This resistance is such that the marginal relay 39 will energize in series therewith. If the calling subscriber initiates a call to an official line, such as "Trouble", "Information", etc., the cord circuit is so arranged, that the calling subscriber is not charged for such a call. Such an official trunk line is indicated at 71 and the sleeve conductor associated therewith, includes a relatively high resistance 72. This resistance is of such high value, that the marginal relay 39, which is arranged to be connected in series therewith through the sleeve contact of the plug P' and the sleeve conductor of the trunk 71, is not operated, with the result that the slow releasing relay 40, whose operating circuit is controlled at the armature and front contact of relay 39 is not energized. Therefore, relay 50 is not operated at this time so that the metering circuit previously described is not completed and the call is not charged.

In the event that the operator disregards the busy signal when she tests the called line by touching the tip of the plug P' to the sleeve

of the jack J', means are provided to prevent the operation of the calling line meter to charge for the connection. In case of such a connection, the call proceeds in a normal manner up to the time when the operator's telephone set is connected to the calling line. When, however, the plug P' is inserted into the jack such as J' of the busy called line, the marginal sleeve relay 26, which is normally energized when the calling end of the cord circuit is connected to the telephone line, fails to operate. This is due to the fact that a second sleeve relay or its equivalent, the lower winding of relay 10, is connected to the sleeve of such a jack, so that the marginal sleeve relay 26 does not receive sufficient current to energize it. Under the normal operation of the system, as soon as the calling plug is in a jack of the called line, the calling supervisory relay 44 is lighted from grounded battery through the lamp, back contact and armature of relay 45, conductor 42, back contact and armature of relay 36, front contact and armature of relay 26, to ground. The lighting of this lamp is an indication to the operator that the called party is being signalled. When, however, the operator mistakenly makes connection to a busy line, the failure of relay 26 to operate, prevents the lighting of the lamp 44. Also since relay 26 is not operated, the ringing control keys 21 to 24 inclusive and key 35, are not operatively connected to the cord circuit taken for use, so that a subscriber on the selected busy line cannot be signalled. Furthermore, the operator's telephone set is held associated with this cord circuit, so that she will immediately discover her mistake and remove the calling plug P' from the jack of the busy line. This is due to the fact that the relay 15, which associates the operator's telephone set with the cord circuit in use, is controlled by the slow-releasing relay 11. This last named relay is controlled at the upper, back contact and armature of relay 10 and at the front contact and armature of relay 9, to ground. Since the original energizing circuit of the relay 10 is controlled at a front contact and armature of relay 26, relay 10 cannot be operated to open the circuit of the relay 11. As soon as the operator removes the plug P' from the jack of the calling line, the relay 9 will deenergize, effecting in turn the deenergization of relays 11 and 15 to restore the operator's telephone set to common use.

If the operator connects her cord circuit to a trunk circuit, such as 61, over which a busy flash back signal is transmitted, such a call is likewise not charged on the calling line meter. As is well-known, such flash back signals intermittently open the operating circuit of the calling supervisory relay such as 36 which circuit includes the tip and ring conductors of the selected trunk. It is desirable in case of connections where a flash back

busy signal is applied not to charge the connection on the meter of the calling line. In the case of such connection the relays 39 and 40 are energized in the manner already described and on the first energization of the calling supervisory relay 36, the slow-releasing relay 50 is energized. This last named relay is so designed that it holds its armature attracted during the intermittent operation of the supervisory relay, which controls the operating circuit. The metering circuit is held open at this time at the left-hand back contact and armature of relay 40. This condition exists until the calling subscriber terminates the call in response to the busy signal. When the calling subscriber replaces his receiver on its switch-hook, the flash recall relay 18 is operated in the manner already described and at its middle armature holds open the metering circuit until the operator removes the plugs P and P' from the jacks with which they have been in engagement.

It will thus be seen that a manual telephone system has been provided which overcomes the difficulties encountered in automatically recording on a liner meter, all successful calls, except those for which the telephone company does not charge.

What I claim is:

1. The method of operating a telephone system, which consists in having a predetermined number of calls in the process of connection simultaneously by an operator, manually extending said calls one at a time to called telephone lines or official lines, automatically registering the calls completed to the telephone lines, and automatically preventing the charging of calls extended to official lines.

2. In a telephone system, a plurality of telephone lines, certain of which are party lines, means including a plurality of cord circuits for interconnecting said telephone lines, a register for each of certain of said lines, sources of ringing current of different characteristics for selectively signaling said party lines, a single key for each source of ringing current, said ringing keys being common to said cord circuits, means for associating said ringing keys with a cord circuit taken for use, and means controlled by the completion of a call from a telephone line provided with a register to another telephone line and the response of the signalled party thereon, for causing said last mentioned register to operate.

3. In a telephone system, a plurality of telephone lines, certain of which are party lines, means including a plurality of cord circuits for interconnecting said telephone lines, a register for each of certain of said lines, an operator's telephone set common to said cord circuits, means responsive to the connection of a cord circuit to a calling telephone line for connecting said operator's

telephone set to said cord circuit, sources of ringing current of different characteristics for selectively signaling said party lines, a single key for each source of ringing current, said keys being common to said cord circuits, means for associating said ringing keys with a cord circuit taken for use, and means responsive to the completion of a call from a telephone line provided with a register, to a called telephone line and the response of the signalled party thereon for operating said last mentioned register.

4. In a telephone system, a plurality of telephone lines, certain of which are party lines and others are official lines, means including a plurality of cord circuits for interconnecting said telephone lines, a register for certain of said lines, sources of ringing current of different characteristics for selectively signalling said party lines, a single key for each source of ringing current, said keys being common to said cord circuits, means for associating said ringing keys with a cord circuit taken for use, and means responsive to the extension of a calling telephone line provided with a register to another telephone line for operating said register, said means being responsive to the completion of a call from said calling telephone line to an official line for preventing said last mentioned register from operating.

5. In a telephone system, a plurality of telephone lines, certain of said telephone lines being party lines, means including a plurality of cord circuits for interconnecting said telephone lines, a register for each telephone line of a certain group, means responsive to the completion of a connection from a telephone line of said group to another telephone line for operating the register of the calling telephone line, a signal at each cord circuit, and means responsive to the initiation of a recall by a telephone line for intermittently actuating said signal.

6. In a telephone system, a telephone line provided with a message-charging device, a plurality of other telephone lines, means including a cord circuit for interconnecting said first mentioned telephone line with any of said other telephone lines, an official telephone line, an operating circuit for said message-charging device, and discriminating means including a relay controlled in one manner over a telephone line and said cord circuit and in another manner over said official line and said cord circuit, said discriminating means functioning to control the closure of said operating circuit.

7. In a telephone system, a telephone line provided with a message-charging device, a plurality of other telephone lines, means including a cord circuit for interconnecting said first mentioned telephone line with any of said other telephone lines, an official telephone line, an operating circuit for said

message-charging device, and discriminating means including a marginal relay controlled in one manner over a telephone line and said cord circuit and in another manner over said official line and said cord circuit, said discriminating means functioning to control the closure of said operating circuit.

8. In a telephone system, a calling telephone line provided with a sleeve conductor and with a message-charging device, an official telephone line provided with a sleeve conductor having a high resistance therein, a plurality of other telephone lines each provided with a sleeve conductor having a low resistance therein, a cord circuit for interconnecting a calling telephone line with said official line and with any of said other telephone lines, said cord circuit being provided with a sleeve conductor, a circuit for said message-charging device including a sleeve conductor of said calling telephone line and the sleeve conductor of said cord circuit, discriminating means including a marginal relay associated with said cord circuit, and a circuit for said marginal relay completed through the sleeve conductor of the official line and through the sleeve conductor of one of said other telephone lines when the cord circuit is connected thereto, said circuit for the message-charging device being placed in its operating or non-operating condition by said marginal relay.

9. In a telephone system, calling telephone lines provided with message-charging devices, party lines each provided with substations, means including a plurality of cord circuits for interconnecting calling telephone lines with any wanted party line, each cord circuit being provided with sleeve conductors, a plurality of sources of current of different characteristics for selectively signaling stations on party lines, a single ringing key common to said cord circuits provided for each source of ringing current, a sleeve relay for each cord circuit operated through one of the sleeve conductors of its cord circuit and the sleeve conductor of a connected party line, said sleeve relay functioning to connect said common ringing key to its cord circuit for controlling the selection of ringing current of the proper characteristic to signal the wanted station on said party line, a marginal relay at said last mentioned cord circuit, means including said sleeve relay for controlling the operation of said marginal relay, a circuit for the message-charging device of the calling telephone line connected to said cord circuit, and means including said marginal relay for controlling the completion of said last mentioned circuit.

10. In a telephone system, a calling telephone line provided with a message-charging device, wanted telephone lines, means including a cord circuit for interconnecting

said calling telephone line with any of said wanted telephone lines, a sleeve conductor for each telephone line, an answering sleeve relay and a calling relay arranged to be operated over the sleeve conductors of the telephone lines to which said cord circuit is connected, a supervisory relay having an operating circuit including the two sides of the calling telephone line in series, a recall signal, a recall relay controlling said recall signal, said recall relay having a circuit controlled at a back contact of said supervisory relay and contacts of the sleeve relay and said calling relay of said cord circuit, a locking circuit for said recall relay independent of said supervisory relay, and an operating circuit for said message-charging device having at least one break-point controlled at said recall relay.

11. In a telephone system, a calling telephone line provided with a message-charging device, wanted telephone lines provided with sleeve conductors, means including cord circuits for interconnecting said telephone lines, a marginal sleeve relay for the calling end of each cord circuit arranged to be controlled over the sleeve conductor of a wanted telephone line when its cord circuit is connected thereto, said marginal relay being designed not to operate when connected in multiple with a second similar sleeve relay at a second cord circuit already connected to said wanted telephone line, an operating circuit for said message-charging device, and means including the marginal relay of said first mentioned cord circuit for controlling the completion of said operating circuit.

12. In a telephone system, a plurality of telephone lines, each provided with a message-charging device, a plurality of wanted telephone lines, means including a plurality of cord circuits for interconnecting calling telephone lines with wanted telephone lines, an operator's telephone set common to said cord circuits, means operating responsive to the connection of a cord circuit to one of said calling telephone lines for connecting said operator's telephone set to said cord circuit to the exclusion of other cord circuits, means for indicating to which cord circuit an operator's telephone set is connected, and means controlled by the connection of said last mentioned cord circuit to a telephone line and the response of the party thereon for automatically operating the message-charging device of said calling telephone line.

13. In a telephone system, a plurality of telephone lines, each provided with a message-charging device, a plurality of party lines, means including a plurality of cord circuits for interconnecting calling telephone lines with party lines, an operator's telephone set common to said cord circuits, means operating responsive to the connection of a cord circuit to one of said calling

telephone lines for connecting said operator's telephone set to said cord circuit to the exclusion of other cord circuits, means for indicating to which cord circuit an operator's telephone set is connected, a plurality of sources of ringing current of different characteristics to signal said party lines selectively, a single ringing key for each source of ringing current common to said cord circuits, means for connecting said common ringing keys to the cord circuit to which said operator's telephone set is connected, and means controlled by the connection of said last mentioned cord circuit to a party line and the response of the party thereon for automatically operating the message-charging device of said calling telephone line.

14. In a telephone system, a plurality of telephone lines, each provided with a message-charging device, a plurality of party lines, means including a plurality of cord circuits for interconnecting calling telephone lines with party lines, an answering supervisory relay for each cord circuit, an operator's telephone set common to said cord circuits, means operating responsive to the connection of a cord circuit to one of said calling telephone lines for connecting said operator's telephone set to said cord circuit to the exclusion of other cord circuits, means for indicating to which cord circuit an operator's telephone set is connected, a plurality of sources of ringing current of different characteristics to signal the stations on said party lines selectively, a single ringing key for each source of ringing current common to said cord circuits, means for connecting said common ringing keys to the cord circuit to which said operator's telephone set is connected, a recall signal, a recall relay controlling said signal, said recall relay having a circuit controlled in part by said supervisory relay, and an operating circuit for said message-charging device of said last mentioned calling telephone line controlled at one point by said recall relay.

15. In a telephone system, a plurality of calling telephone lines each provided with a message-charging device, a plurality of party lines each provided with a plurality of substations, a sleeve conductor for each party line having relatively low resistance therein, an official line provided with a sleeve conductor having relatively high resistance therein, means including a plurality of cord circuits for interconnecting said calling telephone lines with party lines and with said official line, a plurality of sources of ringing current of different characteristics for selectively signaling the wanted substation on a party line, a single key for each source of ringing current, said ringing keys being common to a plurality of cord circuits, a sleeve relay for each cord circuit having an operating circuit completed over the sleeve conductor of

the line with which its cord circuit is connected, a second relay, an initial energizing circuit for said second relay controlled at contacts of said sleeve relay and controlled by one of said common ringing keys, a substitute circuit for said second relay including said last mentioned sleeve conductor, a marginal relay included in said substitute circuit in series with said second relay, an operating circuit for the message-charging device of the calling line connected with said last mentioned cord circuit, said operating circuit having a break-point therein, a third relay controlling said break-point, and a circuit for said third relay controlled by said marginal relay.

16. In a telephone system, a plurality of calling telephone lines each provided with a message-charging device, a plurality of party lines each provided with a plurality of substations, a sleeve conductor for each party line having a relatively small resistance therein, an official line provided with a sleeve conductor having a relatively high resistance therein, means including a plurality of cord circuits for interconnecting said calling telephone lines with party lines and with said official line, supervisory means for each cord circuit, a plurality of sources of ringing current of different characteristics for selectively signaling the wanted substations on the party line, a single key for each source of ringing current, said ringing keys being common to a plurality of cord circuits, a sleeve relay for each cord circuit having an operating circuit completed over the sleeve conductor of the line with which its cord circuit is connected, a second relay, an initial energizing circuit for said second relay controlled at contacts of said sleeve relay and controlled by one of said common ringing keys, a substitute circuit for said second relay, a marginal relay included in series with said second relay, a third relay having a circuit controlled by said marginal relay, a fourth relay governed by the operation of said supervisory means of said last mentioned cord circuit, and an operating circuit for the message-charging device of the calling line connected to said cord circuit, said operating circuit being controlled at contacts of said third and fourth relays.

17. In a telephone system, a plurality of calling telephone lines each provided with a message-charging device, a plurality of party lines each provided with a plurality of substations thereon, a sleeve conductor for each party line having a relatively small resistance therein, an official line provided with a sleeve conductor having relatively high resistance therein, means including a plurality of cord circuits for interconnecting said calling telephone lines with party lines and with said official lines, a plurality of sources of ringing current of different characteristics for selectively signaling the

wanted substation on a party line, a single key for each source of ringing current, said ringing keys being common to a plurality of cord circuits, a sleeve relay for each cord circuit having an operating circuit completed over the sleeve conductor of the line with which its cord circuit is connected, a second relay, an initial energizing circuit for said second relay controlled at contacts of said sleeve relay and controlled by one of said common ringing keys, a substitute circuit for said second relay including said last mentioned sleeve conductor, a marginal relay included in series in the substitute circuit of said second relay, an operating circuit for the message-charging device of the calling line associated with said mentioned cord circuit, said operating circuit having a break-point therein, a third relay controlling said break-point, a circuit for said third relay controlled by said marginal relay, a supervisory relay having an operating circuit including the two sides of the calling line and the answering end of said cord circuit in series, a recall signal, a recall relay controlling said recall signal, said recall relay having a circuit initially controlled at a back contact of said supervisory relay, and means controlled by said recall relay for disabling said marginal relay.

18. In a telephone system, a plurality of telephone lines each provided with answering jacks and a message-charging device, two groups of cord circuits, an operator's telephone set for each group of cord circuits, means including an operator's bar relay of the cord circuit connected to a calling telephone line for connecting an operator's telephone set to said cord circuit to the exclusion of other cord circuits, said operator's bar relay having a high resistance winding and a low resistance winding, a sleeve conductor for each cord circuit normally connected in series with the high resistance winding of said operator's bar relay, the low resistance winding of said operator's bar relay being connected in series with said sleeve conductor on the energization of said relay whereby a second operator's bar relay connected in multiple therewith is not operated, and an operating circuit for said message-charging device including said last mentioned sleeve conductor.

19. In a telephone system, a calling telephone line provided with a message-charging device, a plurality of telephone lines, an official line, a cord circuit for connecting said calling telephone line to any of said lines, a calling supervisory relay for said cord circuit actuated by the response of a party on any of said called lines to which its cord circuit is connected, a second relay controlled in one manner by the connection of the cord circuit to one of said telephone lines and in another manner in the response to the connec-

tion of said cord circuit to said official line, an operating circuit for said message-charging device controlled by said second relay, and means including said calling supervisory relay for disabling said second relay.

20. In a telephone system, a calling telephone line provided with a message-charging device, a plurality of telephone lines, an official line, a cord circuit for connecting said calling telephone line to any of said lines, a calling supervisory relay for said cord circuit actuated by the response of a party on any of said called lines to which its cord circuit is connected, a second relay controlled in one manner by the connection of the cord circuit to one of said telephone lines and in another manner in response to the connection of said cord circuit to said official line, a slow releasing relay actuated in response to the operation of said calling supervisory relay, an operating circuit for said message-charging device controlled by said second relay and by said slow releasing relay, and means including said calling supervisory relay for disabling said second relay.

21. In a telephone exchange system, a calling subscriber's line, a first called subscriber's line having a certain resistance sleeve circuit, a second called subscriber's line having a certain other resistance sleeve circuit, a link circuit for interconnecting said calling line and either of said called lines, a supervisory relay in said link circuit operating when the called subscriber answers, a position meter associated with said link circuit, a marginal relay controlled over the sleeve of said link circuit and adapted to be operated when said link circuit is connected with one of said called lines and not with the other, and means jointly controlled by said supervisory relay and said marginal relay for operating said meter.

22. In a telephone exchange system, a calling subscriber's line, a first called subscriber's line having a certain electrical condition, a second called subscriber's line having a different electrical condition, a link circuit for interconnecting said calling line and either of said called lines, a supervisory relay in said link circuit adapted to be operated when a called subscriber answers, a position meter associated with said link circuit, a marginal relay controlled over said link circuit and adapted to be operated when said link circuit is connected to one of said called lines but not to the other, and means jointly controlled by said supervisory relay and said marginal relay for operating said meter.

23. In a telephone exchange system, a calling subscriber's line, a first called subscriber's line having a certain resistance sleeve circuit, a second called subscriber's line having a certain other resistance sleeve circuit, a link circuit for interconnecting said calling line and either of said called lines, a supervisory

relay in said link circuit operating when the called subscriber answers, a meter, a marginal relay controlled over the sleeve of said link circuit and adapted to be operated when said link circuit is connected with one of said called lines and not with the other, and means jointly controlled by said supervisory relay and said marginal relay for operating said meter.

24. In a telephone exchange system, a calling subscriber's line, a first called subscriber's line having a certain electrical condition, a second called subscriber's line having a different electrical condition, a link circuit for interconnecting said calling line and either of said called lines, a supervisory relay in said link circuit adapted to be operated when a called subscriber answers, a meter, a marginal relay controlled over said link circuit and adapted to be operated when said link circuit is connected to one of said called lines but not to the other, and means jointly controlled by said supervisory relay and said marginal relay for operating said meter.

In witness whereof, I hereunto subscribe my name this 3rd day of September, A. D. 1925.

JOHN H. LEVIS, JR.

95

100

105

110

115

120

125

130