

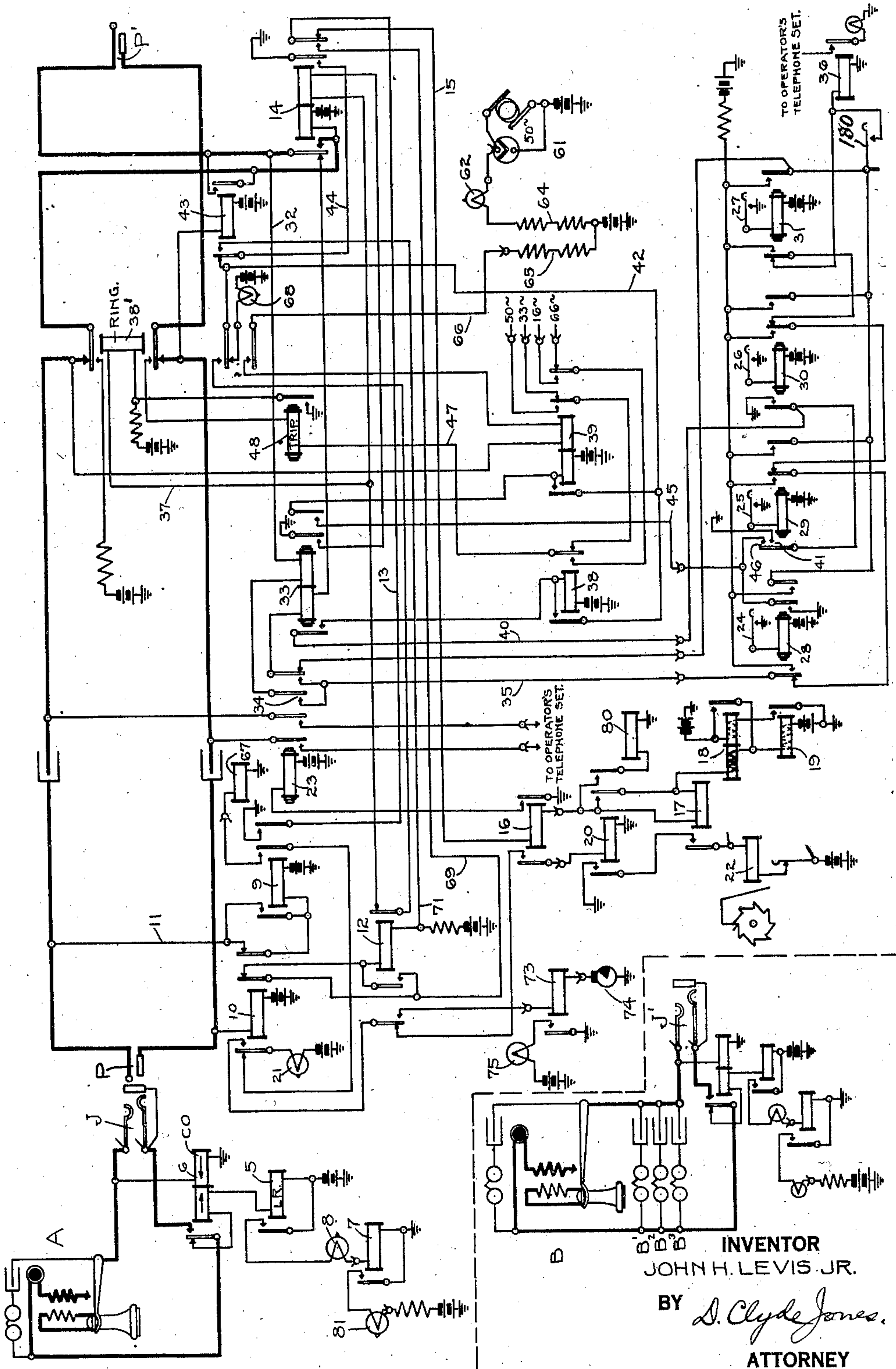
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J. H. LEVIS, JR

MANUAL TELEPHONE SYSTEM

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MANUAL TELEPHONE SYSTEM.

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To all whom it may concern:

Be it known that I, JOHN H. LEVIS, JR., a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Manual Telephone Systems (Case 76), of which the following is a full, clear, concise, and exact description.

The present invention relates to telephone systems, and more particularly to telephone systems in which some portion of the switching operation is controlled by an operator at the telephone exchange.

In such telephone systems it has formerly been the practice to provide a plurality of sets of keys for applying the signaling current to the wanted telephone line. It has also been desirable in such systems to count the number of telephone calls handled by each telephone operator.

In accordance with the present invention a single set of controlling keys is provided for each operator's position, and means are provided for associating said set of controlling keys with the cord circuit to which the operator is connected.

In accordance with another feature of this invention improved means are provided for counting the number of calls handled by each operator. This counting device is so arranged that even if an operator is completing different stages of two telephone calls at the same time, each call will be accurately registered on the counting device.

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

In the drawings there is represented at the upper left hand corner a telephone line with its substation equipment. At the lower left hand corner of this drawing there is diagrammatically shown a party telephone line and substation equipment of one of these lines; the substation equipment of three other substations on this line is merely indicated by the conventional showing of a ringer and condenser. At the middle and right of these telephone lines there is represented a single operator's cord circuit as well as other equipment common to all the cord circuits at a single position.

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

calling substation designated A, to a called substation herein designated B.

When the calling subscriber at A removes his receiver from its switchhook to initiate a call, a circuit is closed for the line relay 5 extending from grounded battery, winding of this relay, left hand winding of the differential cut-off relay 6, back contact and armature of this relay to the calling line and substation circuits, and through the right hand winding of the cut-off relay 6 to ground. Since the cut-off relay is differentially wound and since both of its windings are equally energized, its armature is held retracted. The line relay 5, however, is operated in this circuit and closes a circuit for energizing the relay 7 and the line lamp 8. Relay 7 controls the lighting of pilot lamp 81. The operator on noting that the lamp 8 is lighted, inserts the plug P into a multiple jack J of the calling line. This operation effects the energization of the supervisory relay 9, by a circuit which is closed from grounded battery, winding of relay 9, outer armature and back contact of supervisory relay 10, conductor 11, tip of the plug P, tip of the jack J, right hand winding of the cut-off relay 6 to ground. The relay 9 is operated in this circuit to attract its armatures, and at its left hand armature and front contact closes a substitute holding circuit for itself which is independent of the control of the relay 10. The energizing circuit for the relay 9 including the right hand winding of the cut-off relay 6 is effective to unbalance the differential cut-off relay 6, so that this relay attracts its armature which completes an operating circuit for the relay 10; this circuit extending from grounded battery, winding of the relay 10, sleeve of the plug P, sleeve of the jack J, front contact and armature of cut-off relay 6, through the calling line and substation circuits, and through the right hand winding of relay 6 to ground. The operation of the relay 10 at its outer right hand armature and back contact opens the original actuating circuit of the relay 9, and at its inner right hand armature and back contact opens a break point in the energizing circuit of the flashing recall relay 12, while at its left hand armature and back contact the circuit for lighting the answering supervisory lamp is opened.

With the relay 9 operated, a circuit is closed for effecting the operation of the register at the connecting operator's position. This circuit is closed from ground, 5 outer front contact and armature of relay 9, conductor 13, outer armature and back contact of relay 14, conductor 15, windings of relays 16 and 17, left hand high resistance winding of relay 18, and high resistance 10 winding of relay 19 to grounded battery. The relays 16 and 17 will not operate in series with the high resistance windings of relays 18 and 19. The relay 19, however, is operated and closes a circuit from ground, 15 its armature and front contact, right hand high resistance winding of relay 18 to grounded battery. The relay 18 attracts its armature and closes a locking circuit for itself from grounded battery, its front contact and armature, left hand winding of relay 18 to ground in a circuit serially including relays 17 and 16 which operates these 20 last mentioned relays. Relay 19 deenergizes at this time.

25 As soon as the relay 16 is actuated, it completes a circuit for energizing the relay 20, this circuit extending from ground, winding of relay 20, armature and front contact of relay 16, outer back contact and armature of relay 12, left hand front contact and 30 armature of relay 10, supervisory lamp 21 to grounded battery. The resistance of relay 20 is such that the lamp 21 is dimly lighted to inform the operator to which cord circuit her telephone set is connected. As 35 soon as relay 20 is actuated a short circuit is placed about the winding of relay 17, causing it to be sluggish in releasing its armature but eventually causing it to deenergize. With 40 relays 20 and 17 operated, a circuit is closed for operating the magnet 22 of the call register or meter.

In the event that the operator has simultaneously connected the answering end of 45 two cord circuits to two different calling lines before either of these calls has been completed, this system is arranged so that each of these calls will be accurately registered. As soon as two answering plugs are 50 connected to two different calling telephone lines, the relays such as 16 will be connected in multiple with the circuit serially including the relays 17 and 18. Also when relay 20 was operated, a circuit was closed 55 for the impedance coil 80 and this last mentioned impedance coil is also included in multiple with the circuit last described. The relay 16 is of such design that while it will not operate in multiple with the impedance 60 coil 80 and a second relay 16, it will maintain itself operated in multiple with this impedance coil and relay when once it is actuated. The effect of this arrangement on two "over-lapping" calls, is that the relay 65 16 of the first cord circuit connected to a

calling line will be operated and maintained operated until this call has been extended to the wanted party by inserting the calling plug of the cord circuit into the jack of the wanted line and thereafter signaling this 70 line as will be hereinafter described. As soon as the signaling current is applied to the called line by means of the first cord circuit, the relay 14 thereof will be operated as will appear in the course of this descrip- 75 tion and at its right hand back contact and armature it opens the circuit in which relay 16 was originally operated, thus causing this relay to retract its armatures. The relay 16 at its right hand armature opens the cir- 80 cuit of the slow releasing relay 23 which deenergizes and disconnects the operator's telephone set from the cord circuit under consideration as well as releases relay 33 and permits this telephone set to be con- 85 nected to a second calling line to which this operator has already connected a second cord circuit in the manner which has been referred to as "the overlapping of calls." 90 At the left hand armature and front contact of the relay 16, the operating circuit of relay 20 is opened permitting this relay to deenergize and open the circuit including the impedance coil 80 which, it will be recalled, is included in a circuit in multiple with the 95 relay 16 of the mentioned second cord circuit. As soon as the relay 16 of the first cord circuit and the impedance coil 80 are no longer in multiple with the relay 16 of the second cord circuit it will energize and 100 will operate its associated relay 23 to connect the operator's telephone set to the second cord circuit and will also effect the operation of the meter magnet 22 in the manner already described. 105

When relay 16 of the first mentioned cord circuit is operated, a circuit is closed for actuating the slow releasing relay 23 which attracts its armatures to connect the operator's telephone set (not shown but which 110 may be of any well-known type) to the conductors of the cord circuit taken for use. The operator now receives the designation of the wanted telephone line and proceeds to test the wanted line by touching the tip of 115 the calling plug P' to the sleeve of the jack J' of the wanted line. In the event that the wanted line is idle, the operator inserts plug P' into the jack J' and presses the proper ringing key of the single set of keys at this 120 position to effect the application of ringing current of the proper characteristic to signal the wanted station on the selected line. To test the busy or idle condition of a line the operator touches the tip of the plug P' 125 of the cord circuit to the sleeve of a jack of the wanted line and if this line is busy at the time when it is tested by the operator, the sleeve of its multiple jacks will be characterized by the presence of battery poten- 130

tial applied either through the windings of the answering supervisory relay 10 or the calling supervisory relay 43, thus when the tip of the jack P' engages the sleeve of such a busy line, a circuit is closed over conductor 32, right hand winding of relay 33, armature and contact 34 of relay 23 conductor 35 through the armatures and back contacts of relays 28, 29, 30 and 31 and winding of relay 36 to ground. Relay 36 attracts its armature to close a conductor connected to the operator's telephone set by which a distinct click is caused in the operator's receiver.

Let it be assumed that the wanted line is idle when it is tested by the operator whereupon she inserts the plug P' into the jack J' of this line. The operation of selecting the proper ringing frequency is then effected by depressing some one of the keys 24 to 27 inclusive depending upon which station of the wanted telephone line is desired. Let it be assumed that the operator depresses the ringing key 25 of the group of four ringing keys common to all the cord circuits of this position. This will operate the slow releasing relay 29. With the plug P' in jack J' and with relay 29 operated, a circuit is closed from ground, through the right hand winding of the cut-off relay similar to relay 6, through the tip contacts of the jack J' and of the plug P', conductor 32, right hand winding of relay 33, contact 34 of relay 23, conductor 35 armature and back contact of relay 28, right hand armature and front contact of relay 29, resistance to grounded battery. Relay 33 is energized in this circuit and attracts its armatures. At its right hand armature it closes an operating circuit for the ringing relay 38' and relay 14 in series which circuit is traceable from grounded battery resistance, winding of relay 38', right hand winding of relay 14, right hand front contact and armature of relay 33 to ground. As soon as relay 14 is energized it closes a locking circuit for itself from grounded battery, its left hand winding and armature, tip contacts of the plug P' and jack J', right hand winding of the cut-off relay to ground which maintains the relay 14 operated until this plug is removed from the jack J'. The ringing relay 38' on operation also closes a locking circuit for itself extending from grounded battery, resistance, winding of this relay, back contact and armature of relay 12, middle front contact and armature of relay 38', back contact and armature of supervisory relay 43, conductor 44, inner front contact and armature of relay 14 to ground.

The circuit for lighting the calling supervisory lamp 68 is opened at this time to prevent the lighting of this lamp until the time of disconnection. It will be noted that after the initiation of the ringing, both answering and calling supervisory lamps are

extinguished until the time of disconnection, such an arrangement is known in the manual telephone art as a "Dark key-board".

It will be noted that the locking circuit of the ringing relay 38' is controlled at the right hand back contact and armature of the relay 12 so that if the calling party abandons the call before the called party responds, the relay 12 will be operated in the same manner as in the case of a recall, in the circuit traceable from grounded battery, resistance, winding of relay 12, inner back contact and armature of relay 10, conductor 69, front contact and armature of relay 14, conductor 13, outer armature and front contact of relay 9 to ground. The relay 33 when operated also closes break-points in the circuits which are arranged to variably operate relays 38 and 39 to select any one of the four different frequencies of signaling current. It has been assumed that the ringing key 25 has been depressed to actuate the slow releasing relay 29 and with the relays 29 and 33 actuated, the relays 38 and 39 are operated. The relay 38 is energized in this instance in a circuit traceable from grounded battery, winding of this relay, left hand contact and armature of relay 33, conductor 40, left hand armature and contact 41 of the relay 29 to ground. The relay 38 attracts its armatures closing a locking circuit for itself through its left hand armature and front contact, conductor 42, back contact and armature of relay 43, conductor 44, right hand front contact and armature of relay 14 to ground. The relay 39 is operated in a circuit extending from grounded battery, its left hand winding, outer right hand armature and front contact of relay 33, conductor 45, contacts 46 and 41 of relay 29 to ground. Relay 39 when energized in this circuit attracts its armatures and through its left hand armature and front contact closes a locking circuit for itself over conductor 42 in parallel with the locking circuit of relay 33. With relays 38 and 39 operated, it will be seen that ringing current of 16 cycle frequency is extended from the ringing machine over a circuit including the outer right front contact and armature of relay 39, right hand front contact and armature of relay 38, conductor 47, winding of slow operating trip relay 48, lower front contact and armature of the ringing relay 38 to the sleeve contacts of the plug P' and the jack J' of the wanted line, through the bell at the wanted station B on the party line, through the tip contact of the jack J' and plug P', left hand armature and contact of relay 14, upper armature and front contact of ringing relay 38', resistance to grounded battery. When the wanted party answers, the ringing trip relay 48 is actuated in the well known manner to attract its armature. This closes a shunt

circuit about the ringing relay 38', which deenergizes to render the talking strands of the cord circuit continuous.

While ringing current is being applied to the wanted line, a ringing tone is transmitted to the calling subscriber as follows: A circuit is closed from grounded battery including the 50 cycle source of ringing current generally designated 61, lamp 62, primary winding of the repeating coil 64 to ground. This induces a tone in a circuit extending from grounded battery, secondary winding 65 of the induction coil, conductor 66, lowermost armature and front contact of ringing relay 38, right hand winding of relay 39, over the upper side of the cord circuit to the calling line and substation circuits, over the lower side of the cord circuit, and the winding of relay 43 to grounded battery. It will be noted that the right hand winding of relay 39 is included in the tone circuit in order to reduce the volume of ringing tone that will be heard in the receiver of the calling subscriber. This tone as is well known indicates to the calling party that the ringing current is being applied.

Talking current is applied to the calling line through the windings of relays 9 and 10, while talking current for the called line is supplied through the windings of relays 14 and 43.

When the calling party replaces his receiver on its switchhook the supervisory relay 10 deenergizes, and the relay 9 remains energized as long as the plug P remains in the jack J. Under these conditions the supervisory lamp 21 is lighted in a circuit extending from grounded battery, through this lamp, left hand armature and back contact of relay 10, inner right hand armature and front contact of relay 9, winding of the pilot relay 67 to ground. The operator on noting that lamp 21 is burning, removes the plug P from the jack J. When the called subscriber replaces his receiver on its switchhook, relay 43 deenergizes and relay 14 remains actuated so that a circuit is closed for the calling supervisory lamp 68 extending from grounded battery, through this lamp, middle lower armature and back contact of relay 38, left hand back contact and armature of relay 43, conductor 44, inner right hand front contact and armature of relay 14 to ground.

In the event that the calling party desires to regain the attention of the operator, the subscriber will slowly move his switchhook up and down. This will cause the relay 10 to vibrate its armatures, and thereby close a circuit from grounded battery, winding of the relay 12, inner right hand back contact and armature of relay 10, conductor 69, outer right hand front contact and armature of relay 14, conductor 13, outer right

hand armature and front contact of relay 9 to ground. The relay 12 will be energized in this circuit provided that the called supervisory relay 43 is not actuated, since if this condition exists a shunt circuit will be closed about the relay 12, including conductor 71, left hand contact and armature of relay 43, inner right hand front contact and armature of relay 14 to ground. If relay 12 is operated, it closes a locking circuit for itself over conductor 69, which exists until either the answering or calling plugs are removed from the jacks in which they are in engagement, at which time either one or both of the relays 9 and 14 will be deenergized. As long as relay 12 remains locked up and with relay 10 operated, a circuit is intermittently closed from ground, through the interrupter 74, flashing recall relay 73, left hand front contact and armature of relay 12, left hand front contact and armature of relay 10, lamp 21 to grounded battery. Under the control of this circuit the relay 73 slowly vibrates its armature and thereby causes the recall lamp 75 to be flashed and thereby inform the operator that the calling party desires to regain her attention.

In this system the circuits have been so arranged that the meter will operate to count a recall; this is in keeping with operating practice since it is desired to credit the operator with a recall, since such connection is equally as important as an original connection and requires an equal amount of her time. In the case of a recall the relay 9 will be energized due to the fact that the answering plug P is still in engagement with the contacts of jack J, whereas relay 14 will be deenergized due to the fact that the answering plug P' will be removed from the jack of the called line by the operator as soon as she notes the recall signal on this cord circuit. The original energizing circuit of relay 16 will, therefore, be again completed to close this circuit which effects the energization of relay 23 and connects the operator's telephone set to the calling line. The relay 16 also closes a break point in the energizing circuit of the relay 20, which circuit extends from grounded battery, supervisory lamp 21, armature and front contact of relay 10, armature and back contact of relay 12, front contact and armature of relay 16, winding of relay 20 to ground. This relay when energized effects the operation of the meter magnet 20 in the manner previously described.

It frequently happens that it is desired to test and signal the telephone lines when the answering plug of a cord circuit is not inserted in the jack of a calling line. This occasion may arise when an operator desires to test and ring the telephone line at the request of a lineman or the operator

may desire to signal a subscriber in the case of a revertive call, that is when a subscriber on a telephone line desires to signal a station on the same telephone line. In the testing and signaling at the request of a line-
 5 man, since the answering end of the cord circuit is not in use at this time, the listening-in relay 23 will not function and consequently the circuit for testing and ringing the called line previously mentioned in
 10 this description is not complete. The operator may, therefore, complete another testing and ringing control circuit by depressing the key 180 and by touching the
 15 tip of the plug P' to the sleeve of the line to be tested. If the tested line is busy then its sleeve will be characterized by the presence of battery potential thereon, such as is applied through the windings of the
 20 answering supervisory relay 10 or the calling supervisory relay such as 43. The test circuit may then be described as extending from the tip of the plug P' through the armature and back contact of relay 14, left
 25 hand winding of relay 33, outermost armature and back contact of relay 23, key contact 80, winding of relay 36 to ground. This relay 36 attracts its armature and causes a distinctive click in the operator's head set as previously mentioned.
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In accordance with the usual practice when the operator discovers that the call is revertive she instructs the calling party to hang up for a short period and she then re-
 35 moves the answering plug P from the jack J and inserts the calling plug P' into the multiple jack J, the busy condition will, therefore, be removed by withdrawing the answering plug from the jack J and it will
 40 only be necessary for the operator to depress some one of the ringing keys such as 24 to 27 inclusive to apply the ringing current of the proper frequency to signal the called line in the manner already described.

It is important to note that secret service is provided in this system, that is, the prevention of the operator's listening-in on a conversation after the telephone connection is established. It has been seen how the op-
 50 erator's telephone set is connected to one cord circuit at a time and it will be understood that as soon as relay 14 operates in series with the ringing relay 38', at the time when the signaling of the called line is
 55 initiated it opens the energizing circuit of relay 16 and that relay in turn causes the deenergization of the listening-in relay 23 to disconnect the operator's telephone set from its cord circuit. It should also be
 60 noted that if a second operator attempts to connect the answering end of her cord circuit to the multiple jack of a calling line to which another cord circuit has already been connected then the relay 9 of the sec-
 65 ond cord circuit will not operate. This is

due to the fact that the two relays 9 will be placed in a multiple circuit and the second relay will not receive sufficient current to be energized in this way. Thus the operator cannot listen in on a connection by
 70 inserting the answering end of her cord circuit in a multiple jack of a line already engaged in conversation and the listening-in relay 23 disconnects the operator's telephone set as soon as the called line is signaled.
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It should be stated that the series circuit extending through relays 16, 17, 18 and 19 in addition to controlling the counting of connections completed by the operator, commonly known as a peg count, also controls
 80 the operation of the relay 23 which functions to delay the connection of the operator's head set to the cord circuit connected to the calling telephone line. The purpose of delaying the connection of the operator's
 85 telephone set to this cord circuit is for the purpose of permitting the energy in the calling telephone line to be dissipated in the cord circuit connected thereto before the operator's receiver is extended to the cord cir-
 90 cuit. This prevents annoying clicks in the operator's telephone set. Reference to the drawing will indicate that this delay is accomplished by the sequential operation of the relays 19, 18 and 16 in the order named.
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What I claim is:

1. In a telephone system, a plurality of telephone lines and a plurality of circuits for connection therewith, a recording device common to a plurality of connection
 100 circuits, a controlling circuit having a portion thereof common to a plurality of said circuits, branches of said controlling circuit, one of which is individual to each connection circuit, a marginal relay in each branch
 105 circuit, and means for preventing the operation of more than one relay at the same time.

2. In a telephone system, the combination of a plurality of telephone lines, link conductors for connecting the lines together, an
 110 answering switch and a calling switch, each adapted when operated to connect the link conductors to one of said lines, a ringing circuit including one of said lines, a signal on the line in the ringing circuit, a manual
 115 switch, a source of signal operating current adapted to be connected in said ringing circuit under the control of said manual switch, a recording device, and means for controlling the same, a relay controlling the
 120 association of said manual switch and said controlling means with a link circuit, and means operating said relay when the calling switch is closed to disassociate said manual switch and controlling means from said link
 125 circuit.

3. In a telephone system, a calling telephone line, a called telephone line, a plurality of connective circuits with answering and calling connective switches, a relay
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operated when connection is made by means of the answering switch of a connective circuit with the calling telephone line, a recording device and a key common to a plurality of connective circuits and adapted to be associated with a particular connective circuit by said relay, and means operated after the closure of the calling connective switch to disassociate said key and recording device from the particular connective circuit.

4. In a telephone system, telephone lines serving as calling and called lines, means for characterizing said lines by a busy or idle condition, a link circuit for connecting with one of said telephone lines, two test circuits for said link circuit for determining the busy or idle condition of a telephone line, a break point in one of said test circuits arranged to be closed responsive to the connection of said link circuit to a calling telephone line, and a manual switch for closing a break point in said second test circuit.

5. In a telephone system, telephone lines serving as calling and called lines, means for characterizing said lines by a busy or idle condition, link circuits for connecting one of said telephone lines with another of said telephone lines, two test circuits for said link circuits, a break point in one of said test circuits being closed responsive to the connection of a link circuit to a calling telephone line, and a manual switch common to said link circuits for closing a break point in said second test circuit.

6. In a telephone system, telephone lines serving as calling and called lines, means for characterizing said lines by a busy or idle condition, a link circuit for connecting one of said telephone lines with another of said telephone lines, two test circuits for said link circuit for determining the busy or idle condition of a wanted line, an operator's telephone circuit, a relay for connecting said operator's circuit to said link circuit and for closing a break point in one of said test circuits, and a manual switch for closing a break point in said other test circuit.

7. In a telephone system, telephone lines serving as calling and called lines, means for characterizing said lines by a busy or idle condition, link circuits for connecting one of said telephone lines with another of said telephone lines, two test circuits for said link circuits for determining the busy or idle condition of a wanted telephone line, an operator's telephone set common to said link circuit, a relay for connecting said operator's telephone set to a link circuit and for closing a break point in one of said test circuits, and a manual switch common to said link circuits for closing a break point in said other test circuit.

8. In a telephone system, telephone lines serving as calling and called lines, means for characterizing said lines by a busy or idle condition, link circuits for connecting one of said telephone lines with another of said telephone lines, two test circuits for said link circuits for determining the busy or idle condition of a wanted telephone line, a relay for connecting said operator's telephone set to a link circuit and for closing a break point in one of said test circuits, a manual switch common to said link circuits for closing a break point in said other test circuit, and means for limiting the number of such relays that are simultaneously operated.

9. In a telephone system, a plurality of telephone lines, a plurality of link circuits each terminating at each end in a connective switch, a source of signaling current, mechanism common to said link circuits including an operator's telephone set, a recording device and a manual switch for associating said source of current with a selected link circuit, means responsive to the connection of a connective switch of a link circuit to a telephone line for connecting said mechanism to said link circuit, and means effective after the connection of the other connective switch of said link circuit to a second telephone line for disconnecting said mechanism from said link circuit.

10. In a telephone system, a plurality of telephone lines, a plurality of link circuits each terminating at each end in a connective switch, sources of signaling current of different character, mechanism common to said link circuits, including an operator's telephone set, a recording device and a set of keys, one for each source of current for associating the same with a selected link circuit, means responsive to the connection of a connective switch and a link circuit to a telephone line for connecting said mechanism to said link circuit, and means effective after the connection of the other connective switch of said link circuit to a second telephone line for disconnecting said mechanism from said link circuit.

11. In a telephone system, a plurality of telephone lines, cord circuits for interconnecting one telephone line with any of the other telephone lines, an indicating lamp associated with each cord circuit, each lamp being normally extinguished but arranged to be lighted at full brilliancy to indicate that its associated cord circuit is to be disconnected from a telephone line, an operator's telephone set arranged to be connected with any of said cord circuits, and means effective on the connection of said telephone set to a cord circuit for dimly lighting the signal lamp of the associated cord circuit.

12. In a telephone system, a plurality of telephone lines, substation signals on said

telephone lines arranged to be selectively actuated in response to current of different frequencies, sources of current of different frequency, a plurality of cord circuits, each cord circuit serving to connect any telephone line with any other telephone line, a set of keys common to said cord circuits, said set having only one key for each source of signaling current, a slow relay controlled by each ringing key, a pair of relays arranged to be variably and selectively operated to select a desired source of ringing current, and a pair of circuits for operating said relays, said circuits being closed at the key-controlled relays.

13. In a telephone system, a plurality of telephone lines, substation signals on each line arranged to be selectively operated by current of different frequencies, a plurality of cord circuits, each cord circuit serving to interconnect any telephone line with any other telephone line, an operator's telephone set and a counting device common to said cord circuits, mechanism responsive to the connection of a cord circuit to a telephone line for associating an operator's telephone set and counting device therewith, sources of signaling current for variably operating said substation signals, means for selecting the proper source of signaling current to actuate the desired substation signal, said means including a pair of circuits and a single set of keys common to all of said cord circuits, but one key being provided for each source of current, and means including said mechanism for associating said set of keys with a cord circuit to which said operator's telephone set is connected.

14. In a telephone system, a plurality of telephone lines, substation signals on each telephone line, the signals of each telephone line being variably operated in response to current of different characteristics, a plurality of cord circuits, each cord circuit being arranged to connect a calling telephone line with any of the other telephone lines, an operator's telephone set common to said cord circuits, mechanism responsive to the connection of a cord circuit to a telephone line for connecting the operator's telephone set to said cord circuit, sources of current of different frequency, a manual switch for each source of current, said manual switches being common to a plurality of cord circuits, and means for associating said manual switches with the cord circuit to which said operator's telephone set has been connected, means responsive to the actuation of a manual switch and the connection of the other end of said cord circuit to a wanted telephone line for connecting a predetermined source of current to said last mentioned telephone line, and means responsive to the connection of said source of current to said line for transmitting a tone to said calling telephone line.

15. In a telephone system, a plurality of telephone lines, sub-station signals on said telephone lines arranged to be selectively actuated in response to current of different character, sources of current of different character, a plurality of cord circuits, each cord circuit serving to connect any telephone line with any other telephone line, a signal associated with each cord circuit, a set of keys common to said cord circuits, an operator's telephone set, means responsive to the initiation of a call over a cord circuit for connecting said operator's telephone set to said cord circuit, means for thereupon actuating the signal associated with said cord circuit in a distinctive manner, means responsive to the extension of a call over said cord circuit for associating said common keys with said cord circuit, and means responsive to the actuation of one of said common keys and the connection of the other end of said cord circuit to a telephone line for extending a source of current to a wanted signal on said last mentioned telephone line.

16. In a telephone system, a plurality of telephone lines, substation signals on said telephone lines arranged to be selectively actuated in response to current of different character, sources of current of different character, a plurality of cord circuits, each cord circuit serving to connect any telephone line with any other telephone line, a signal associated with each cord circuit, a set of keys common to said cord circuits, an operator's telephone set, means responsive to the initiation of a call over a cord circuit for connecting said operator's telephone set to said cord circuit, means for actuating the signal associated with said cord circuit in a distinctive manner, means responsive to the extension of a call over one of said cord circuits for associating said common keys with said cord circuit, means responsive to the actuation of one of said common keys and the connection of the other end of said cord circuit to a telephone line for extending a source of current to actuate a wanted signal on said last mentioned telephone line, and subscriber controlled intermittently actuated recall means for actuating the signal associated with said cord circuit.

17. In a telephone system, a plurality of telephone lines, a signal on each telephone line, a plurality of link circuits for connecting one telephone line with a wanted telephone line, a source of ringing current, ringing control mechanism including a ringing key common to said link circuits, means responsive to the connection of a link circuit to a telephone line and to a called telephone line for associating said ringing control mechanism with said last mentioned link circuit, a ringing circuit completed

from said source of current to the signal of the called telephone line when said ringing control mechanism is operated and when the other end of said link circuit is connected to the wanted telephone line, and a subscriber controlled intermittently actuated recall signal located at each of said link circuits.

18. In a telephone system, a plurality of telephone lines, a signal on each telephone line, a plurality of link circuits for connecting one telephone line with a wanted telephone line, sources of ringing current and ringing control mechanism including ringing keys common to said link circuits, means responsive to the connection of a link circuit to a telephone line and to a called telephone line for associating said ringing control mechanism with said last mentioned link circuit, a ringing circuit completed from one of said sources of current to the signal of the called telephone line when said ringing control mechanism is selectively operated and when the other end of said link circuit is connected to the called telephone line, and a subscriber-controlled intermittently actuated recall signal located at each of said link circuits.

19. In a telephone system, an operator's position, a plurality of telephone lines terminating thereon, a plurality of cord circuits at said operator's position, each cord circuit terminating in answering and calling switches, an operator's telephone set normally disconnected from said cord circuits, means responsive to the contemporaneous connection of the answering switches

of two cord circuits to calling telephone lines for connecting said telephone set to one of said cord circuits to the exclusion of the other cord circuit, a source of ringing current, a manual key common to said cord circuits, means for associating said manual key with said cord circuit, and means responsive to the connection of the calling switch of said first cord circuit to the wanted telephone line for associating said operator's telephone set with said second cord circuit.

20. In a telephone system, an operator's position, a plurality of telephone lines terminating thereon, a plurality of cord circuits at said operator's position, each cord circuit terminating in answering and calling switches, an operator's telephone set normally disconnected from said cord circuits, means responsive to the contemporaneous connection of the answering switches of two cord circuits to calling telephone lines for connecting said telephone set to one of said cord circuits to the exclusion of the other cord circuit, a source of ringing current, manual keys common to said cord circuits, means for associating said manual keys with said cord circuit, and means responsive to the connection of the calling switch of said first cord circuit to the wanted telephone line for associating said operator's telephone set with said second cord circuit.

In witness whereof, I hereunto subscribe my name this 28th day of August A. D. 1920.

JOHN H. LEVIS, JR.