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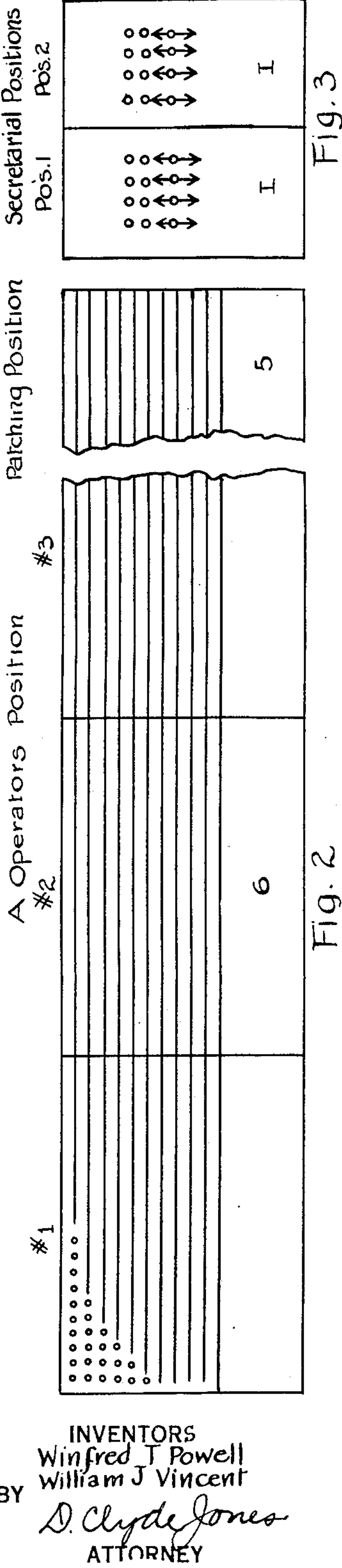
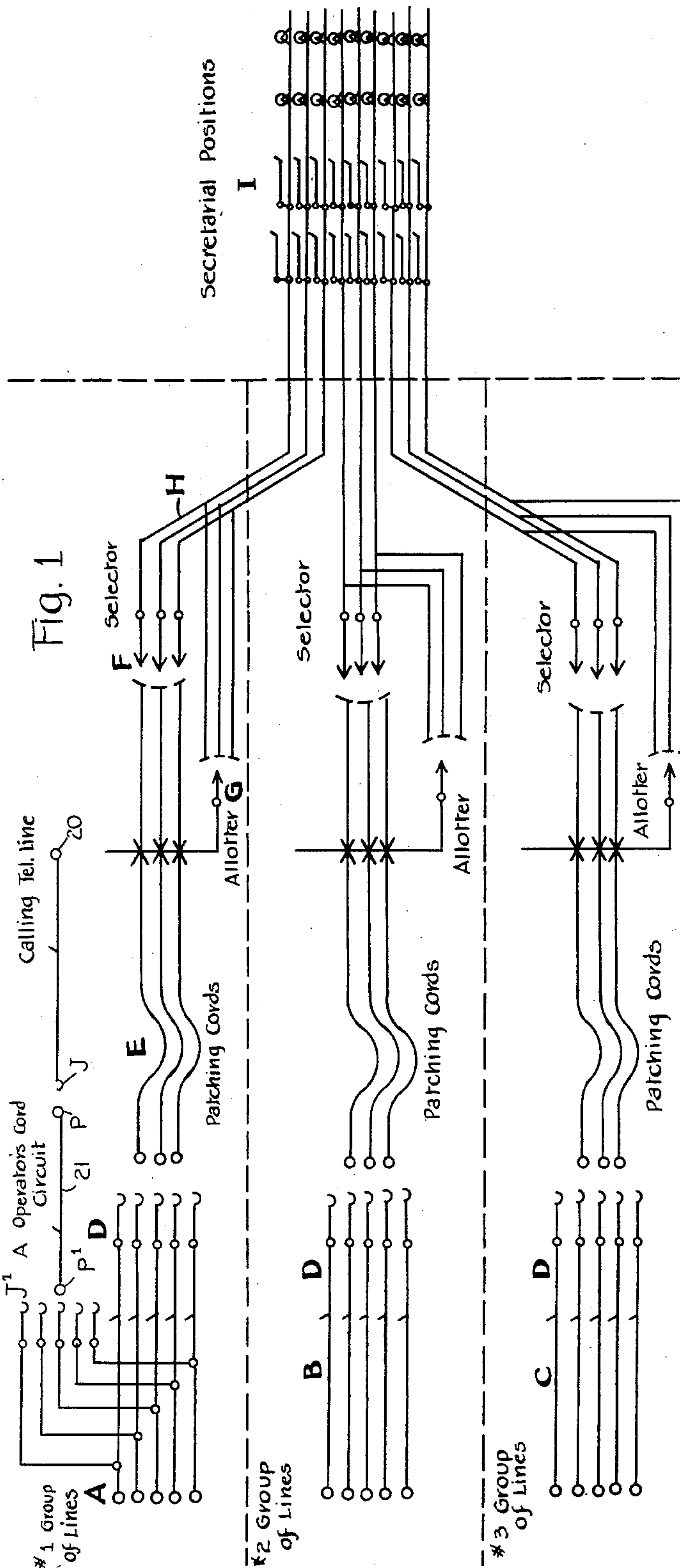
W. T. POWELL ET AL

1,934,949

TELEPHONE SYSTEM

Filed Feb. 6, 1932

2 Sheets-Sheet 1



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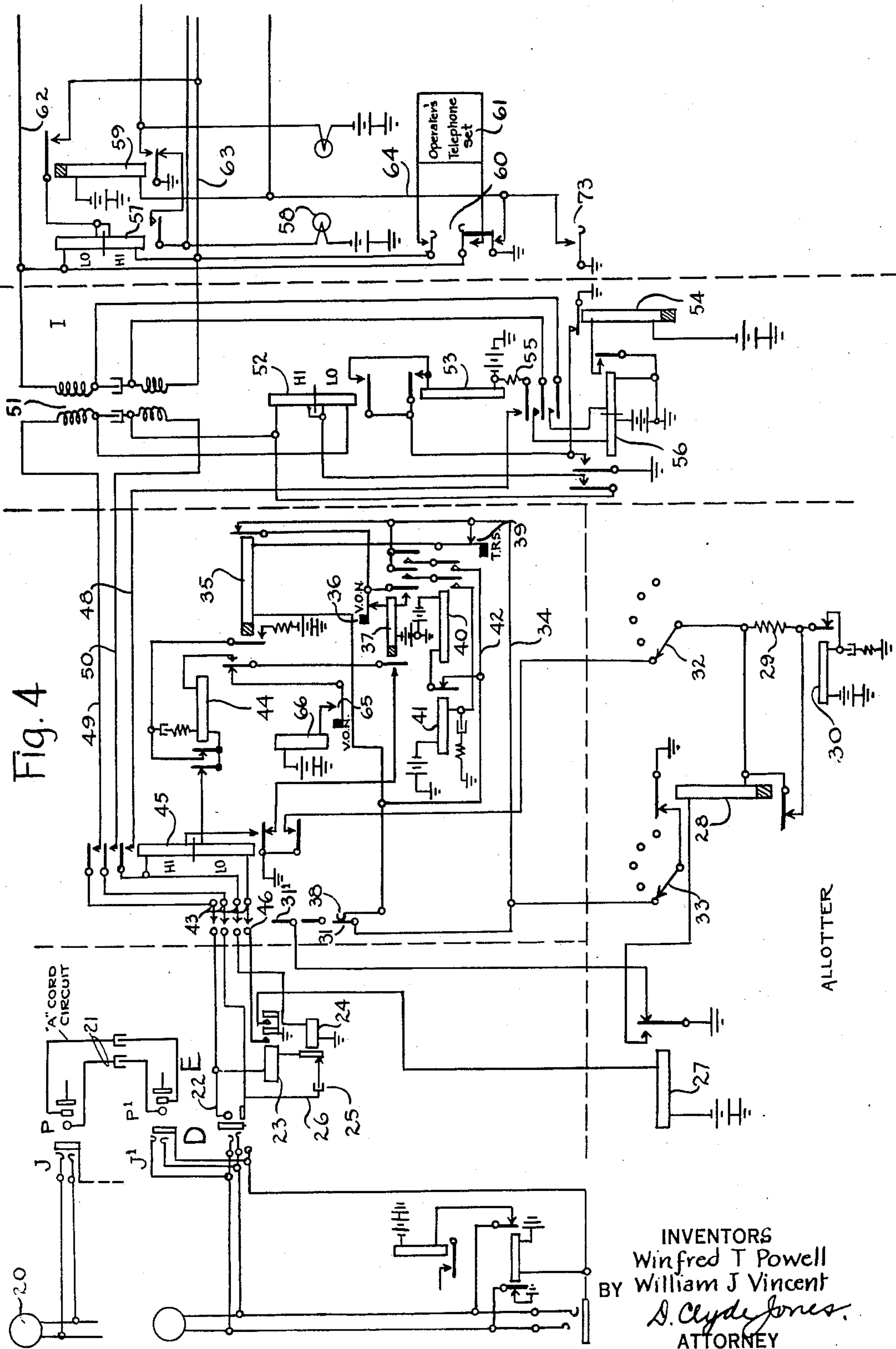
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UNITED STATES PATENT OFFICE

1,934,949

TELEPHONE SYSTEM

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19 Claims. (Cl. 179—27)

This invention relates to telephone systems, and more particularly to telephone systems arranged to provide secretarial service.

At the present time, agencies independent of the telephone operating companies, provide a type of service known as secretarial service whereby subscribers, such as, doctors, insurance agents and others who do not have secretaries and yet whose duties require them to be away from their offices for considerable periods, may have their telephone calls answered and certain information in accordance with pre-arranged instructions, given. The telephone equipment which has been used in providing such service has been ill-adapted for this purpose and has also been expensive, while the service itself, since it was not a part of the service provided by the telephone operating company, did not afford the high degree of accuracy and reliability afforded in commercial telephone practice.

In accordance with the present invention, a novel arrangement is provided in a telephone system whereby such secretarial service may be supplied, on the payment of a prescribed fee, in addition to the regular service offered by the telephone operating companies, and whereby the equipment affording such service, is designed for giving quick and reliable operation at a minimum of cost.

A further feature of the invention relates to an arrangement whereby a call to an unattended subscriber's substation may be transferred to an answering secretarial desk of a telephone exchange wherein automatic switches provided on a percentage basis, reduce the number of necessary channels between a secretary's position or positions at the telephone exchange and the lines of the subscribers entitled to such service.

For a clearer understanding of the invention, reference is made to the drawings in which Fig. 1 is a schematic showing of the present invention; Fig. 2 represents the outline of an elevational view of a multiple switchboard including a "patching" position; Fig. 3 is a plan view indicating the mechanical equipment of two secretarial positions; and Fig. 4 is a diagrammatic showing of a portion of such a telephone system representing the detailed circuits thereof, which are particularly adapted for use in providing the secretarial service.

Referring especially to Fig. 1, there are indicated three groups of telephone lines A, B and C with one hundred lines in each group, entitled to secretarial telephone service, although it will be understood that the number of such groups and

the number of telephone lines in each group may be varied in accordance with the traffic requirements of each telephone system. At D there are indicated, jacks connected in multiple with other multiple jacks of these lines, and such a section 60 of a multiple switchboard 6 may be used for this service, the jacks such as D may be multiple calling jacks in this section of the switchboard. In this system there are provided so-called patching cords, such as E, which cords may terminate 65 at one end in plugs for connection with the multiple jacks D and which may terminate at the other end in the fixed contacts or terminals of a plurality of selectors or finder switches F which are herein represented as being ten in 70 number corresponding with percentage trunking familiar in automatic telephone exchange practice. If desired each patching cord may terminate at both ends in a plug, in which case the connections from the fixed contacts of the finder 75 switches may terminate in jacks, into which the plug of one end of the patching cord may be inserted. The brushes of each selector switch are connected by a trunk, such as H, to a secretarial position or positions "I" where this trunk is provided with listening and holding keys together 80 with incoming and holding lamps, which will be hereinafter referred to. An allotter switch G is provided for each group of selector switches, for the purpose of assigning an idle selector switch 85 for use.

It is believed that the invention will best be understood by describing the manner in which the secretarial service is performed in the case of a call to an unattended called line. When the 90 subscriber entitled to such service is about to leave his office, he calls up the telephone company and gives the necessary instructions, whereupon a patching cord E is inserted in a multiple jack of his line. Thereafter when a party at the 95 substation of a calling telephone line, such as 20, originates a call intended for such unattended line, the following procedure takes place: When the calling subscriber at substation 20 initiates the call by removing his receiver from its 100 switch hook (not shown), the well-known line equipment (not shown) functions to light a lamp thereof and an A operator inserts the plug P of an idle cord circuit 21 into the jack J of this calling line. This operator, using well-known 105 equipment (not shown) associated with the cord circuit, inquires the number of the wanted telephone line and inserts the plug P' into the jack J' of this wanted subscriber's line whereupon ringing current is transmitted through both sides of 110

the subscriber's line in series, either automatically or in response to manually operated means. It has been pointed out that this called subscriber's line has been associated with one or more secretarial positions "I", by connecting the patching cord E to a multiple jack of this line, so that when ringing current is applied to the terminals of the desired telephone line, this current is transmitted through the tip and ring contacts of the multiple jack D and the contacts of the plug of the patching cord, and thence through conductor 22 of the cord, winding of the relay 23, back contact and armature of cut-off relay 24, condenser 25, and conductor 26 of the cord connected to the ring contact of the patching plug, which completes this circuit. The relay 23 is operated and locked mechanically in response to this ringing current and at its right-hand armature and contact completes a circuit from ground through the winding of group relay 27 to grounded battery, which relay, it will be understood, is common to a group of patching cords E, the number of which in the present disclosure is ten. As soon as the group relay 27 is operated, it closes a circuit traceable from its grounded armature and front contact, winding of the slow releasing start relay 28, armature and back contact of relay 28, armature, back contact and winding of the motor magnet 30 of the allotter to grounded battery which circuit energizes the start relay. It will be understood that when the group relay 27 is operated it removes ground potential from the group contact 31' of the finder switch.

As soon as the starting relay 28 is operated, it closes a circuit from ground, its upper armature and front contact, allotter brush 33, conductor 34, back contact and armature of the rotary starting relay 35, vertical off-normal contacts 36, winding of the slow releasing, vertical starting relay 37, to grounded battery. This last named relay on operating, closes a locking circuit for itself through its innermost front contact and armature and the remainder of its original energizing circuit, which circuit is now independent of the off-normal contacts 36. It should be noted that at this time, the slow releasing relay 35 is short circuited, since both of its terminals are connected to ground, one of its terminals being connected to ground through the group brush 38 of the selector and the group contact with which it is in engagement and thence to grounded conductor 34; the other terminal of the relay 35 being connected to the ground conductor 34 through the rotary off-normal contacts 39 which are closed until the tenth rotary step of the selector. With the rotary start relay 35 thus short circuited, it cannot operate, but the vertical start relay 37 is operated to start the vertical movement of the selector switch. This is effected by operating the interrupter relay 40 from grounded battery, its winding, armature and back contact of the vertical stepping magnet 41, conductor 42, group brush 38 and the group contact 31 with which it is in engagement, allotter brush 33, front contact and armature of relay 28 to ground. The interrupter relay 40 thus attracts its armature and thereby closes a circuit from grounded battery, winding of the vertical stepping magnet 41, innermost front contact and armature of the relay 40, middle, front contact and armature of relay 37, conductor 34, allotter brush 33, front contact and armature of relay 28 to ground. The stepping magnet 41 when operated moves the brushes 43, and the group brush 38 of the se-

lector one step in their vertical direction; also, when the stepping magnet 41 is energized it opens the circuit of the interrupter relay 40, which in turn opens the circuit of the stepping magnet 41. If the called line is not in the group thus selected, the group brush 38 will be in engagement with a group contact similar to 31 which will be characterized by ground potential. As long as brush 38 encounters ground potential on its group contacts, relay 35 will be short circuited, and the vertical start relay 37 will remain operated through its innermost front contact and armature, while the circuit of interrupter relay 40 will be intermittently opened each time that the vertical stepping magnet 41 is energized to advance the selector brushes one more step. When the group of contacts of the group of cords including the one connected to the called line, is reached by the selector brushes, the group contact 31' thereof will be characterized by the absence of ground potential, due to the fact that the group relay 27 is operated. As soon as the group brush 38 encounters this group contact 31', the interrupter relay 40 will remain inactive but the rotary start relay 35, since it is no longer short-circuited, will be operated from ground, armature and front contact of starting relay 28, allotter brush 33, conductor 34, rotary off-normal contacts 39, winding of rotary start relay 35, conductor 42, back contact and armature of vertical stepping magnet 41, winding of the interrupter relay 40 to grounded battery. The relay 35 is energized in the circuit, but the interrupter relay 40 is not operated, due to the resistance of the relay 35 in series therewith. Relay 35 when it operates, opens a break point in the operating circuit of the vertical start relay 37 so that this relay is disabled at this time, and no primary movement of the switch can be effected.

It has been mentioned that the vertical start relay 37 is slow releasing and it thereby introduces a delay sufficiently long to permit the selector brushes to stop vibrating before their rotary movement is started. When the relay 37 has released, it closes an operating circuit for the rotary stepping magnet 44, from grounded battery, resistance coil, front contact and armature of relay 35, back contact, armature and winding of stepping magnet 44, outer front contact and armature of relay 35, armature and back contact of relay 37, inner back contact and armature of relay 45 to ground. The stepping magnet 44 is thus energized, but immediately interrupts its own circuit to step the selector brushes 43 intermittently until the test brush thereof encounters the test contact 46, which is characterized by ground potential applied at the right hand armature and front contact of the line relay 23. The presence of ground potential on this test contact, indicates that it is connected to the desired patching cord and the selector switch is brought to rest with its brushes in engagement with the contacts of this cord.

When this desired patching cord is selected, the stepping magnet 44 is short-circuited and the switching relay 45 is operated in a circuit, traceable from grounded battery, resistance coil, front contact and armature of relay 35, the back contacts and armatures in series of stepping magnet 44, through the low resistance winding of the relay 45, the test brush and the selected test contact 46 with which it is in engagement, front contact and armature of relay 23 to ground.

The relay 45 on operation closes a circuit

from ground, its lower-most armature and front contact, allotter brush 32, resistor 29, armature back contact and winding of the motor magnet 30, to grounded battery. The resistor 29 prevents the motor magnet 30 from operating at this time, and consequently, the allotter brushes remain in the position where they were standing. The circuit just described however, short circuits the slow releasing start relay 28, which after a short interval retracts its armatures. This interval is of such duration as to allow the holding circuit including the high resistance winding of relay 45 of the selector to be established before the holding ground is disconnected at the upper armature and front contact of relay 28. At the close of this interval the allotter advances its brushes to assign an idle trunk for use since its magnet is intermittently operated from grounded battery, its winding back contact and armature, back contact and armature of relay 28, brush 32, front contacts and armatures of relays 45, at busy trunks, to ground.

The switching relay 45 on operation also extends the connection thus far established including the conductors 22 and 26, through the tip and ring selector brushes and through the tip and ring conductors 49 and 50 of the trunk, through the left-hand windings of the repeating coil 51, and thence in series through the high and low resistance windings of the relay 52. This relay is thus energized and closes an operating circuit from grounded battery, winding of the holding relay 53, lower front contact and armature of relay 52, upper back contact and armature of the slow releasing relay 54 to ground. As soon as the holding relay 53 is operated it completes a holding circuit for the selector and for the patching cord E, which circuit extends from grounded battery, resistor 55, inner armature and front contact of relay 53, conductor 48, inner front contact, armature and high resistance winding of relay 45, its lower inner front contact and armature to ground. A circuit for holding the cut-off relay 24 of the cord is completed in multiple with the circuit last described from ground, winding of the cut-off relay, sleeve brush of the selector switch, upper innermost armature and front contact of relay 45 to conductor 48. These last described circuits serve to maintain the connection until the secretarial operator has answered the call.

The operation of the relay 53, completes a circuit from grounded battery left-hand winding of the relay 56, middle contact and armature of relay 53, lower right-hand winding of the repeating coil 51, through the high resistance winding of relay 57 and through the low resistance winding of this relay in series, upper right-hand winding of the repeating coil, lower-most armature and front contact of relay 53, right-hand winding of relay 56 to ground. This circuit in addition to connecting battery to the secretarial operator's trunk "T", effects the operation of the relay 57, but the relay 56 remains inoperative at this time due to the high resistance winding of the relay 57. The operation of the relay 57 effects the lighting of the incoming lamp 58 from grounded battery, lamp 58, armature and front contact of relay 57, back contact and armature of relay 59, to ground.

The secretarial operator on noting the lighting of this lamp, actuates the listening key 60 to connect her telephone set 61 to the conductors 62 and 63 of the trunk to which the incoming call

has been connected. The secretarial operator then inquires as to what subscriber was called and may convey to the calling party that the wanted subscriber is away from his office, but will return at a certain time. In addition, the secretarial operator may keep a record of the party calling this subscriber, which information may be transmitted to him when he returns to his office. When the listening key 60 is actuated, a holding circuit is closed for the slow releasing, holding relay 59 from grounded battery, winding of this relay, conductor 64, lower contacts of the listening key 60 to ground. The relay 59 on operation at its upper armature and front contact, short-circuits the high resistance winding of the relay 57. With this resistance removed from the circuit of the relay 56, it operates and at its outer left-hand armature and front contact, short-circuits the high resistance winding of the relay 52, which results in the "tripping" or discontinuance of the application of ringing current to the called line in the well-known manner, and this relay is also effective in giving supervision also in the well-known manner to the A operator. The relay 56 on operation also closes a locking circuit for the holding relay 53, extending from grounded battery, winding of this relay, its upper front contact and armature, inner front contact and armature of relay 56 to ground. The relay 56 at its right-hand armature and contact, closes a circuit from ground, winding of the slow releasing relay 54 to grounded battery.

When the listening key 60 is restored to normal, the secretarial operator, if she so desires, may hold the connection by actuating the holding key 73 since the slow releasing relay 59 may have its circuit maintained either at the lower contacts of the listening key 60, or at the contacts of the holding key 73.

When the secretarial operator has finally disposed of a call, both the listening key 60 and the holding key 73 are restored to normal which results in the release of the slow releasing relay 59, which in turn is effective to include the high resistance winding of relay 57 in the operating circuit of the relay 56. This last named relay thereupon deenergizes and at its right hand armature and ground contact effects the release of the slow releasing relay 54. Since the relay 56 releases quickly and since the relay 54 releases slowly, there is an interval in which the locking circuit of the holding relay 53 is interrupted so that this relay releases. When, however, relay 54 releases, it again connects ground potential through its upper armature to its back contact in readiness for the next call. When the holding relay 53 deenergizes, it removes the holding battery from the conductor 48 which permits both the switching relay 45 and cut-off relay 24 to release. When the relay 45 releases, it closes a circuit from ground, its inner armature and back contact, back contacts and armatures of relays 37 and 35, vertical off-normal contacts 65, winding of the release magnet 66 to grounded battery. This magnet operates in the well-known manner to restore the selector brushes 43 to their normal position. The release of the relay 24 again connects the relay 23 in series with patching cord conductors 22 and 26 in readiness for receiving another call. The A operator removes the plugs P and p' from the jacks with which they were in engagement and if a B operator co-operated in establishing the last mentioned connection, this B operator

restores the cord circuit used, to its normal condition.

While a selector having vertical and rotary movement has been disclosed and described, it will be understood that the invention is not limited to this type of switch, but other forms of switches and even relay type selectors may be substituted therefor without departing from the spirit of the present invention.

What we claim is:

1. The method of handling telephone calls intended for unattended subscribers' substations which comprises extending the telephone calls to the respective unattended substations, and simultaneously and automatically non-numerically extending each such call over one of a plurality of possible paths to a secretarial operator.

2. The method of handling telephone calls intended for unattended subscribers' substations of a group of substations, which comprises extending the telephone calls to the respective substations and then automatically and non-numerically extending said calls in succession to a secretarial operator.

3. The method of handling telephone calls intended for unattended subscribers' substations, which comprises extending the telephone calls to the respective substations and then extending said calls automatically and non-numerically to a secretarial operator through a number of channels less than the number of said called substations.

4. The method of handling telephone calls intended for unattended subscribers' substations, which comprises extending said calls to said substations and completing the calls to a secretarial operator automatically and non-numerically in response to the extension of said calls to said substations, through a number of channels less than the number of said substations.

5. The method of handling telephone calls intended for unattended subscribers' substations, which comprises extending said calls to said substations, signalling said substations, and extending the calls to a secretarial operator automatically and non-numerically through a number of channels less than the number of said lines in response to said signalling.

6. The method of handling telephone calls intended for unattended substations which comprises extending such calls to said unattended substations, and extending such calls to a secretarial operator automatically and non-numerically over a number of channels approximately equal to the maximum number of probable simultaneous calls.

7. In a telephone system, a group of telephone lines, a group of unattended telephone lines, a secretarial position, means for interconnecting a line of one group with a line of a second group, and means including exclusively non-numerical automatic switching means for extending such interconnected lines to said secretarial position.

8. In a telephone system, a group of telephone lines, a group of unattended telephone lines, a secretarial position, means for interconnecting a line of one group with a line of the second group, and exclusively non-numerical means including any one of a group of automatic switches less than the number of said unattended lines, for extending said interconnected lines to said secretarial position.

9. In a telephone system, a group of telephone lines, a group of unattended lines, a secretarial position, means for interconnecting a line of one group with a line of a second group, means for signalling the unattended line of said connection such as by applying ringing current thereto, and means including exclusively non-numerical automatic switching means for extending such interconnected telephone lines to said secretarial position in response to said signalling means.

10. In a telephone system, a plurality of telephone lines, means for interconnecting said telephone lines, an auxiliary position, means including a link circuit for establishing a portion of a connection from any of said telephone lines to said auxiliary position prior to the initiation of a call intended for said telephone line, and non-numerical automatic switching means for selectively connecting said auxiliary position to the link circuit associated with said telephone line when called.

11. In a telephone system, a plurality of telephone lines, means for interconnecting said telephone lines, an auxiliary position, link circuits connectible to said telephone lines prior to the initiation of calls intended therefor, non-numerical switches to which said link circuits are connected prior to the initiation of calls intended for said telephone lines, means for connecting non-numerical switches to said auxiliary position, and means responsive to the extension of a call intended for one of said telephone lines for operating one of said non-numerical switches to extend the link circuit connected to said last-mentioned telephone line, to said auxiliary position.

12. In a telephone system, a plurality of telephone lines, means for interconnecting said telephone lines, an auxiliary position, link circuits connectible to said telephone lines prior to the initiation of calls intended therefor, non-numerical switches to which said link circuits are connected prior to the initiation of calls intended for said telephone lines, means for connecting non-numerical switches to said auxiliary position, and means responsive to the extension of a call to one of said telephone lines for operating one of said non-numerical switches to extend the link circuit connected to said last-mentioned telephone line to said auxiliary position, and allotting means for assigning idle non-numerical switches for use in succession.

13. In a telephone system, a plurality of telephone lines, an operator's position and a "patching" position, both having jacks in which said telephone lines terminate, means including said operator's position for interconnecting said telephone lines, an auxiliary position, "patching" cords connectible to said telephone lines through the jacks thereof at said "patching" position, and means including a non-numerical switch operated responsive to the extension of a call to one of said telephone lines for extending the patching cord connected to said telephone line, to said auxiliary position.

14. In a telephone system, a plurality of telephone lines, an operator's position and a "patching" position, both having jacks at which said telephone lines terminate, means including said operator's position for interconnecting said telephone lines, an auxiliary position, "patching" cords connectible to said telephone lines through the jacks thereof at said "patching" position, means including non-numerical switches operat-

ing responsive to the extension of calls intended for said telephone lines for extending the "patching" cords connected thereto, to said auxiliary position, said non-numerical switches being equal in number to the maximum number of simultaneous calls extended through said "patching" cords, and allotting means for assigning non-numerical switches for use in succession.

15. In a telephone system, a plurality of telephone lines, an operator's position and a "patching" position, both having jacks at which said telephone lines terminate, means including operator's cord circuits at said operator's position for interconnecting said telephone lines, an auxiliary position, "patching" cords connectible to said telephone lines through the jacks thereof at said "patching" position, each "patching" cord having a relay connected thereto and responsive to ringing or other signalling current, means for applying ringing or signalling current to a telephone line when called, means including a non-numerical switch responsive to the action of said relay under the control of said ringing or signalling current for extending the patching cord connected to said called telephone line, to said auxiliary position.

16. In a telephone system, a plurality of telephone lines, an operator's position and a "patching" position, both having jacks at which said telephone lines terminate, "patching" cords connectible to the jacks of telephone lines at said "patching" position, means including said operator's position equipment for interconnecting said telephone lines, an auxiliary position provided with a plurality of answering trunks, and means including a non-numerical switch for extending an answering trunk to the "patching" cord of a telephone line on the extension of a call to said telephone line.

17. In a telephone system, a plurality of telephone lines, an operator's position and a "patching" position, both having jacks at which said telephone lines terminate, "patching" cords connectible to the jacks of telephone lines at said "patching" position, means including said operator's position for interconnecting said telephone lines, an auxiliary position provided with a plu-

ality of answering trunks, means including a non-numerical switch for extending an answering trunk to the "patching" cord of a telephone line on the extension of a call to said telephone line, and an operator's telephone set at said auxiliary position connectible to any of said answering trunks.

18. In a telephone system, a plurality of telephone lines, an operator's position and a "patching" position, both having jacks at which said telephone lines terminate, "patching" cords connectible to the jacks of telephone lines at said "patching" position, means including said operator's position for interconnecting said telephone lines, an auxiliary position provided with a plurality of answering trunks, means including a non-numerical switch for extending an answering trunk to the patching cord of a telephone line on the extension of a call to said telephone line, an operator's telephone set at said auxiliary position connectible to any of said answering trunks, and means for maintaining the connection from the answering trunk to the patching cord of a called telephone line while said operator's telephone set is connected to said answering trunk.

19. In a telephone system, a plurality of telephone lines, an operator's position and a "patching" position, both having jacks at which said telephone lines terminate, "patching" cords connectible to the jacks of telephone lines at said "patching" position, means including said operator's position for interconnecting said telephone lines, an auxiliary position provided with a plurality of answering trunks, means including a non-numerical switch for extending an answering trunk to the patching cord of a telephone line on the extension of a call to said telephone line, an operator's telephone set at said auxiliary position connectible to any of said answering trunks, means for maintaining the connection from the answering trunk to the patching cord of a called telephone line while said operator's telephone set is connected to said answering trunk, and a holding key also operative to maintain said last-mentioned connection.

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