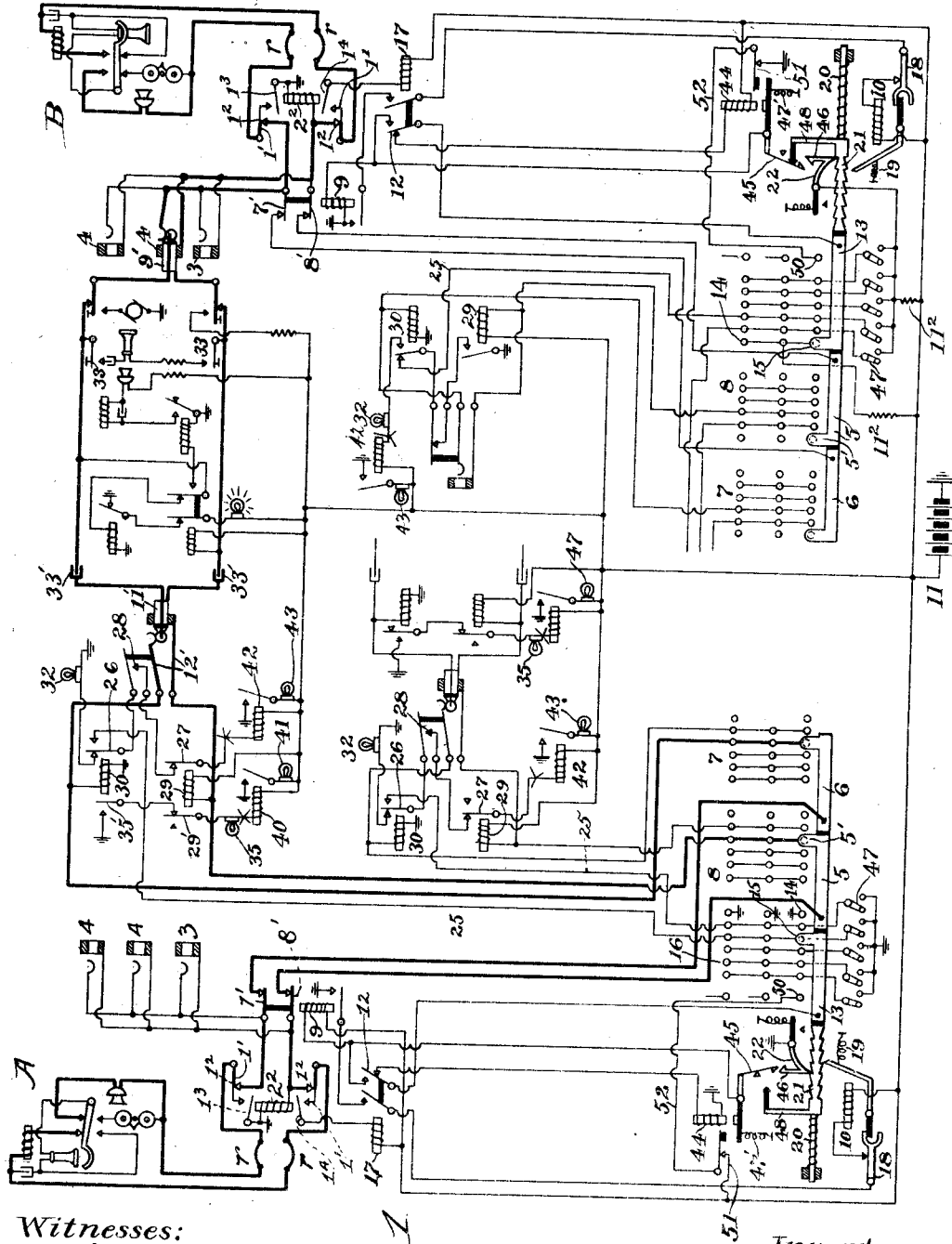


F. W. DUNBAR.
TELEPHONE EXCHANGE SYSTEM.
APPLICATION FILED JAN. 13, 1905.

1,133,111.

Patented Mar. 23, 1915.
3 SHEETS—SHEET 1.



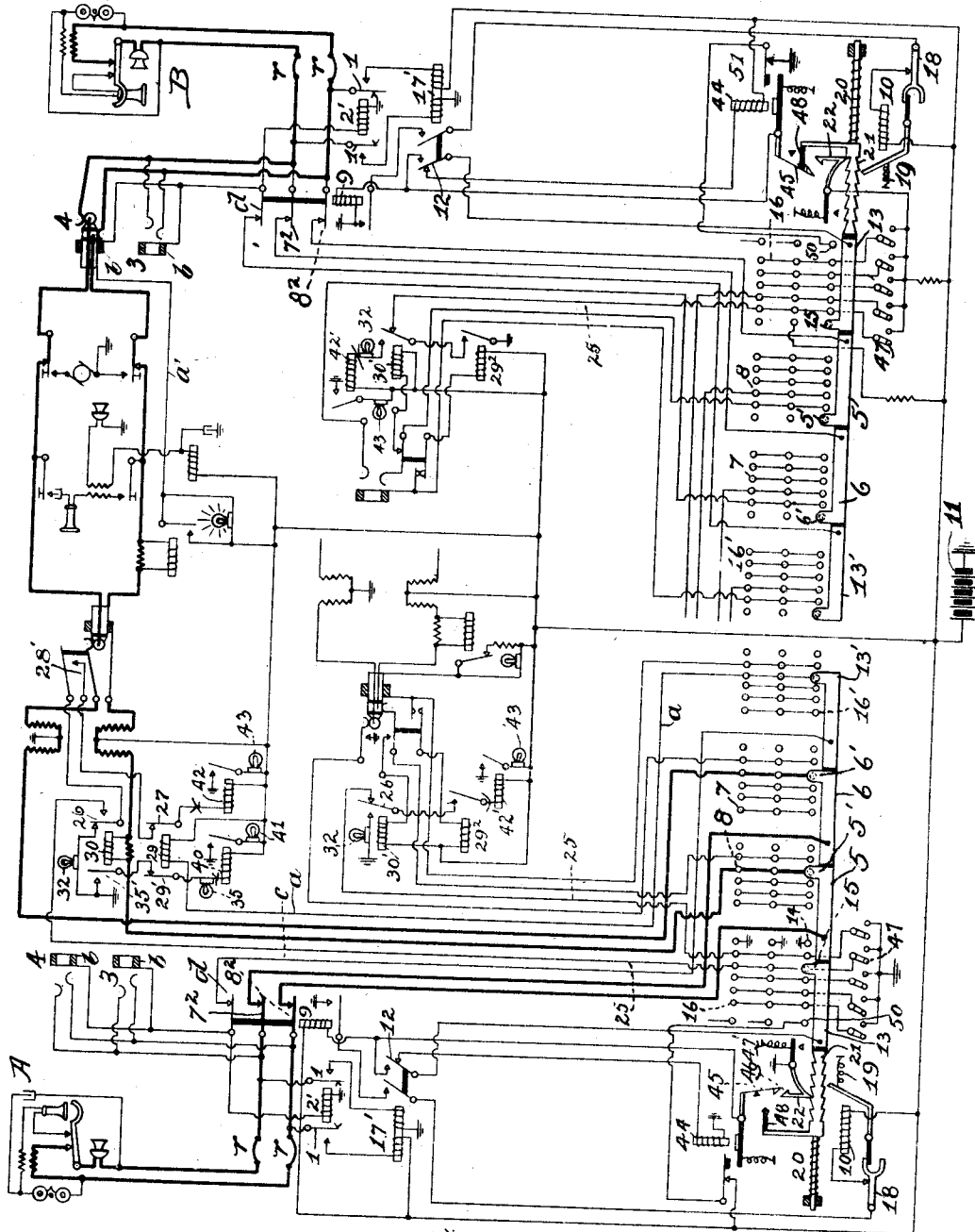
Witnesses:
Alec A. Strander
Leon Strick

Fig. 1

Inventor:
Francis W. Dunbar
By G. L. Bragg
Atty.

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3 SHEETS-SHEET 2.



Witnesses:
Alec Ostrander
Leon Strick

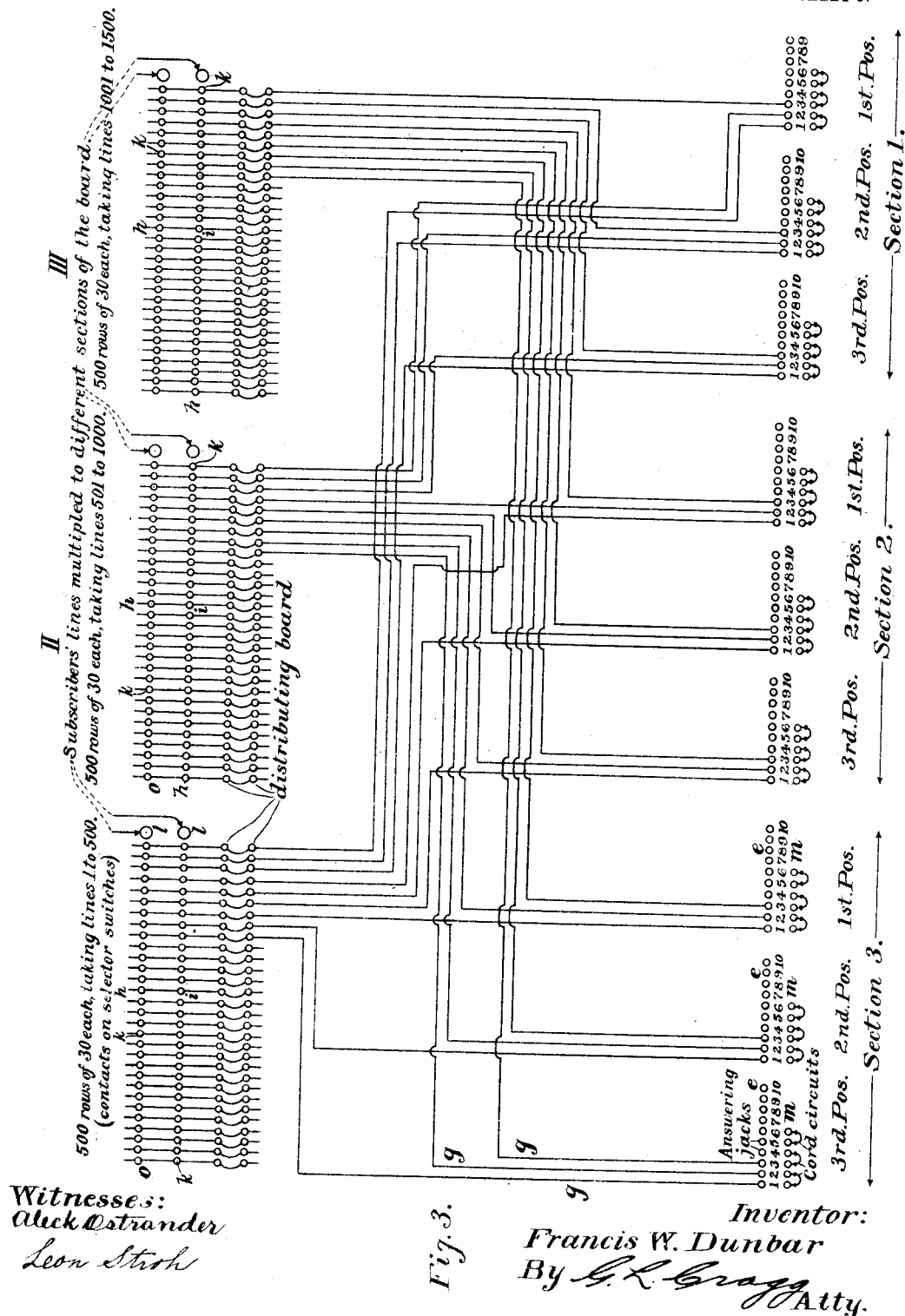
Fig. 2.

Inventor:
Francis W. Dunbar
By G. L. Crapp, Att'y.

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F. W. DUNBAR.
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Patented Mar. 23, 1915.
3 SHEETS—SHEET 3.



UNITED STATES PATENT OFFICE.

FRANCIS W. DUNBAR, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESSE ASSIGNMENTS, TO
KELLOGG SWITCHBOARD & SUPPLY COMPANY, A CORPORATION OF ILLINOIS.

TELEPHONE EXCHANGE SYSTEM

1,132,111.

Specification of Letters Patent.

Patented Mar. 23, 1915.

Application Filed January 13 1905. Serial No. 240,624.

To all whom it may concern:

Be it known that I, FRANCIS W. DUNBAR, citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful improvement in Telephone Exchange Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to telephone exchange systems, and has for its object the simplification of operators' line equipment present upon the operator boards, and also has for its object the provision of improved distribution of the instrumentalities employed for uniting subscribers for conversation whereby the efficiency of the equipment may be greatly increased.

My invention is practised by providing answering-jacks (either in the sense such term is used in multiple switch-board practice or in the sense of any jack used with which cord circuit connection is made to answer a calling subscriber) for a plurality of telephone lines and selective switching mechanism in circuit relation with the lines, whereby these jacks may become connected with calling telephone lines, whereafter suitable cord connecting apparatus, such, for example, as commonly employs two plugs to each cord outfit, may be used for uniting a calling line with a called subscriber's line, the answering-plug of an operator's cord circuit being for the purpose engaged with the jack connected with a calling line, the line-jack, preferably permanently connected, of the called line receiving the connecting plug. There are comparatively few answering-jacks as compared with the group of telephone lines with which they are associated and there may be as many cord circuits as there are answering-jacks or the cord circuits may be somewhat in excess of the number of answering-jacks provided to allow for impairment of such cords. The jacks are desirably in the form of sleeves or flanges, behind which are disposed springs, that constitute the jacks' "spring jacks" and the elements of the cord circuits that are designed for engagement with these jacks are formed into corresponding plugs. I do not wish to be limited, however, to the shape of the jacks, nor to the shape of the answering ends of the cord circuits that are manually

applied thereto. For example, the answering-jacks might be in the form of plugs mounted upon the operators' board and the answering-plugs might be in the form of sleeved elements to ride over the answering-jacks, in the form of plugs, to effect the desired connection of the cord circuits with calling lines. I, therefore, use the term "answering-jacks" and "answering-plugs" in the broad sense here indicated, and I do not wish to be limited to the mechanical construction of the answering-jacks, nor to the mechanical construction of the answering-terminals of the cord circuits manually manipulated by the operators to connect the cord circuits with answering-jacks. The line-jacks are most preferably in the form of sleeved members with springs behind the same and the manually manipulated ends of the cord circuit are of corresponding plug construction adapted for insertion within said sleeved members.

In multiple switch-board practice every effort has been made to provide room upon the multiple boards for as many jacks as possible. To this end the jacks have been placed on three-eighths inch centers vertically and horizontally, while the lamps in association with the answering-jacks have been placed on centers three-eighths of an inch apart horizontally and one-half an inch apart vertically. In the present switch-board practice there are from three hundred to five hundred answering jacks on as many line signals to each three position section of a multiple board, which obviously take up a great deal of room that would be very desirable for line-jacks.

It is one of the objects of my invention, as hitherto stated, to reduce the operator's line equipment and I am enabled by means of my invention to dispense with most of the answering jacks and line signals, as by means of my invention thirty jacks, whether of the sleeved or plug construction, may serve for each section of the switch-board and a corresponding number of lights may be employed. The calling lights may be placed upon the back of the shell of the operators' board, while the jacks are preferably, though not necessarily, mounted upon the vertical face of the board.

Another object of my invention is to simplify mechanical interconnection of the cord circuits and the answering-jacks, which ob-

ject is accomplished by having the selecting mechanism associated with the lines select the jacks in their order, say from right to left rather than promiscuously, so that the answering-ends of the cords will lead to the answering-jacks in an orderly fashion one after the other, instead of being indiscriminately distributed into association with the answering-jacks of the switch-boards, according to present practice, for with multiple switch-boards now in use the indiscriminate distribution of the answering-ends of the cords is accompanied by an interweaving of these cord ends, so that it is difficult in effecting disconnecting to pick out the connecting ends that mate with the answering ends, which confusion is greatly lessened, if not altogether dispensed with, by means of my invention.

The present invention (which I shall describe in connection with metallic telephone lines, the application of the invention to grounded lines being well understood by those skilled in the art) finds its embodiment in a pair of moving line terminals for each telephone line and motor mechanism jointly controlled by answering-jack circuit apparatus and a subscriber's apparatus for effecting engagement between these terminals and the answering-terminals of an idle answering-jack circuit, that may be brought into engagement with the said line-terminals by the movement of the latter. This motor mechanism is desirably not constantly operated, but is preferably only operated on the initiation of a call, to which end I associate the operating winding of each mechanism with the line in such a way that when the line circuit is operatively metallically closed at a subscriber's station, the circuit through the said winding will be complete and the motor mechanism set into operation. The continuity of this circuit, including the winding, not only depends upon the subscriber's switch-hook, but also upon circuit connections at the exchange controlled by the answering-jack circuits. The presence of some one of these circuit-connections is necessary to the completion of the circuit through the winding, and such circuit connections are always placed in position to be included in circuit with the winding by the apparatus of the answering-jack circuits when the said answering-jack circuits are busy. This apparatus, when their associate answering-jack circuits are idle, serves to effect removal of these latter circuit connections, which circuit connections are preferably located altogether at the office. Each switching device operated by this motor winding is provided not only with the line-terminal, but also has a terminal of a circuit controlling the winding, which rides over terminals of the office connections spoken of, whereby circuit is

maintained through the winding as long as the said office connections are maintained complete by the apparatus associated with busy answering-jack circuits, whereby the line-terminals are caused to pass over the terminals of the answering ends of the busy answering-jack circuits. When the said terminal of the controlling circuit comes into contact with a terminal of an office connection that is rendered incomplete by the apparatus of an idle answering-jack, obviously, the circuit that controls the winding is then open and the movement of the traveling switching mechanism ceases, such cessation occurring with the line-terminals of the calling line in contact with the terminals of the answering end of the idle answering-jack circuit.

I preferably employ line-relay mechanism for the control of the motor winding provided for each line and the circuit that controls said motor winding is, therefore, preferably a local circuit, the winding displacing the line signal, as by means of my invention the only calling signals that need be provided may be associated with the answering-jack circuits, though I do not wish to be limited to this embodiment of the invention. The said line-relay mechanism governs switching mechanism that governs the continuity of said controlling local circuit at one point, the balance of the control being obtained by the traveling terminal of the winding and the office connections, whose operative condition is determined by the answering-jack circuits, all as hitherto set forth. In order that special signaling lamps may not be required, the traveling switch contacts that have been described are also accompanied by another moving switch contact under the control of the motor winding, which latter contact coöperates with terminals of signaling circuits associated with the answering-jack circuits, so that, when the movement of the traveling switching mechanism is arrested, the circuit through the calling signal will be completed to notify the operator of a new call. A line-jack is permanently associated with each line in addition to the traveling terminals of each line, this being an important feature of my invention.

While my invention has found particular utility in connection with and is well adapted for application to multiple switch-board systems, it has other applications which will be readily understood to those skilled in the art. Where the invention is employed in connection with multiple switch-board systems the telephone lines may be connected with the different sections of the switch-board in accordance with any suitable practice, as the apparatus of my invention does not interfere in any way with the usual operation and arrangement of the

operator's listening keys, ringing keys, testing facilities, and the supervision of the called subscriber's line. I have provided supervisory signals for the calling line which are brought into operation by means of another feature of my invention. I do not wish to be limited, however, to the provision of any supervising means, but have employed the same as they have been found very desirable in modern practice of telephony.

In accordance with another feature of my present invention, the lines, the answering-jacks and the selective switching mechanism controlling the association of the answering-jacks with the lines, are so inter-related that the operators at one section of the board are fully supplied to their capacity before the operators at an ensuing section are employed, the operators at said ensuing section being fully supplied with work before the operators at the next section are employed, and so on throughout the system, whereby the most economical method of operating the exchange is provided.

In multiple switch-board practice it is well understood by those skilled in the art that each line has in addition to the multiple jacks distributed throughout the boards of the system, an answering-jack and a line-indicator, the answering-jack and indicator of each line being collocated. These indicators and jacks are distributed in groups of uniform quantity among the different sections of the switch-board, so that there is disposed at all operators' positions the same number of answering-jacks and the same number of line-signals. It is, of course, apparent that telephone operators possess varying degrees of skill and speed in handling calls. The uniform distribution of answering-jacks and line-indicators renders it difficult and impracticable, in accordance with present practice, to apportion work to suit the capacity of the different operators. The ordinary skilled operator can properly attend to two hundred seventy calls in an hour, if the calls be uniformly distributed throughout the sixty minutes. The average time or length of each call is approximately one minute, twenty seconds, thus allowing each operator to attend to forty-five calls per hour, if kept busy throughout the sixty minutes. Six hundred circuits kept uniformly busy throughout the hour can, therefore, handle two hundred seventy calls during the hours the work of the ordinary operator. A large operator, however, can handle in a proper manner more than two hundred seventy calls per hour, while others, less skilled, are unable to handle properly as many as two hundred seventy. I preferably provide means whereby one or more answering-jacks at each operator's position may be thrown out of operation or out of operative

relation with respect to the lines, whereby each operator may be given as many answering-jacks in operative relation to the line-circuits as can properly be attended to by her. Thus, certain operators may have but three or four answering-jacks in operative condition, while others, highly skilled, may have eight, nine or even ten answering-jacks placed in operative relation to the lines. By this means each operator may be kept as busy as her degree of skill will permit and paid according to her ability or skill, the number of answering-jacks which she can attend to efficiently being a correct gage or measure of the number of calls which she can handle efficiently per hour.

It may be properly assumed that one-eighth of the total number of calls made during the entire twenty-four hours of the day will occur during the busiest hour. The switch-board must be designed to handle the business at all hours of the day. Consequently the number of sections of switch-board is determined by the number of operators required to handle the business during the busiest hour. If during this busiest hour—or moment, each operator be employed at her maximum efficiency, the necessary switch-board equipment will be minimum.

In the present systems of manual telephony it is customary to provide an "intermediate distributing board" whose function is to present facilities for distributing the answering-jacks and calling signals throughout the various sections of switch-board, so as to cause as uniform a distribution as possible of the calls during this busiest hour or moment. At best, however, owing to the daily fluctuations in the amount of business from certain groups and from all classes of lines, it is impossible to distribute the said jacks and calling signals so as to secure more than a rough approximation to a uniform distribution of calls. By means of my invention, however, a distribution of calls may be automatically secured, such that when the number of answering-jacks in operative relation with the calling lines is properly proportioned among and according to the skill of the individual operators, each operator will be working at her maximum efficiency not only during the busy hour, but at all hours. Consequently the necessary number of sections of switch-board will be decreased and fewer operators at all hours of the day will be required.

In all present systems of telephony the calls at all hours of the day are distributed throughout the entire switch-board, this requiring the presence of one or more operators at each section of the board at all times, save certain of the night hours, when the business is so slack that from one to ten operators—depending upon the size of the ex-

change—can handle the entire number of calls by walking from section to section and picking up the various calls as they may come in. At all such times the efficiency of the operators—reckoned on a basis of number of calls answered per hour—is very low, the result being that the average number of calls handled per operator per hour throughout the twenty-four is less than half the number which the average operator is able to handle efficiently were she kept uniformly busy.

By means of my invention I am enabled to distribute the calls so that during the night hours all the calls will appear at the first section of the switch-board—or at the first two or three—depending upon the size of the exchange and the volume of night business, so that, as the business increases, operator after operator may be added as required—the first or lower numbered sections being always busy and the higher number sections coming gradually into operation as the busy hours approach. I am thus enabled to secure the same average number of calls answered per operator per hour throughout the twenty-four as is secured during the busiest hour of the day—resulting in a decrease in operating expense of 50% or more. I do not contemplate, however, in large exchanges providing the necessary switching facilities, so that each line may be connected with any one of all the answering-jacks, although in smaller switch-boards it would be preferable to do so. In large exchanges I prefer to divide the lines into groups of several hundred each and divide the answering-jacks into a corresponding number of groups, so that any line in a certain group may be connected with any answering-jack assigned to that group, if the lower numbered answering-jacks of that group already be busy. If that particular one be not busy, the first idle answering-jack thus selected, will automatically make connection with a calling subscriber. For example, I will assume an exchange of four thousand five hundred lines and provide a group of thirty answering-jacks for each five hundred lines, thus making two hundred seventy answering-jacks in all, divided equally between nine sections of switch-board, or thirty answering-jacks to the section (instead of three hundred to five hundred as hitherto) and ten to the operator. During the night hours, therefore, all calls will appear at the first section of the switch-board, unless in some particular group of five hundred lines there were more than three calling lines simultaneously connected in conversation—in which case the fourth line of that group making a call while the other three calling parties of the same group were still connect-

ed, would indicate at the first position of the second section. A fifth call from the same group occurring while the other four were still conversing, would appear at the second position of the second section and would necessitate the operator leaving her position at the first section to attend to it. Such a condition would not be apt, however, to arise, as it would require (assuming one operator only was needed for the business at this time) five-sixths of the total business which this single operator could efficiently handle, to originate in a group containing only one-ninth of the total number of lines.

In the example above chosen as an illustration I would employ selector switches, each comprising thirty points, that is, facilities for connecting thereto thirty answering-jack circuits. The first point of each switch would be connected to the answering-jack appearing at the first operator's position, the second point being connected with the answering-jack appearing at the second operator's position, etc., the last three points of each switch being divided between the twenty-seven operators' positions at the discretion of the manager. Each section thus has three answering-jack circuits for each group of five hundred lines, it being apparent that the exchange manager may so divide the answering-jack circuits at the various sections and positions as to accommodate their number to the ability of the operators and still preserve a uniform number of operative answering-jack circuits for each group of lines, or a number correctly proportioned to the business of each group—for example, he may cut or render inoperative the first, second and third answering-jack circuits of one operator, the fourth, fifth and sixth of a second operator, and the seventh, eighth and ninth of a third operator, thus giving each of these three operators six effective or operative answering-jack circuits, and diminishing the number of answering-jacks of each group of five hundred lines by one each. It will be apparent to those skilled in the art that an unlimited number of combinations may be thus secured and the business of each operator adjusted to meet her abilities. Moreover, as thirty answering jack circuits are provided for each group of five hundred lines, each, if worked to its maximum efficiency, will be capable of handling forty-five calls per hour, or a total of one thousand three hundred fifty calls during the busy hour, representing an average of 2.7 calls per subscriber during the busy hour, or 21.6 per subscriber per day. Ample margin is present for a reduction in the total number of answering-jack circuits in service to an average of seven or eight per operator and still furnish facilities for handling a greater

number of calls per day than will originate in an average exchange of the size chosen as an example.

While the apparatus of my invention is particularly serviceable in connection with multiple switch-board practice, I do not wish to be limited in all embodiments of the invention to such practice.

My invention contemplates means associated with the selective switches for rendering impotent those answering-jack circuits at each or any operator's positions which it may be desired to cut out of service, so that the selective switches will pass by those circuits thus rendered impotent as though they were already in use.

I will explain my invention more fully by reference to the accompanying drawings, illustrating preferred embodiments thereof in which—

Figure 1 represents the adaptation of my invention to one well recognized system of telephony. Fig. 2 represents the adaptation of my invention to another well recognized system of telephony. Fig. 3 is a diagrammatic view illustrating the distribution that may be made of the lines and answering-jack circuits, the apparatus of the invention enabling a wide range of distribution to suit the business of the exchange and the capacity of the operators.

Like parts are indicated by similar characters of reference throughout the different figures.

Referring first more particularly to Fig. 1, each subscriber's station, A, B, is provided with customary common battery subscriber's apparatus, the switch hook at each station serving operatively metallically to unite the sides of the line when the receiver is removed. I do not deem a detailed description of the subscriber's station apparatus to be essential, as the illustration is sufficient to make the same understood to those skilled in the art.

Although I have illustrated one arrangement of subscriber's station apparatus, it will be obvious to those skilled in the art that other arrangements may be employed at the substations, and I do not wish to be limited to the arrangement and apparatus shown, nor do I wish to be limited in all embodiments of the invention to its application to a common battery system.

The subscribers' lines indicated are metallic lines and extend in two branches to the exchange, where they terminate in pivoted armature-contacts 1'—1' of a cut-off relay 22. The alternate contacts 12'—12' of contacts 1'—1' constitute terminals of the office end of the line which is supplied with the line-jack 3 that I have spoken of. The system illustrated being a multiple switch-board system, there are also provided upon

other sections of the board than where jack 3 is located other jacks 4 in connection with the said alternate contacts and the office end of the line similar to the connection of jack 3. The grounded armature 1' is a terminal of magnet 22 and normally engages upper contact 12' and removes it from engagement with contact 12'. The armature 1' normally engages and removes lower contact 1' from contact 12'. The line terminals 5—6 are normally connected with the subscriber's line through the agency of the normal contacts of the armature 1'—1' of a relay 9. The terminals 5—6 are normally in the position indicated at the right-hand of the figure in readiness to be connected with an idle answering-jack circuit.

In the figure being particularly described there is illustrated one set of tip contact buttons 7 and one set of sleeve contact buttons 8 normally out of operative relation with the terminals 5—6. These contact buttons 7—8 are connected with the tip and sleeve contacts of an answering-jack and may be said to constitute the answering end or terminals of the answering jacks and the answering-jack circuits. There are as many rows of contact buttons (horizontal rows being indicated in a straight line, though the arrangement of the rows in any given direction or position is not essential to the practice of the invention) as there are telephone lines to which a group of answering-jack circuits has been assigned. The tip and sleeve terminals 7—8 of one row are multiplied with those in the adjacent rows, so that any pair of terminals 5—6 may ride over any row of tip and sleeve contact buttons and rest in engagement with those contact buttons that may be connected with an idle answering-jack circuit. There are as many multiplied sets of sleeve contact buttons and tip contact buttons as there are answering-jack circuits assigned to a group of lines. In the left of Fig. 1 the line terminals 5—6 have been shown shifted into connection with sleeve and tip contact buttons, whereby a calling line, subscriber A, is connected with the strands of an answering-jack circuit. Normally, however, these terminals 5—6 are not in connection with any sleeve and tip contact button, as they require the agency of a selecting magnet or motor 10 to place them in the relation illustrated at the left of the drawing. The controlling circuit of the winding of the motor 10 is preferably not one that directly includes said winding, but is one that includes the common battery 11, the magnet or relay 9, which magnet is of high resistance, the alternate contact of armature switch 12, the said armature switch, and the contact 13 that travels together with the contacts 5—6, and which normally rests upon a grounded

contact button 14, the said element 13 having an elongated projection 15 for engaging the said contact 14 and any of the companion contact buttons 16 arranged in the same row, the number of contact buttons 16 equaling the number of tip contact buttons and equaling also the number of sleeve contact buttons, obviously. The projection 15 is so wide that it makes connection with one button in its path before leaving another. The controlling circuit thus outlined is normally open at the switch-arm 12, so that the controlling circuit is normally ineffective. When a subscriber initiates a call, the circuit is metallically closed at his station by the switch-hook thereat, whereupon current finds path from the battery 11, through the winding of magnet or line-relay 17, to the normal contact of the lower cut-off relay armature, over the subscriber's line, to the normal contact of the upper grounded armature 13, thence back to the ground at the battery 11, the relay 17 thereupon being energized to attract its armature mechanically coupled with the switch-arm 12, thereby closing the then only existing gap in the controlling circuit. As there is included the winding of relay 9 in this controlling circuit, the grounded contact of said relay is then engaged by its armature, whereby circuit is closed through the winding 10, that may be traced from the said grounded contact of the relay 9, to the front contact of the armature, constituting an armature-switch, of relay 17, to the bifurcated lazy arm 18, the contact for said arm with which said arm is normally held in engagement by the spring 19, the said winding 10, to the grounded battery 11. The armature of the winding 10 is thereupon attracted to move the contacts or terminals 6, 5 and 13, which are preferably arranged in straight line in a single bar, mechanically speaking, against the force of an expansion spring 20, the said bar being notched at 21, so that each operation thereof by the armature will effect a movement of the contacts 5, 6 and 13 a distance equal to the distance between the centers of adjacent buttons 7, between the centers of adjacent buttons 8, and between the centers of adjacent buttons 14-16. The detent 22 locks the bar in the position to which it has been advanced against the force of the spring 20. After each attraction of the armature of the relay 10, the lazy arm 18 is moved away from its contact and stays away until the armature has been released, which operation is secured because the free end of said lazy arm is bifurcated, an extension of said armature being interposed between the bifurcated members of the arm, it being the armature extension alone that has operating influence upon said arm. When the armature is released, it will again be attracted if the button 16 with which the

extension 15 has now been placed in engagement happens to be grounded, it being grounded whenever the associate answering-jack circuit is busy.

In the illustration it is supposed that the first button 16 encountered by the element 15 is associated with a busy answering-jack circuit and is, therefore, grounded, thereby occasioning another operation of the magnet 10 to bring said element 15 into contact with the next button 16. This button 16 happens to be associated with an idle answering-jack circuit or one that was idle prior to the insertion of the answering plug 11' into a selected jack, so that the controlling circuit of the winding 10 that included the high resistance magnet 9 is opened, the armature of said magnet falling away from the grounded contact, thereby opening the circuit containing the winding 10, so that the selecting switch is no longer to be operated by the armature of the magnet 10, whereby the line-terminals 5-6 are engaged with buttons 8-7 that are the terminals of the idle answering-jack circuit with which the button 16 then in engagement with the element or brush 15 is associated. When a calling line and its selecting mechanism have sought out an idle answering-jack circuit, the brush 15 and the engaging contact 16 effect the calling signal to the operator, as will be hereinafter set forth. It is understood that each row of buttons has associated therewith a motor operated switching device including contacts 5, 6 and 13, and that the contacts 16 that the brush 15 engages are grounded when their answering-jack circuits are busy. The form of motor mechanism illustrated may be departed from and it is understood that the means employed for securing an interruption of the motor winding circuit, where the operation of the motor is thus controlled, may be departed from and equivalent apparatus well known to those skilled in the art employed. As hitherto stated, the first contact button 16 encountered by the brush 15 has been grounded because its answering-jack circuit is supposed to be busy. It will be seen that not only are the tip and sleeve contact buttons 7-8 of the various answering-jack circuits of a group multiplied together respectively, but that the associate buttons 16, equal in number to the said group of answering-jack circuits, are also multiplied, one multiplied group belonging to one answering-jack circuit, another multiplied group belonging to another answering-jack circuit, and so on, just as in the case of each group of multiplied tip contact buttons and multiplied sleeve contact buttons, so that any wiper 15 belonging to any motor mechanism, when encountering any contact button 16 in its row that may be grounded, is caused by the mechanism to

pass beyond said contact. Apparatus whereby a ground is placed upon a group of multiplied contact buttons 16 belonging to one busy answering-jack circuit is illustrated in detail, this group being the second group from the right of the mechanism shown at the lower left hand corner of Fig. 1. Mechanical arrangement and relative disposition of the various groups of contact buttons are unessential to the practice of my invention so long as electrical functions are accomplished. Referring now to the completed connections of the groups of buttons 16 that are indicated in the second row from the right in the left hand corner of the figure, there is provided for each answering-jack circuit such a conductor as that indicated at 25 that desirably includes an armature 26, the said armature's normal contact, the alternate or front contact of the armature 27, which contact is connected with the armature 26 and the spring-jack contacts 28 in series with and between 26--27. When an answering-jack circuit is idle, the conductor 25 is open. The conductor 25 is grounded, together with the contacts 16 connected therewith, by the switch 12 when it is released by the line-relay, such grounded connection being traced from the grounded terminal of the relay 44, to the switch 12, the contact terminal 13, and to the row of contact buttons 16 in electrical connection therewith, so that the wiper 15 of any selecting mechanism making contact with any other button 16 in the group connected with the conductor 25, will be moved from the button 16, thus engaged by means of the meter 10 and the associate mechanism that has been specified. When the answering-jack circuit has been selected, and the cut-off relay has attracted its armature, circuit through the winding of magnet or relay 29 associated with the armature 27 is closed, which circuit may be traced from the grounded battery 11, to the said magnet winding, the connection of said winding with the sleeve strand of the answering-jack, the group of buttons 8, the wiper 5' connected with one of said buttons, the terminal 5, the armature 8', to the grounded terminal of the cut-off magnet 2', whereby the relay winding 29 is energized.

The battery 11 in addition to energizing the winding of cut-off relay 2', has its current divided just before it reaches the said relay, a portion flowing over the line, to the transmitter at the sub-station A, thence back to contacts 1'--12, the switch element 7' and the contact engaging the same, the line-terminal 6, the button 7 in connection therewith, to the tip strand of the answering-jack circuit, and through the grounded relay 30, whereby the transmitter is supplied with battery current and the said relay is caused to attract both of its armatures, the

armature 26 thereupon connecting the call signal 32, preferably a lamp, in circuit with the common battery 11 by way of the armature 26 and its front contact, the contacts 28, the armature 27 and its engaging contact, and the connections illustrated between said armature 27 and the battery. The operator in response to the signal conveyed by the lamp 32, engages her answering-plug 11' with the answering-jack 12' provided with tip and sleeve contact elements adapted for connection with corresponding elements of the answering-plug, the strands of the cord circuit and the connecting plug. The answering-plug separates the contacts 28 to open the call signal circuit. The operator upon depressing her listening keys 23 and having ascertained the line to be called, calls the wanted subscriber by operating a ringing key, the operator first having inserted the connecting plug into the jack of the called subscriber. When the called line is connected with the connecting end of the cord circuit, Supervisory apparatus corresponding with that end of the cord circuit and disposed to the right of the condensers 23'--23'', has its operative condition changed. This supervisory apparatus is of a type well understood to those skilled in the art and need not be described. The relays 29 and 30 connected with the tip and sleeve strands of the answering-jack circuit, shown at the top of the diagram, effect control of the supervisory signal 35 corresponding to the calling subscriber, for the armature 35' is grounded when released by a calling subscriber when he restores his telephone, whereupon the supervisory lamp 35 is operated. The operator in response to the clearing out signal, withdraws plug 11', whereafter, as will be explained, battery 11 is removed from the relay 29, whose armature 29' is released to open circuit through the lamp 35. The cord and answering-jack arrangement shown below that just described is generally similar thereto, except that the calling subscriber's supervisory apparatus is associated directly with the cord circuit.

The pilot signal controlling relay 10 governing a pilot signal 41 may be included in the same circuit with the signal 35, so that the signal 41 may correspond in its operation to the signal 35. In order that better supervision may be had, a second pilot signal controlling magnet 42 is included in the circuit in which the signal 32 is contained, so that the added pilot signal 43, preferably a lamp, may correspond in its operation to the lamp 32. I believe it to be invention with me to supply the supervising signaling mechanism associated with the answering-jack circuit, in combination with apparatus whereby a connection between the terminals of the answering end of the

answering-jack circuit and the terminals of a calling line may be connected automatically.

I have set forth in what manner and by what means a connection is put up between calling and called subscribers by the semi-automatic mechanism. I will now describe the preferred means by which the motor is again permitted to operate.

In the embodiment of the invention shown, the switching mechanism operated by the motor is a reciprocating mechanism, but I do not wish to be limited to such a mechanism, nor where the reciprocating mechanism is employed do I wish to be limited to the rectilinear motion thereof. Such mechanism being illustrated and preferably employed, I will describe not only the manner in which the motor may be placed in condition to be operated, but also the mechanism by which the restoration of the reciprocating mechanism to its initial position may be effected.

A releasing circuit is desirably employed which includes an electro-magnet 44 that controls the detent 22, this magnet (referring particularly to the left of Fig. 1) controlling the said detent to cause the same to be withdrawn from the tooth upon the bar section 21 with which it is engaged to permit the coil-spring 20 to thrust the contacts 5, 6 and 13 to their initial positions.

When the line-relay 17 has released the switch-arm 12 upon the selection of an answering-jack circuit by the line, the releasing circuit containing the magnet 44 is partially closed. When the connecting-plug 11' has been withdrawn after a conversation, subscriber A having restored his telephone receiver, the complete releasing magnet circuit is then established, which circuit may be traced from the grounded terminal of the winding of magnet 44, the switch-arm 12, the terminal 13, the buttons 16 in electrical connection therewith, the conductor 25, the armature 26 and its normal or back contact, the contacts 28, the armature 27 and its contact, to the grounded battery 11. The armature of the magnet 44 is pivoted between its ends and is provided with a spring catch or hook 45 that is adapted to engage with the hook 46 upon the detent 22 which is pivoted between its ends, the said detent having a spring at one end to force the other end into engagement with a tooth upon the bar 21. The energization of the magnet 44 merely effects connection between the hooks 45 and 46, whereby said detent, which is grounded, effects the completion of a circuit which may be traced from the grounded detent 22, to the hook 45, the relay 9, to the grounded battery 11, the said relay being thereby energized to move the switches 7' and 8' from their contacts and disconnect the answering-jack circuit from the calling subscriber's

line, whereby the cut-off relay 2' is deenergized to restore its armature, and the relay 29 is included in open circuit to efface the signal occasioned at the lamp 35. The circuit including the releasing magnet 44 is broken when the magnet 29 is included in open circuit, the opening in the circuit occurring at 27, whereby the relay 44 is deenergized, permitting the spring 47' to pull the detent out of engagement with the bar section 21, so that the spring 20 may restore the switching apparatus, the disengagement between the hooks 45-46 being occasioned by the projection 48 that engages the spring hook 45 when the restoration has been nearly completed, thereby restoring the selecting switching mechanism to its initial idle condition. Thus it will be seen that by the removal of the armature 27 from its front contact, the ground is removed from the series of contacts 16 in electrical connection with the brush 15, so that any brush similar to 15 thereafter coming into contact with any of these contact buttons, will not cause a continuation of the operation of the motor mechanism, but said motor mechanism will thereupon be arrested as has been explained.

The energization of the releasing magnet cannot take place until after the calling subscriber has restored his telephone receiver, for the circuit of said magnet 44 depends upon the contact between the armature 26 and its normal or back contact, which cannot be had, in preferred practice, until the calling subscriber has restored his receiver, as heretofore specified, although the magnet 44, while in readiness to be effective, is not effective until the operator has withdrawn the answering-plug. As soon, therefore, as the operator has inserted an answering-plug, the releasing magnet is beyond line control but is jointly controlled by one of the subscribers (in the embodiment of the invention shown, the calling subscriber) and the apparatus of the operator. Prior to the insertion of the answering-plug, however, it is obvious that the calling subscriber has full control over the releasing magnet and may restore the switching mechanism associated therewith at any time before the answering-plug is inserted by restoring his telephone on its switch-hook.

The magnet 9 is desirably placed in series with the releasing magnet 44 associated with a busy answering-jack circuit elsewhere in use. This circuit may be traced from grounded battery 11, through relay 9 of the calling line, alternate contact of 12, switch member 13 with its brush 15, contact 16 engaging said brush to a similar contact 16 associated with said busy answering-jack, the switch members 13 and 15 of the line associated with said busy answering-jack normal contact of 12, and relay 44 of said lat-

ter line, to ground. The magnet 44 is, therefore, preferably wound to a low resistance, while the magnet 9 is wound to a comparatively high resistance, whereby the magnet 44 is prevented from operation when placed in series with the magnet 9, but the latter magnet is permitted to operate. When the magnet 44 is to operate, it encounters the low resistance path from the armature 27 to the battery, the magnet 42 being desirably of low resistance.

If any operator should be provided with so many answering-jack circuits as to be beyond her capacity during the busiest time, I provide means whereby some of her answering-jack circuits may be cut out of service, so that selecting switches passing over a group of contacts will not select more than a predetermined number of idle answering-jack circuits. In this way the work that an operator has to do is accurately adjusted to her maximum capacity. The means whereby the answering-jack circuits are made unresponsive to a calling line resides in imposing upon each group of contacts 16 associated with an answering-jack circuit to be elided, an artificial condition which, in the embodiment of the invention shown, should be an artificial ground that may be placed thereupon by the manually operated switches 47 that may be thrown into and out of electrical connection with the selected groups of contacts 16 to accomplish the purpose desired.

In order that the switch parts 13, 5 and 6 may not through some fault in the operation of the apparatus, or in case all answering-jacks are busy, pass all their associate contacts without causing the selection of an answering-jack circuit and thereafter be not restored, I provide the extra contact buttons 50 connected with said battery by way of the switch 51 and conductor 52 containing said switch, said switch being opened by the armature of magnet 44 when attracted. An extra contact 50 is connected with the switch element 13 when said element has been moved to its fullest extent by the motor 10. Circuit through magnet 17 is opened because the calling subscriber has vibrated his switch-hook in order to learn why he has not secured his connection, whereby armature-switch 12 is engaged with the free terminal of magnet 44. This results in the closure of the circuit containing said magnet 44, which may be traced from battery 11, switch 51, conductor 52, contact 50, brush element 12, armature-switch 12, to the grounded terminal of magnet 44. The armature of said magnet engages the parts 45 and 46 and opens the switch 51 to deenergize said magnet 44 and permit the spring 47' to withdraw the detent 22, all with the results hitherto specified.

The apparatus illustrated upon the right of the drawing is generally similar to that shown upon the left. The buttons 14 and the buttons forming parts of the devices 47 are, however, directly connected with the battery 11 through resistance 11' instead of being directly grounded. The magnet 44 instead of being directly grounded, is grounded through the battery 11. The contact point of switch 51 is directly grounded instead of being grounded through the battery, the detent 22 is grounded through the battery instead of being directly grounded, and the ground upon magnet 9 is direct rather than by way of the battery. The conductor 25 (on the right) is grounded directly instead of by way of the battery, and corresponding changes are made in the circuits and apparatus associated with the signals 22 and 43.

Fig. 2 indicates what is known as a three wire cord circuit, for use in multiple switch-board practice, in which line and cut-off relays are employed, the third answering-jack strand *a* and cord strand *a'* being employed with a third contact element *b* of the line-jack and having separable connection with the conductor *c* normally in engagement with the moving member *d* controlled by the relay 9 which controls also the elements 7²-8². The switch *d* is a terminal of a conductor including the winding of the cut-off relay 2'. Inasmuch as the conductor *c* and the conductor *a* are added to the equipment generally described in connection with Fig. 1, there is added the traveling terminal 13' moving with the terminals 5-6 and multiplied rows of contact buttons 16', with which the terminal 13' is adapted for electrical connection. The group of terminal buttons 16' that belongs to an answering-jack circuit is placed in connection with the extra strand *a*. When the traveling switch rests with the terminal 13' in connection with one of these groups of contacts 16' and the relay 9 that corresponds in function to relay 9 of Fig. 1 is deenergized, the cut-off relay 2', that corresponds in function to the cut-off relay 2² of Fig. 1, attracts its armature, as the winding of said cut-off relay is thereupon included in circuit with the grounded battery 11, whereby the line-relay 17', corresponding in function to the line-relay 17, is excluded from circuit. It will be unnecessary further specifically to describe the answering-jack circuit apparatus of Fig. 1, parts similarly designated having similar functions.

I have stated how an operator may have her equipment reduced to suit her capacity if it be below the maximum. I will describe with reference to Fig. 3 how the work may be distributed among the different operators' positions, the work of which operators may be varied to suit their maximum

capacities by controlling the operativeness of their answering-jack circuits as hitherto specified.

In Fig. 3 I have not had room to illustrate to the fullest extent the example set forth in the introduction to this specification, but the diagram that is furnished will readily demonstrate the feature of the invention now being described. At each operator's position there are indicated ten answering-jacks *e*, more or less of which are in service, according to the capacity of the operator. Single lines *g* extend to these answering-jacks, each of which is intended to indicate the group of answering-jack strands leading to said answering-jacks. Those answering-jacks, as stated, that are not to be placed in operation, have their conditions artificially changed to make them correspond with answering-jacks that are already in use, so that the wire connected with these answering-jacks will not be automatically selected. There are illustrated three divisions, I, II and III, of subscribers' lines arranged in accordance with the plan outlined hitherto, there being indicated for each group of subscribers' lines two rows *h-i* of five hundred rows of contacts, there being thirty groups of contacts in each row. The connected circles *k* are intended to represent all of the multiple contacts associated with a given answering-jack. For example, the connected circles *k* (there being five hundred of such circles corresponding to each answering-jack) represent the tip and sleeve contact buttons 7 and 8 and any additional contact buttons, as the buttons 16, that may be associated therewith. The circles *l* indicate the motor mechanism and the associated contacts 13, 5 and 6, for example, which ride over the sets of buttons *k-k* until a set is found that is associated with an idle answering-jack or an answering-jack whose circuit has not been caused to have the characteristics of a busy answering-jack. There are five hundred such devices *l* in association with groups I, II and III of telephone lines, one for each row, *h, i*, etc., in order that the calls may be received in the order of the operators, so that no operator at one section need have any calls to attend to unless the operators at the sections ahead of her have all of their cord circuits in use (considering now the normal business of the exchange), there being cord circuits *m* provided with answering and connecting-plugs for connecting calling with called subscribers.

The first lot of five hundred contacts *k* (shown at the right of group No. I) is connected with the first answering-jack at the first position of the first section of the board; the second lot of such sets of contacts *k* at division No. I is connected with

the first answering-jack at the second position of the first section of the board; the third lot of contacts *k* is connected with the first answering-jack at the third position of the first section of the board.

The first lot of five hundred contacts *k* (shown at the right of group No. II) is connected with the second answering-jack at the first position of the first section of the board; the second lot of contacts *k* is connected with the second answering-jack at the second position of the first section of the board; the third lot is connected with the second answering-jack at the third position of the first section of the board.

The first lot of five hundred contacts *k* of group No. III is connected with the third answering-jack at the first position of the first section of the board; the second lot is connected with the third answering-jack at the second position of the first section of the board; the third lot is connected with the third answering jack at the third position of the first section of the board.

If more than nine calls are received from divisions I, II and III at a time, the selectors *l* will pass by the contacts associated with the answering-jack circuits that I have mentioned at section *l* of the board and will seek contacts that are not connected with a busy answering-jack circuit, which contacts will be found in association with the answering-jacks at section No. 2, if these answering-jacks are not busy, but if the answering-jacks are busy at section No. 2, the selectors will continue in their travel to seek contacts associated with the idle answering-jacks at section No. 3. In order that this result may be accomplished, the fourth lot of five hundred contacts *k* at division No. I is connected with the first answering-jack at the first position of the second section of the board; the fifth lot of contacts *k* is connected with the first answering-jack at the second position of the second section of the board; the sixth lot of contacts *k* is connected with the first answering-jack at the third position of the second section of the board.

The fourth lot of contacts *k* of group No. II is connected with the second answering-jack at the first position of the second section of the board; the fifth lot of contacts *k* is connected with the second answering-jack at the second position of the second section of the board; the sixth lot of contacts *k* is connected with the second answering-jack at the third position of the second section of the board.

It will be unnecessary to further trace the different connections, as they will be apparent by an inspection of the diagram. In this way answering-jack conductors extending from the selective switching devices corresponding to each group of sub-

scribers are subdivided into a plurality of groups that are extended to answering-jacks at different sections of the board, the first group of answering-jack circuits being preferably assigned to the first board section, the second group to the second section, the third group to the third section, and so on.

The groups of answering-jack circuits corresponding to each group of lines are connected with the board sections in the same order in which automatic selection is effected between the calling lines and the answering-jack circuits. That is, in the example shown, the first group of three answering-jack circuits of the group of lines I is extended to the first board section, the second group to the second board section, the third group to the third board section, and so on. And so with the groups of answering-jack circuits extending from the division II of the lines; the first group of three answering-jack circuits is extended to the first board section, the second group to the second section, and so on. Thus, each group of telephone lines has a group of answering-jack circuits extending to each of the board sections, the group extending to the first board section being first adapted for automatic connection with calling lines, as their contact buttons are the first to be encountered by the traveling terminals of the calling lines, the operators at the second board section, therefore, having no work till the first operators have reached their capacities, the operators at the third board section having no work till the operators at the second board section are fully occupied, and so on. It will have also been observed that the answering-jack circuits of each group are distributed among the various operators' positions at the section to which said answering-jack circuits extend, to equalize the work of the operators at each section, as far as possible.

In the system of my invention there need not be any intermediate distributing boards, the main distributing board indicated at 7 being, however, preferably maintained.

While the different switch-board sections are arranged in serial order, it is obvious that my invention does not depend upon the physical disposition of the sections relative to each other.

A feature of my invention resides in the provision of the supplemental contacts 13, 14 and 16 in addition to the talking terminals of each telephone line, all operating in conjunction with the answering-jack circuits.

A very useful feature of my invention is the provision of local circuits including subscriber operated switches, as 12, and a cooperating contact 16, and apparatus included by said switch elements in any local circuit thus established, which apparatus

will serve to effect the restoration of the selecting mechanism, so that said mechanism may be used in perfecting other connections.

In the precise embodiment of the invention illustrated there are, as has been stated, as many supplemental line-contacts 13 and as many sets of contacts 16 and 14 as there are telephone lines in a particular group. In the embodiment of the invention illustrated, there are thus many more contacts 13—14 provided for the local circuits than there are contact arms 12, but the said contacts 13 are adapted to be included in local circuit with any of the corresponding contacts 16. I do not wish to be limited, however, to the precise arrangement illustrated.

I have indicated in Figs. 1 and 2 those systems that are most commonly employed throughout the United States in large exchanges, the two being illustrated in order that the wide applicability of my invention may be readily understood. I do not deem it essential to illustrate further systems and the application of my invention thereto.

It is obvious that my invention lends itself to a variety of arrangements, associations and groupings of answering-jack circuits to suit differing practices, and I do not, therefore, wish to be limited to the precise grouping and arrangement shown, nor to the application thereof to multiple switch-board and common battery systems. It is also obvious that many changes may be made in the embodiments of my invention herein shown and particularly described without departing from the spirit of the invention, and I do not, therefore, wish to be limited to the embodiments shown, but

Having thus described my invention, I claim as new and desire to secure by Letters-Patent:—

1. A telephone exchange system including a plurality of telephone lines provided with line-jacks and divided into groups, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, automatically operated selective switching mechanism, including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, and cord circuits in association with said answering-jacks provided with answer-

ing-plugs for engagement with said jacks, substantially as described.

2. A telephone exchange system including a plurality of telephone lines provided with line-jacks and divided into groups, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, the answering-jacks of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism, including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

3. A telephone exchange system including a plurality of telephone lines provided with line-jacks and divided into groups, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, automatically operated selective switching mechanism, including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for checking the operation of the selective switching mechanism, answering-jack circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy answering-jack circuits, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

4. A telephone exchange system including a plurality of telephone lines provided with line-jacks and divided into groups, a plurality of answering-jack circuits for each

group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, the answering-jacks of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism, including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for checking the operation of the selective switching mechanism, answering-jack circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy answering-jack circuits, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

5. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, automatically operated selective switching mechanism, including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

6. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, the answering-jacks of each

group being distributed among the operators' positions at each section, automatically operated selective switching mechanism, including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

7. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, automatically operated selective switching mechanism, including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for checking the operation of the selective switching mechanism, answering-jack circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy answering-jack circuits, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

8. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, the answering-jacks of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism, in-

cluding traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for checking the operation of the selective switching mechanism, answering-jack circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy answering-jack circuits, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

9. A telephone exchange system including a plurality of telephone lines provided with line-jacks and divided into groups, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, automatically operated selective switching mechanism including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

10. A telephone exchange system including a plurality of telephone lines provided with line-jacks and divided into groups, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, the answering-jacks of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line-terminals and multiplied cord con-

tacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting
 5 said answering-jack circuits with calling lines, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second
 10 switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack
 15 jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

20 11. A telephone exchange system including a plurality of telephone lines provided with line-jacks and divided into groups, a plurality of answering-jack circuits for each group of telephone lines also divided into
 25 groups and extending to answering-jacks at different sections of the switch board, automatically operated selective switching mechanism including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching
 30 mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for checking the operation of the selective switching mechanism, answering-jack
 35 circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy answering-jack circuits, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the
 40 first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling
 45 lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

55 12. A telephone exchange system including a plurality of telephone lines provided with line-jacks and divided into groups, a plurality of answering-jack circuits for each group of telephone lines also divided into
 60 groups and extending to answering-jacks at different sections of the switch-board, the answering-jacks of each group being distributed among the operators' positions at each section, automatically operated selective
 65 switching mechanism including travel-

ing line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for checking the operation of the selective switching mechanism, answering-jack circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy answering-jack circuits, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the
 85 groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

13. A telephone exchange system including a plurality of telephone lines provided with line-jacks and divided into groups, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, automatically operated selective switching mechanism including traveling
 95 line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting
 100 said answering-jack circuits with calling lines, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, the first group of answering-jack circuits corresponding to each group of telephone lines
 110 extending to the first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for
 125 engagement with said jacks, substantially as described.

14. A telephone exchange system including a plurality of telephone lines provided with line-jacks and divided into groups, a 130

plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, the answering-jacks of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

15. A telephone exchange system including a plurality of telephone lines provided with line-jacks and divided into groups, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, automatically operated selective switching mechanism including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for checking the operation of the selective switching mechanism, answering-jack circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy answering-jack circuits, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, the first group of answering-jack circuits corresponding to

each group of telephone lines extending to the first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

16. A telephone exchange system including a plurality of telephone lines provided with line-jacks and divided into groups, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, the answering-jacks of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for checking the operation of the selective switching mechanism, answering-jack circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy answering-jack circuits, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

17. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the

switch-board, automatically operated selective switching mechanism including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

18. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, the answering-jacks of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

19. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, automatically operated selective switching mechanism including travel-

ing line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for checking the operation of the selective switching mechanism, answering-jack circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy answering-jack circuits, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

20. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, the answering-jacks of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for checking the operation of the selective switching mechanism, answering-jack circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy answering-jack circuits, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

21. A multiple switch-board telephone ex-

change system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, automatically operated selective switching mechanism including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said circuits with calling lines, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

22. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, the answering-jacks of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits, for connecting said answering-jack circuits with calling lines, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the first switch-board section, the second

group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

23. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, automatically operated selective switching mechanism including traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for checking the operation of the selective switching mechanism, answering-jack circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy answering-jack circuits, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

24. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, the answering-jacks of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism in-

cluding traveling line-terminals and multiplied answering-jack contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the answering-jack circuits for connecting said answering-jack circuits with calling lines, apparatus for checking the operation of the selective switching mechanism, answering-jack circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy answering-jack circuits, apparatus for changing the electrical character of the answering-jack circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into cooperation with an idle answering-jack circuit that may be used, the first group of answering-jack circuits corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second switch-board section, and so on, said selective mechanism operating with the answering-jack circuits to connect the idle answering-jack circuits with calling lines in the order in which the groups of answering-jack circuits are connected with the switch-board sections, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

25. A telephone exchange system whose telephone lines have line-jacks and have answering-jack circuits provided with answering-jacks, selective switching mechanism for uniting calling telephone lines with idle answering-jack circuits and including traveling line-terminals in addition to the line-jacks, and also including multiplied contacts connected with the answering ends of the answering-jack circuits, apparatus governed by the answering-jack circuits and selective switching mechanism influencing the selective switching mechanism to enable it to operate when the line-terminals of said mechanism encounter the terminals of the answering ends of busy answering-jack circuits and causing the arrest of the switching mechanism when said line-terminals connect with the answering-terminals of idle answering-jack circuits, mechanism for causing the idle answering-jack circuits to cooperate with the selective mechanism as if said latter idle answering-jack circuits were busy, whereby they may be passed by the selective mechanism, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

26. A telephone exchange system whose telephone lines have line-jacks and have answering-jack circuits provided with answering-jacks, selective switching mechanism for

uniting calling telephone lines with idle answering-jack circuits and including line-terminals in addition to the line-jacks and also including contacts connected with the answering ends of the cord circuits, calling subscribers' supervisory signaling apparatus connected with the answering-jack circuits, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

27. A telephone exchange system whose telephone lines have line-jacks and have answering-jack circuits provided with answering-jacks, selective switching mechanism for uniting calling telephone lines with idle answering-jack circuits, calling subscribers' supervisory signaling apparatus connected with the answering-jack circuits, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

28. A telephone exchange system whose telephone lines have line-jacks and have answering-jack circuits provided with answering-jacks, selective switching mechanism for uniting calling telephone lines with idle answering-jack circuits, calling subscribers' supervisory signaling apparatus connected with the answering-jack circuits, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

29. A telephone exchange system whose telephone lines have line-jacks and have answering-jack circuits provided with answering-jacks, selective switching mechanism in circuit relation with the lines for uniting calling telephone lines with idle answering-jack circuits and including traveling line-terminals in addition to the line-jacks and also including multiplied contacts connected with the answering ends of the answering-jack circuits, relay mechanism connected with each answering-jack circuit and governing the selective switching mechanism to release the same, said relay mechanism being jointly controlled by the apparatus of a connected subscriber and the operator's answering-jack, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

30. A telephone exchange system whose telephone lines have line-jacks and have answering-jack circuits provided with answering-jacks, selective switching mechanism in circuit relation with the lines for uniting calling telephone lines with idle answering-jack circuits and including traveling line-terminals in addition to the line-jacks and also including multiplied contacts connected with the answering ends of the answering-

jack circuits, relay mechanism connected with each answering-jack circuit and governing the selective switching mechanism to release the same, and a selective switching jointing mechanism whereby the apparatus of the calling subscriber and the answering-jack circuit are connected with each other, and a selective switch provided with a selective switching mechanism, with said jack circuits, substantially as described.

21. A telephone exchange system, comprising telephone lines, and including answering-jack circuits provided with answering-jack mechanisms, and including relay circuit mechanism connected with each answering-jack circuit, and governing the selective switching mechanism to release the same, and a selective switching jointing mechanism whereby the apparatus of a connected subscriber and the operator's answering-jack circuit are connected with each other, and a selective switch mechanism serving when operating to move the switch parts in one direction, and when released, to return the said switch parts in a reciprocal direction, and cord circuits in association with said answering-jack circuits, for engagement with said jacks, substantially as described.

22. A telephone exchange system, comprising telephone lines, and including answering-jack circuits provided with answering-jack mechanisms, and including relay circuit mechanism connected with each answering-jack circuit, and governing the selective switching mechanism to release the same, said relay mechanism being jointly controlled by the apparatus of a connected subscriber and the operator's answering-jack circuit, and a selective switch mechanism serving when operating to move the switch parts in one direction, and when released, to return the said switch parts in a reciprocal direction, and cord circuits in association with said answering-jack circuits, for engagement with said jacks, substantially as described.

23. A telephone exchange system, comprising telephone lines, and including answering-jack circuits provided with answering-jacks, selective switching mechanism in circuit relation with the lines for uniting calling telephone lines with idle answering-jack circuits, and including traveling line-

terminals in addition to the line-jacks and also including multiple contacts connected with the answering ends of the answering-jack circuits, relay mechanism connected with each answering-jack circuit and governing the selective switching mechanism to release the same, said relay mechanism being jointly controlled by the apparatus of the calling subscriber and the operator's answering-jack circuit, and a selective switching mechanism serving when operating to move the switch parts in one direction, and when released, to return the said switch parts in a reciprocal direction, and cord circuits in association with said answering-jack circuits, provided with answering-plugs for engagement with said jacks, substantially as described.

24. A telephone exchange system, comprising telephone lines, and including answering-jack circuits provided with answering-jack mechanisms, and including relay circuit mechanism connected with each answering-jack circuit, and governing the selective switching mechanism to release the same, said relay mechanism being jointly controlled by the apparatus of the calling subscriber and the operator's answering-jack circuit, and a selective switching mechanism serving when operating to move the switch parts in one direction, and when released, to return the said switch parts in a reciprocal direction, and cord circuits in association with said answering-jack circuits, provided with answering-plugs for engagement with said jacks, substantially as described.

25. A telephone exchange system, comprising telephone lines, and including answering-jack circuits provided with answering-jack mechanisms, and including relay circuit mechanism connected with each answering-jack circuit, and governing the selective switching mechanism to release the same, said relay mechanism being jointly controlled by the apparatus of a connected subscriber and the operator's answering-jack circuit, and a selective switch mechanism serving when operating to move the switch parts in one direction, and when released, to return the said switch parts in a reciprocal direction, and cord circuits in association with said answering-jack circuits, for engagement with said jacks, substantially as described.

swering-plugs for engagement with said jacks, substantially as described.

36. A telephone exchange system whose telephone lines have line-jacks and have answering-jack circuits provided with answering-jacks, selective switching mechanism in circuit relation with the lines for uniting calling telephone lines with idle answering-jack circuits and including traveling line-terminals in addition to the line-jacks and also including multipled contacts connected with the answering ends of the answering-jack circuits, relay mechanism connected with each answering-jack circuit governing the selective switching mechanism to release the same, said relay mechanism being jointly controlled by the apparatus of the calling subscriber and the operator's answering-jack mechanism at the exchange for resetting the moving contacts of the selective switching mechanism to their normal or initial positions, whereby the first idle answering-jack circuit in a series is automatically selected upon the re-operation of the selective switching mechanism, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

37. A telephone exchange system including telephone lines having line-jacks and traveling line switches, a plurality of answering-jack circuits for said telephone lines, each having an answering-jack, selective mechanism in circuit relation with the telephone lines, elements in association with said answering-jack, selective mechanism in circuit relation with the telephone lines, elements in association with said answering-jack circuits and selective mechanism serially ordered with respect to the selective mechanism, apparatus governed by the answering-jack circuit apparatus and placing said elements in different operative conditions, according to the busy or idle conditions of the answering-jack circuits, an instrumentality cooperating with said serially ordered elements when their operative conditions have been changed by their corresponding answering-jack circuits becoming idle, to cause the answering-jack circuit corresponding to the first element, whose operative condition is thus changed, to become operatively associated with the selective mechanism and a calling line, mechanism for causing some of the elements to have their operative condition continuously similar to the operative condition of those elements associated with busy answering-jack circuits to reduce the number of answering-jack circuits available for connection with calling lines, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

38. A telephone exchange system including telephone lines having line-jacks and traveling line switches, a plurality of answering-jack circuits for said telephone lines, each having an answering-jack, selective switching mechanism in circuit relation with the telephone lines, multipled answering-jack contacts in association with said answering-jack circuits and selective switching mechanism serially ordered with respect to the selective switching mechanism, apparatus governed by the answering-jack circuit apparatus and placing said answering-jack contacts in different electrical conditions, according to the busy or idle conditions of the answering-jack circuits, electromagnetic mechanism cooperating with said serially ordered contacts when their operative conditions have been changed by their corresponding answering-jack circuits becoming idle, to cause the answering-jack circuit corresponding to the first multipled answering-jack contact, whose operative condition is thus changed, to become operatively associated with the selective switching mechanism and a calling line, mechanism for causing some of the serially ordered contacts to have their operative condition continuously similar to the operative condition of those answering-jack contacts associated with busy answering-jack circuits to reduce the number of answering-jack circuits available for connection with calling lines, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

39. A telephone exchange system including telephone lines having line-jacks and traveling line switches, a plurality of answering-jack circuits for said telephone lines, each having an answering-jack, selective mechanism in circuit relation with the telephone lines, elements in association with said answering-jack circuits and selective mechanism serially ordered with respect to the selective mechanism, apparatus governed by the answering-jack circuit apparatus and placing said elements in different operative conditions, according to the busy or idle conditions of the answering-jack circuits, an instrumentality cooperating with said serially ordered elements when their operative conditions have been changed by their corresponding answering-jack circuits becoming idle, to cause the answering-jack circuit corresponding to the first element, whose operative condition is thus changed, to become operatively associated with the selective mechanism and a calling line, mechanism for releasing the selective mechanism, mechanism for causing some of the elements to have their operative condition continuously similar to the operative condition of those elements associated with busy answering-

jacks to reduce the number of answering-jack circuits available for connection with calling lines, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

40. A telephone exchange system including telephone lines, having line-jacks and traveling line switches, a plurality of answering-jack circuits for said telephone lines, each having an answering-jack, selective switching mechanism in circuit relation with the telephone lines, multiplied contacts in association with said answering-jack circuits and selective switching mechanism serially ordered with respect to the selective switching mechanism, apparatus governed by the answering-jack circuit apparatus and placing said contacts in different electrical conditions, according to the busy or idle conditions of the answering-jack circuits, electro-magnetic mechanism cooperating with said serially ordered contacts when their operative conditions have been changed by their corresponding answering-jack circuits becoming idle, to cause the answering-jack circuit corresponding to the first of said contacts, whose operative condition is thus changed, to become operatively associated with the selective switching mechanism and a calling line, mechanism for releasing the selective switching mechanism, mechanism for causing some of the serially ordered contacts to have their operative condition continuously similar to the operative condition of those serially ordered contacts associated with busy answering-jack circuits to reduce the number of answering-jack circuits available with calling lines, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

41. A telephone exchange system including telephone lines having line-jacks and traveling line switches, a plurality of answering-jack circuits for said telephone lines, each having an answering-jack, selective switching mechanism in circuit relation with the telephone lines, answering-jack contacts in association with said answering-jack circuits and selective switching mechanism serially ordered with respect to the selective switching mechanism, apparatus governed by the answering-jack circuit apparatus and placing said answering-jack contacts in different electrical conditions, according to the busy or idle conditions of the answering-jack circuits, electro-magnetic mechanism cooperating with said serially ordered contacts when their operative conditions have been changed by their corresponding answering-jack circuits becoming idle, to cause the answering-jack circuit corresponding to the first answering-jack con-

tact, whose operative condition is thus changed, to become operatively associated with the selective switching mechanism and a calling line, mechanism for causing some of the serially ordered contacts to have their operative condition continuously similar to the operative condition of those answering-jack contacts associated with busy answering-jack circuits to reduce the number of answering-jack circuits available for connection with calling lines, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

42. A telephone exchange system including telephone lines having line-jacks and traveling line switches, a plurality of answering-jack circuits for said telephone lines, each having an answering-jack, selective switching mechanism in circuit relation with the telephone lines, contacts in association with said answering-jack circuits and selective switching mechanism serially ordered with respect to the selective switching mechanism, apparatus governed by the answering-jack circuit apparatus and placing said contacts in different electrical conditions, according to the busy or idle conditions of the answering-jack circuits, electro-magnetic mechanism cooperating with said serially ordered contacts when their operative conditions have been changed by their corresponding answering-jack circuits becoming idle, to cause the answering-jack circuit corresponding to the first of said contacts, whose operative condition is thus changed, to become operatively associated with the selective switching mechanism and a calling line, mechanism for releasing the selective switching mechanism, mechanism for causing some of the serially ordered contacts to have their operative condition continuously similar to the operative condition of those serially ordered contacts associated with busy answering-jack circuits to reduce the number of answering-jack circuits available with calling lines, and cord circuits in association with said answering-jacks provided with answering plugs for engagement with said jacks, substantially as described.

43. A telephone exchange system including telephone lines having line-jacks and line switches, a plurality of answering-jack circuits for said telephone lines, each having an answering-jack, selective switching mechanism in circuit relation with the telephone lines, answering-jack contacts in association with said answering-jack circuits and selective switching mechanism serially ordered with respect to the selective switching mechanism, apparatus governed by the answering-jack circuit apparatus and placing said answering-jack contacts in different electrical

cal conditions, according to the busy or idle conditions of the answering-jack circuits, electro-magnetic mechanism cooperating with said serially ordered contacts when their operative conditions have been changed by their corresponding answering-jack circuits becoming idle, to cause the answering-jack circuit corresponding to the first answering-jack contact, whose operative condition is thus changed, to become operatively associated with the selective switching mechanism and a calling line, mechanism for causing some of the serially ordered contacts to have their operative condition continuously similar to the operative condition of those answering-jack contacts associated with busy answering-jack circuits to reduce the number of answering-jack circuits available for connection with calling lines, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

44. A telephone exchange system including telephone lines having line-jacks and line switches, a plurality of answering-jack circuits for said telephone lines, each having an answering-jack, selective switching mechanism in circuit relation with the telephone lines, contacts in association with said answering-jack circuits and selective switching mechanism serially ordered with respect to the selective switching mechanism, apparatus governed by the answering-jack circuit apparatus and placing said contacts in different electrical conditions, according to the busy or idle conditions of the answering-jack circuits, electro-magnetic mechanism cooperating with said serially ordered contacts when their operative conditions have been changed by their corresponding answering-jack circuits becoming idle, to cause the answering-jack circuit corresponding to the first of said contacts, whose operative condition is thus changed, to become operatively associated with the selective switching mechanism and a calling line, mechanism for releasing the selective switching mechanism, mechanism for causing some of the serially ordered contacts to have their operative condition continuously similar to the operative condition of those serially ordered contacts associated with busy answering-jack circuits to reduce the number of answering-jack circuits available with calling lines, and cord circuits in association with said answering-jacks provided with answering-plugs for engagement with said jacks, substantially as described.

45. A telephone system including telephone lines, operators' link-circuits at the exchange, a pair of signals individual to each said circuit at the exchange, progressive selective switches at the exchange responsive to the initiation of calls to auto-

matically connect calling lines with idle ones of said link-circuits, means for displaying certain ones of said signals to indicate calls, manually controlled operators' connection devices for effacing said signals and means actuated thereby to place said second signals under control of the calling subscribers.

46. A telephone system including telephone lines, a link-circuit at the exchange, a call signal individual thereto, a supervisory signal individual thereto, a progressive selective switch at the exchange responsive to a call initiated over a calling line to connect said link-circuit and line and display said call signal, and a manually controlled operator's answering switch for rendering said call signal inert and operatively associating said supervisory signal with the calling line.

47. A telephone system including telephone lines, a link-circuit at the exchange, a call signal individual thereto, a supervisory signal individual thereto, a progressive selective switch at the exchange responsive to a call initiated over a calling line to connect said link-circuit and line and display said call signal, a spring-jack for said link-circuit, a plug connector for association with said jack to render said call signal inert, and means controlled by said plug for placing said supervisory signal under substation control.

48. A telephone exchange system including a plurality of telephone lines provided with line-jacks and divided into groups, a plurality of answering-jack circuits for each group of telephone lines also divided into groups and extending to answering-jacks at different sections of the switch-board, automatically operated selective switching mechanism, including traveling line-terminals and multiplied answering-jack contacts engaged thereby, line relays for said lines operated by the removal of the receivers at the substations to initiate travel of said line terminals to select an idle answering-jack circuit, the travel of said mechanism when started being automatically controlled, signals for said answering jack circuits displayed on selection made, cord-circuits in association with said answering jacks, with answering plugs for engagement with said answering-jacks to efface said signals, and means for restoring said switching mechanisms to normal.

49. A telephone system including telephone lines, a link-circuit at the exchange, a spring-jack terminal at one end of said link-circuit, a progressive selective switch at the other end of said circuit, means responsive to a switch at the substation of a calling line to cause said switch to automatically connect link-circuit and line, an operator's connection plug for connection

with said terminal, a release circuit for restoring said switch operable from the station of said line when said link-circuit is connected therewith, and means effective on connection of said plug with said spring-jack to remove the control of said release circuit from said station and transfer it to the operator.

50. A telephone system including a telephone line, a progressive selective switch for said line, link-circuits at the exchange, multiple terminals of said link-circuits for engagement by said switch, a traveling contact member for said switch for selecting terminals of an idle-link-circuit, an operating relay normally disconnected from said member, a line relay for connecting said operating relay therewith, a release magnet for said switch, and a switch contact of said line relay for shifting the connection of said member to said operating relay or said

release magnet according to the active or passive condition of said switch.

51. A telephone system comprising telephone lines, answering jacks for said lines, a line switch individual to each of said lines for extending the circuits thereof to said jacks, means controlled over the metallic circuit of calling lines for causing the switches to extend the calling lines to jacks, line signals for said jacks operated when such connections are extended, cord circuits for extending said lines, and means for effacing a calling signal when a cord is connected to a calling jack.

In witness whereof, I hereunto subscribe my name this tenth day of January A. D., 1907.

FRANCIS W. DUNBAR.

Witnesses:

G. L. CRAGO,

A. J. OSTRANDER.