

F. W. DUNBAR.
TELEPHONE SYSTEM.
APPLICATION FILED NOV. 12, 1904.

1,211,688.

Patented Jan. 9, 1917.

3 SHEETS—SHEET 1.

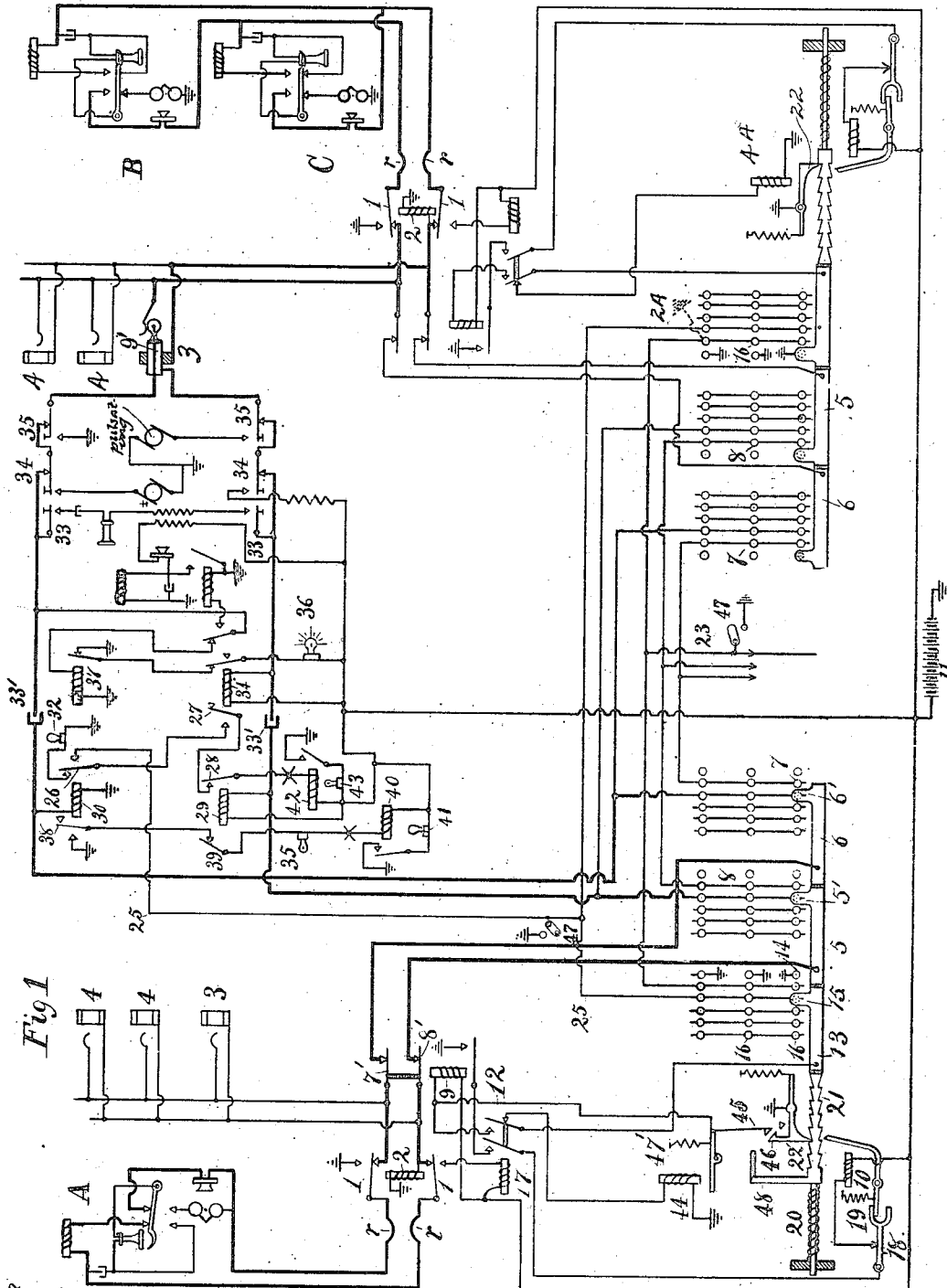


Fig 1

Witnesses:
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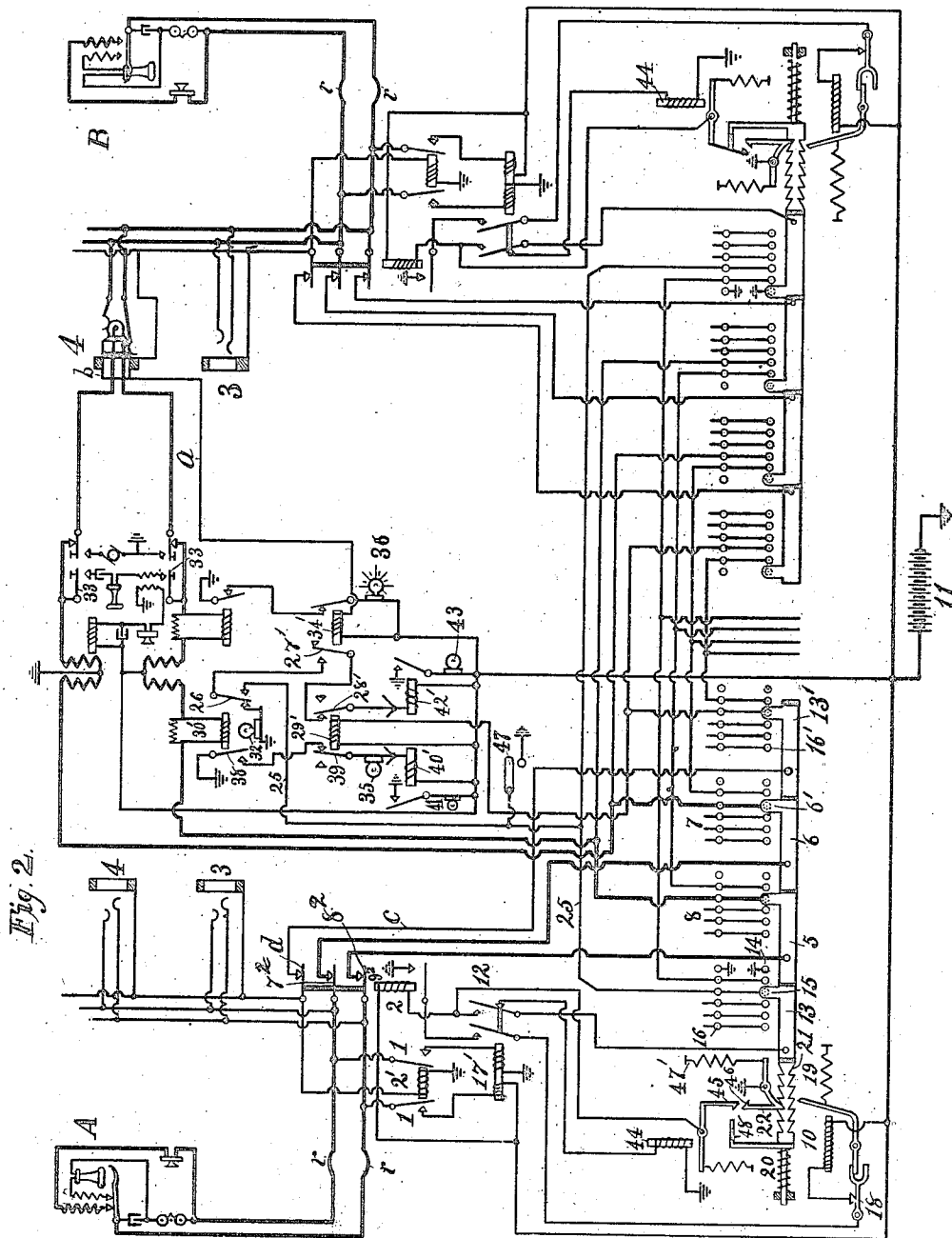


Fig. 2.

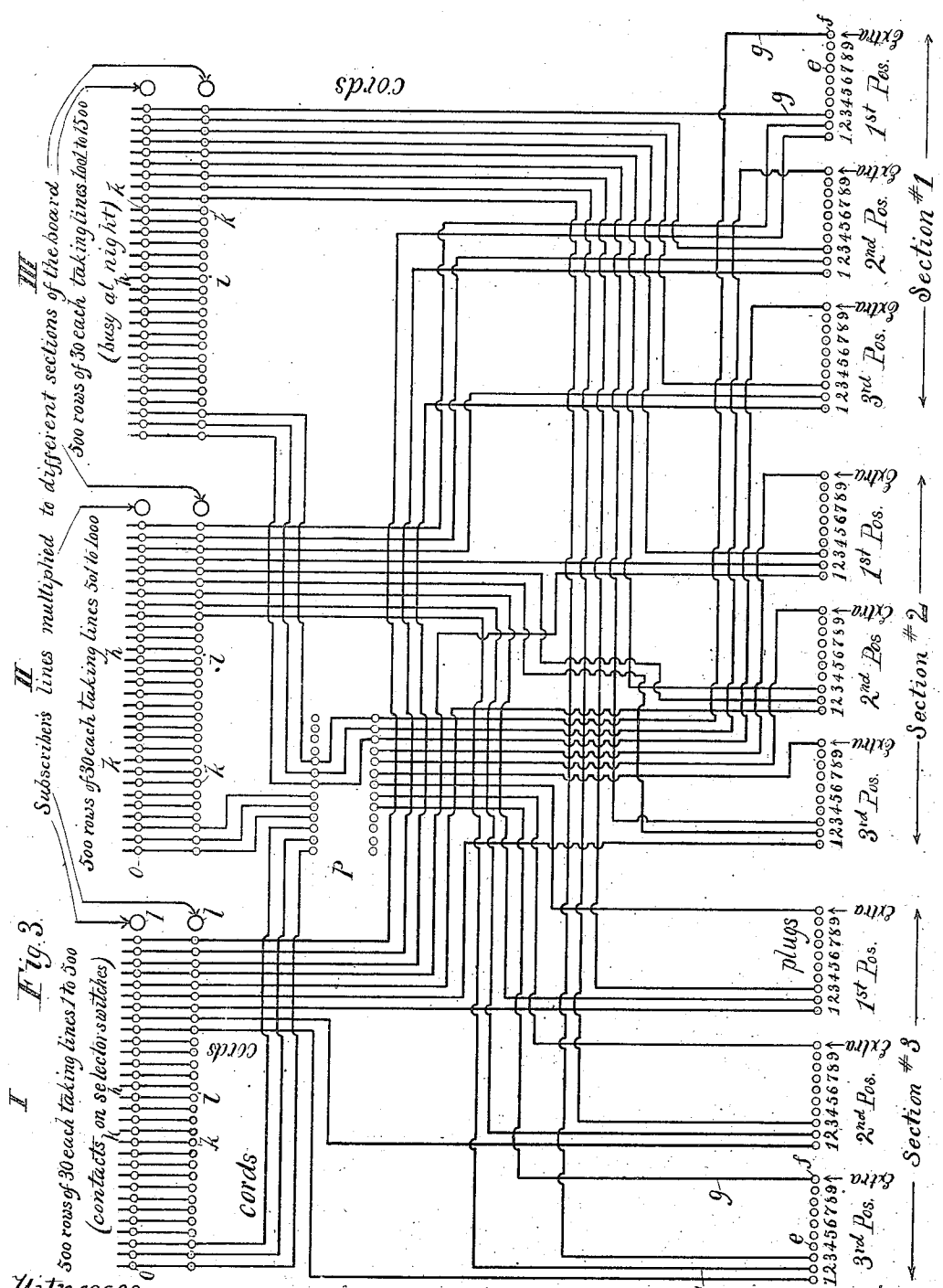
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Witnesses:
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UNITED STATES PATENT OFFICE.

FRANCIS W. DUNBAR, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
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TELEPHONE SYSTEM.

1,211,688.

Specification of Letters Patent.

Patented Jan. 9, 1917.

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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 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 telephony, and has for its object the provision of an improved telephone exchange system wherein advantages of automatically and manually controlled line connectors are present and disadvantages in these classes of apparatus are eliminated. Broadly speaking, I obtain these results by making these line connectors (which, in the preferred embodiment of my invention, are cord circuits) partially under automatic control and partially under manual control. The end of each cord circuit that is placed under automatic control is the answering end. Traveling switching mechanism is employed for selectively effecting connection between the answering ends of idle cord circuits and calling telephone lines.

The present invention finds its embodiment in a pair of moving line terminals for each telephone line and motor mechanism jointly controlled by the cord connecting apparatus and a subscriber's apparatus for effecting engagement between these terminals and the terminals of an idle cord 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 cord connectors. 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 cord circuits when the said cord circuits are busy. This apparatus, when their associate cord 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 terminals, but also 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 cord circuits, whereby the line terminals are caused to pass over the terminals of the answering ends of the busy cord 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 cord circuit 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 cord circuit.

A very important feature of my invention resides in the adaptation of my novel apparatus to telephone lines already equipped in which relays were originally installed for the purpose of operating line signals. I adapt this relay mechanism to the control of the motor winding provided for each line and the circuit that controls said motor winding is, therefore, preferably included in 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 cord 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 cord 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 co-operates with terminals of signaling circuits associated with the cord 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. The opposite end of each cord circuit is provided with a connecting plug, which the operator inserts into a line-jack or connecting jack of any suitable form, after she has determined in the usual way the connection desired. This provision of a line-jack to each line, in addition to the traveling terminals of each line, is an important feature of my invention inasmuch as by its provision the connecting end of each cord circuit may, in conjunction with its connecting plug, be under the manual control of the operator.

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. Inasmuch as the answering end of each cord circuit is changed in the manner specified, 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 carry-out this feature of my invention the same traveling contact or terminal that is employed to effect the operation of a calling signal is also employed to associate the supervisory signal with the calling line, this supervisory signal being limited purely to the functions of a supervisory signal, the functions of a calling signal being apportioned to a particular instrumentality provided in addition to the supervisory signal. The circuit relations of the supervisory signal for the calling line that I prefer will be more fully hereinafter set forth.

I have shown in a general way in what manner a calling line will automatically be

brought into connection with the answering end of an idle cord circuit. When two connected subscribers are through with their conversation and have replaced their telephones, the supervisory signals will indicate to the operator that the manually operated connecting plug should be withdrawn, whereupon the movable switch is restored, through the agency of electro-magnetic apparatus governed by the cord circuit, to its initial position, so that the calling subscriber may then be at liberty to initiate another call.

Another feature of my invention relates to the distribution of work among the operators, and by this feature of my invention a wide range of flexibility in such distribution is effected, particularly in the case of multiple switch-boards. In multiple switch-board practice it is well understood to 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 270 calls in an hour if the calls be uniformly distributed through the sixty minutes. The average time or length of each call is approximately one minute and twenty seconds, thus allowing each cord circuit to complete 45 calls per hour if kept busy throughout the sixty minutes. Six cord circuits kept uniformly busy throughout the hour can, therefore, handle 270 calls during the hour—the work of the ordinary operator. Certain operators can, however, handle in a proper manner more than 270 calls per hour, while others, less skilled, are unable to handle properly as many as 270. Moreover, the flexible cords require frequent renewals and a certain percentage may be continually out of order. For these reasons I provide a greater number of cord circuits at each operator's position than six, say ten. Moreover, I provide means whereby one or more cord circuits at each operator's position may be thrown out of operation or out of operative relation with respect to the line circuits, whereby each operator may be given as many cord circuits in operative relation to the line circuits as can be properly han-

dled by her. Thus certain operators may have but three or four cord circuits in operative condition, while others, highly skilled, may have eight, nine, or even ten cord circuits placed in operative relation to the calling 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 cord circuits which she can efficiently handle being a correct gage or measure of the number of calls which she can efficiently handle 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 this 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 spring-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 cord circuits in operative relation with the calling lines is properly proportioned 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 manual systems of telephony the calls at all hours of the day are distributed throughout the entire switchboard, 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 exchange—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 capable of handling 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 calls will appear at the first section of 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 numbered sections coming gradually into operation as the busier 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 expenses of 50% or more. I do not contemplate, however, in large exchanges providing the necessary switching facilities, so that each line may select any one of all the cord circuits, although in smaller switchboards 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 cord circuits into a corresponding number of groups, so that any line in a certain group may select any cord circuit assigned to that group if the lower numbered cord circuits of that group already be busy, and if that particular one be not busy. For example, I will assume an exchange of 4,500 lines and provide a group of twenty-seven cord circuits for each 500 lines, thus making two hundred forty-three cord circuits in all. In addition, I will preferably provide twenty-seven extra cord circuits, one for each operator's position, thus making a total of two hundred seventy cord circuits, divided equally between nine sections of switch-board, or thirty to the section and ten to the operator. Each operator's position would normally have one cord circuit belonging to each group of 500 lines and one extra cord circuit to be connected as the business may dictate. Each section would, therefore, be provided with three cord circuits for each group of 500 lines and three additional ones. During the night hours, therefore, all calls would appear at the first section of switch-board, unless in some particular group of 500 lines there were more than three calling lines simultaneously connected for conversation—in which case the fourth line of that group making a call, while the three other calling parties of the same group were still connected, 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 required for the business at this time, that five-sixths of the total business which this single operator could efficiently handle was originating in a group containing only one-ninth of the total number of lines. The extra cord circuits above spoken of are, however, provided at this section of switch-board, so that they may be switched onto any particular group of lines which are found to originate a large amount of night business, thus allowing six simultaneous calls from the same group of 500 lines appearing at the first section.

In the example above chosen as an illustration I would employ selector switches, each comprising thirty points, that is facilities for connecting thereto thirty cord circuits. Ordinarily the first twenty-seven points of each switch of each group of 500 lines would be connected to the twenty-seven cord circuits assigned to that group, the remaining three points serving for the extra cord circuits arranged and connected as the business of each group might dictate. The first point of each switch would be connected to the cord circuit appearing at the first operator's position, the second point being connected to the cord circuit appearing at the second operator's position, etc. Each section thus has in addition to the so-called extra cord circuits, three cord circuits for each group of 500 lines, it being apparent that the exchange manager may so divide the cord 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 cord 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 cords 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 cord circuits, and diminishing the number of cord circuits of each group of 500 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 cord circuits are provided for each group of 500 lines, each, if worked to its maximum efficiency, will be capable of handling 45 calls per hour, or a total of 1,350 calls during the busy hour, representing an average of 27 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 cord 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.

My invention contemplates means associated with the selective switches for rendering impotent those cord circuits at each or any operators' 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 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 cord 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, C, 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. Stations B and C in Fig. 1 are party line stations.

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 sub-stations, 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 the armatures 1—1 of a cut-off relay 2. The alternate contacts of the armatures, those contacts that are engaged by the armatures when the cut-off relay is energized, 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. That which in a multiple switch-board would correspond to an answering jack and in any other switch-board would correspond to a line-jack, is found in the terminals 5—6 which are normally connected with the subscriber's line through the agency of the normal contacts of the armatures 7'—8' 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 cord 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 correspond to the tip and sleeve of the answering plug hitherto used in manually operated boards, the connecting plug 9' being of any preferred type and adapted for insertion within the jacks 3—4. There are as many rows (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 cord 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 are connected with an idle cord circuit. There are as many multiplied sets of sleeve contact buttons and tip contact buttons as there are cord circuits assigned to a group of lines and in some cases more in order that the additional buttons may be provided with their cord circuits for reserve, as will be hereinafter set forth. 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 a cord circuit whose connecting plug 9' is placed in a line-jack of a called subscriber, as B or C. 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 equalling the number of tip contact buttons and equalling 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 switcharm 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 cutoff relay armature 1, over the subscriber's line, to the normal contact of the upper armature 1, 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 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 cord circuit is busy. In the illustration it is supposed that the first button 16 encountered by the element 15 is associated with a busy cord 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 cord circuit or one that was idle prior to the insertion of the connecting plug 9', 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 cord 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 cord 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 cord circuits are busy. The form of motor mechanism illustrated may be departed from and it is understood that other means 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 cord circuit is supposed to be busy, such ground being indicated by dotted lines at 24. It will be seen that not only are the tip and sleeve contact buttons 7-8 of the various cord circuits of a group multiplied together respectively, but that the associate buttons 16, equal in number to the said group of cord circuits, are also multiplied, one multiplied group belonging to one cord circuit, another multiplied group belonging to another cord 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 cord 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 and the continuation of this group in the second row from the left of the corresponding buttons upon the lower right hand corner of Fig. 1. The groups of the various buttons 7, 8 and 16 upon the right of the drawing are virtually continuations of the similarly numbered buttons upon the left of the drawing. In practice, these rows of buttons may each be continued in a vertical line, although they are shown subdivided for ease in illustration. 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 and the second row from the left in the lower right hand corner of the figure, there is provided for each cord circuit such a conductor as that indicated at 25 that desirably includes an armature 26, the said armature's normal contact, the normal or back contact of the armature 27, which contact is connected with the armature 26, the front or alternate contact of the armature 28, which contact is connected with the armature 27 and the grounded battery 11. When a cord circuit is idle, the conductor 25 is open, because of the unattracted armature 28, as will be fully set forth. 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 motor 10 and the associate mechanism that has been specified.

When the cord circuit has been selected, and the cut-off relay has attracted its armatures 1, circuit through the winding of magnet or relay 29 associated with the armature 28 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 plug 9', 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 the upper armature 1 of the cut-off relay, 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 cord 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 armature 27 and its back contact, the armature 28 and its front contact, and the connections illustrated between said armature 28 and the battery. The operator in response to the signal conveyed by the lamp 32, upon depressing her listening keys 33 and having ascertained the line to be called, selects the wanted subscriber by operating a ringing key. In the instance shown, she operates the ringing key 34—34 to signal one of the sub-stations on the party line and the key 35—35 to signal the other station, though the adaptation of the invention to party line practice set forth is merely to illustrate the wide range of application of the invention, and I do not, therefore, deem a further description of the operator's listening and ringing outfits to be essential, as such apparatus is well understood to those skilled in the art. 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 33'—33', has its operative condition changed. This supervisory apparatus is of a type well understood by those skilled in the art and need not be described any further than to state that the supervising relay 34 has added thereto the armature 27, so that, when said relay 34 is energized (as it is upon the insertion of the connecting plug in a manner well understood, and as will be readily understood by reference to the diagram), the said armature 27 is attracted to open the circuit including the signaling lamp 32, the signal of the calling subscriber being thus automatically effaced. The relays 29 and 30 effect control of the supervisory signal 35 corresponding to the calling subscriber in a way similar to the control of the supervisory signal 36 effected by the relays 37, 34 that correspond in their supervisory control with the relays 30—29, respectively.

After the calling subscriber has been placed in connection with a called subscriber and still has his telephone from its hook, the magnet 30 still is energized to keep withdrawn its armature 38 from its normal back and grounded contact, whereby the circuit

through the lamp 35 remains opened at this point. When said subscriber restores his telephone, the magnet 30 has its circuit opened at the switch-hook of said subscriber, permitting the armature 38 to engage its contact and close circuit through lamp 35, which may be traced from the ground thrown upon said armature 38, the front contact of the armature 39 of relay 29, and thence to the grounded battery 11, this circuit not being interrupted at the armature 39 because the winding of the relay 29 is still included in a circuit that includes the battery 11, a portion of the sleeve strand, a contact button 8 in engagement with the wiper 5', the line terminal 5, and the ground at the cut-off relay. When, however, the brush 5' is moved to its initial position upon the release and restoration of the selective switching mechanism, the winding 29 is de-energized and the signal at 35 is effaced. The pilot signal controlling relay 40 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 end of the cord circuit, in combination with apparatus whereby a connection between the terminals of the answering end of the cord 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 a cord circuit by the line, the releasing circuit containing the magnet 44 is partially closed. When the connecting plug 9 is withdrawn after a conversation and subscriber A has 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 armature 27 and its back contact, the armature 28 and its front 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 cord circuit from the calling subscriber's line, whereby the cut-off relay 2 is deenergized to restore its armatures, and the relay 29 is included in open circuit to efface the signal occasioned at the lamp 33. 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 28, 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 hooks 45-46 are separated 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. The contact between springs 45 and 46 closes a circuit through the relay 9 which relay upon energizing, disconnects the line wipers from the subscriber's line during the restoration of the switch. Thus it will be seen that by the removal of the armature 28 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 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 and effaced the signal furnished by the indicator 32, as heretofore specified, although the magnet 44, while in readiness to be effective, is not effective until the operator has withdrawn the connecting plug in order to deenergize the magnet 34 to permit the closure of the armature 27 against its back contact. As soon, therefore, as the operator has inserted a connecting 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 connecting 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 connecting 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 cord circuit. The latter magnet is, therefore, preferably wound to a low resistance, while the magnet 9 is wound to a higher 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 28 to the battery, the magnet 42 being desirably of low resistance.

If any operator should be provided with so many cords as to be beyond her capacity during the busiest time, I provide means whereby some of her cords 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 cord circuits. In this way the work that an operator has to do is accurately adjusted to her maximum capacity. The means whereby the cord circuits are made unresponsive to a calling line resides in imposing upon each group of contacts 16 associated with a cord 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 addition to providing instrumentalities whereby the amount of work assigned to an operator may be reduced to meet her capacity, I also provide means whereby the work of more efficient operators may be increased, which feature will be more fully set forth in connection with Fig. 3, after a slight description of Fig. 2 has been given.

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 cord strand *a* is connected with a third contact element *b* of the connecting plug and has separable connection with the conductor *c* normally in engagement with the moving member *d*, controlled by the relay 9² 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 a cord 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 9² 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 2 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 cord circuit apparatus of Fig. 2, it being sufficient to state that the elements 27', 28', 29', 30', 34', 40' and 42' have functions corresponding to elements 27, 28, 29, 30, 34, 40 and 42.

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 cord 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 nine connecting plugs *e*, more or less of which are in service, accord-

ing to the capacity of the operator, there being supplied in addition to each group of nine plugs, an extra plug *f*, making ten in all. Single lines *g* extend to these plugs, each of which is intended to indicate the group of cord strands leading to said plugs. Those plugs, as stated, that are not to be placed in operation have their conditions artificially changed to make them correspond with plugs that are already in use, so that the cords connected with these plugs 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 500 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 connecting plug. For example, the connected circles *k* (there being 500 of such circles corresponding to each plug) 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 plug or a plug whose circuit has not been caused to have the characteristics of a busy plug. There are 500 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).

The first lot of 500 contacts *k* (shown at the right of group No. I is connected with the first plug 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 plug at the second position of the first section of the board. The third lot of contacts *k* is connected with the first plug at the third position of the first section of the board.

The first lot of 500 contacts *k* (shown at the right of group No. II) is connected with the second plug at the first position of the first section of the board. The second lot of contacts *k* is connected with the second plug at the second position of the first section of the board. The third lot is connected with the second plug at the third position of the first section of the board.

The first lot of 500 contacts *k* of group No. III is connected with the third plug at the first position of the first section of the

board. The second lot is connected with the third plug at the second position of the first section of the board. The third lot is connected with the third plug 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 7 will pass by the contacts associated with the plugs that I have mentioned at section 1 of the board and will seek contacts that are not connected with a busy cord circuit, which contacts will be found in association with the plugs at section No. 2, if these plugs are not busy, but if the plugs are busy at section No. 2, the selectors will continue in their travel to seek contacts associated with the idle plugs at section No. 3. In order that this result may be accomplished, the fourth lot of 500 contacts k at division No. I is connected with the first plug at the first position of the second section of the board. The fifth lot of contacts k is connected with the first plug at the second position of the second section of the board. The sixth lot of contacts k is connected with the first plug 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 plug at the first position of the second section of the board. The fifth lot of contacts k is connected with the second plug at the second position of the second section of the board. The sixth lot of contacts k is connected with the second plug 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 cord conductors extending from the selective switching devices corresponding to each group of subscribers are subdivided into a plurality of groups that are extended to connecting plugs at different sections of the board, the first group of cords 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. At this point it is well to state that I do not wish to be limited, in practising this feature of my invention, to the traveling selecting terminals of the calling lines, as I desire to claim broadly the arrangement shown in Fig. 3 including any automatically operated means associated in any suitable way, for connecting idle cord circuits with calling lines.

The groups of cords 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 cord circuits. That is, in the example shown, the first group of three cords 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 cords extending from the division II of the lines; the first group of three cords 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 cords 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 cords of each group are distributed among the various operators' positions at the section to which said cords extend, to equalize the work of the operators at each section as far as possible.

While I have provided means whereby the facilities for connecting subscribers at any board section may be reduced to be commensurate with the capacity of less efficient operators all as hitherto set forth, I have also provided means whereby facilities for putting up connections at the different board sections may be increased or provided to replace broken cord sets. In practising this feature of my invention, one extra plug f may be supplied at each operator's position, that is, three to a section, and each group of lines has included in the rows of contacts $h-i$ three groups of contacts o adapted for connection with said plugs f ; for which purpose a distributing board p , or its equivalent, may be provided to which fractions of cord strands extend from the elements o and from which what are adapted to constitute the balance of said strands extend to the plugs f . At the board p the cord sections may be united as desired, to increase the capacity of any board section, or to replace broken down cord circuits.

In the system of my invention there need not be any intermediate distributing boards, the main distributing board 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.

There are certain features of my invention that need not be limited to selective switching mechanism having traveling line contacts, and I have claimed said features broadly herein.

It will be obvious that my invention lends itself to a variety of arrangements, associa-

tions and groupings of cord circuits to suit differing practices, and I do not, therefore, wish to limit myself to the precise grouping and arrangement shown, nor to the application thereof to multiple switch-boards.

I do not wish to be limited to a resetting of the moving switch contacts of the selective mechanism to their normal or initial positions by reciprocal movement thereof.

It is 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 of the invention herein shown, but

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

1. A telephone system including a pair of connected telephone lines, a selective switch and a manual link circuit through which a conversational circuit extends, multiple private or test contacts for said selective switch for preventing intrusion upon the talking circuit, means including a relay of said link circuit for altering the electrical condition of said contact to restore to normal said selective switch, and a centralized source of current for operating and talking purposes.

2. A telephone system including telephone lines, relatively movable switch contacts and an operator's link circuit through which a talking circuit between a calling and a called line may be completed, means including a test contact for determining the talking circuit, means for restoring said switch contacts to normal including said test contact and a switch contact in said link circuit, and a centralized source of current for operating and talking purposes.

3. A telephone system including a telephone line, a selective switch at the exchange connected with said line, a manual link circuit connected with said switch, contacts of said switch and said link circuit forming part of the talking circuit, an additional contact piece for said switch in connection with a contact piece of said link circuit serving to protect the talking circuit against intrusion, means for altering the electrical condition of said contact piece when disconnection is desired, release mechanism for said switch responsive to said altered electrical condition, and a centralized source of current for operating and talking purposes.

4. A telephone system including a pair of connected telephone lines, a selective switch and a manual link circuit through which a conversational circuit extends, a test contact for said switch for preventing intrusion upon the conversational circuit, release mechanism for said switch, means including said release mechanism, said test contact and

a relay of said manual link circuit for restoring to normal the said automatic switch, and a centralized source of current for operating and talking purposes.

5. In a telephone system, a subscriber's line, a switch individual to said line provided with a pair of line wipers and with a test wiper, a plurality of manual trunks one end of each of said trunks terminating in the banks of said switch, the other end of said trunks terminating in terminal plugs, means for operating said switch to select one of said manual trunks, release means for said switch operated over a circuit including said test wiper, and a centralized source of current for operating and talking purposes.

6. A telephone system including a telephone line, a selective switch at the exchange connected with said line provided with a test wiper and with normally disconnected line wipers, operators' link circuits provided with contacts terminating in the bank of said automatic switch, means for operating said switch to automatically select an idle one of said link circuits, a release circuit for said switch including said test contact and apparatus of said selected link circuit, and restoring means in said switch responsive to the closure of said release circuit, and a centralized source of current for operating and talking purposes.

7. In a telephone system a subscriber's line, a step-by-step switch individual thereto provided with line wipers and with a test wiper, an operator's trunk line, one end terminating in a connecting plug and the other end terminating in bank contacts of said switch, means for operating said switch to connect with said trunk line, means for releasing said switch from said trunk line including a release circuit extending through the said test wiper, and a centralized source of current for operating and talking purposes.

8. In a telephone system, a calling subscriber's line, a switch individual thereto provided with a pair of line contacts and a test contact, a plurality of operators' trunk lines, means including said test contact for selecting an idle one of said operator's trunks, means for releasing said individual switch including a release circuit extending through said test contact, and a centralized source of current for operating and talking purposes.

9. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of link circuits for each group of telephone lines also divided into groups and extending to link connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the link circuits for connecting said link

circuits with calling lines, and apparatus for changing the electrical character of the link 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 coöperation with an idle link circuit that may be used, substantially, as described.

10. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, and apparatus for changing the electrical character of the cord 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 coöperation with an idle cord circuit that may be used, substantially as described.

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

12. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism, including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the tele-

phone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, and apparatus for changing the electrical character of the cord 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 coöperation with an idle cord circuit that may be used, substantially as described.

13. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord circuits to cause them, when idle, to coöperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into coöperation with an idle cord circuit that may be used, substantially as described.

14. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord 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 coöperation with an idle cord circuit that may be used, substantially as described.

15. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at differ-

ent sections of the switch-board, automatically operated selective switching mechanism, including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, substantially as described.

16. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism, including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, substantially as described.

17. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of link circuits for each group of telephone lines also divided into groups and extending to link connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the link circuits for connecting said link circuits with calling lines, apparatus for changing the electrical character of the link 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 link circuit that may be used, additional link circuits equipped similarly to the aforesaid link circuits and extending between the board sections and the groups of telephone lines, and a distributing agency by means of which said latter link circuits are completed, substantially as described.

18. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency by means of which said latter cord circuits are completed, substantially as described.

19. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism, including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency by means of which said latter cord circuits are completed, substantially as described.

20. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of tele-

phone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism, including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency by means of which said latter cord circuits are completed, substantially as described.

21. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency by means of which said latter cord circuits are completed, substantially as described.

22. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone

lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used.

23. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism, including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency by means of which said latter cord circuits are completed, substantially as described.

24. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism, including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable

the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency by means of which said latter cord circuits are completed, substantially as described.

25. 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 and provided at each of such sections with a jack, a plurality of link circuits for each group of telephone lines also divided into groups and extending to link connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the link circuits for connecting said link circuits with calling lines, and apparatus for changing the electrical character of the link 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 link circuit that may be used, substantially as described.

26. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, substantially as described.

27. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord

also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism, including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, substantially as described.

28. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism, including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, substantially as described.

29. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord

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 cord circuit that may be used, substantially as described.

30. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, substantially as described.

31. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism, including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, substantially as described.

32. A multiple switch-board telephone exchange system including a plurality of tele-

phone lines divided into groups and multiplied to different sections of the multiple switch-board and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism, including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, substantially as described.

33. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency by means of which said latter cord circuits are completed, substantially as described.

34. A multiple switchboard telephone exchange system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord

connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency by means of which said latter cord circuits are completed, substantially as described.

35. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multipled to different sections of the multiple switch-board and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism, including traveling line terminals and multipled cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency by means of which said latter cord circuits are completed, substantially as described.

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

and multipled cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency by means of which said latter cord circuits are completed, substantially as described.

37. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multipled to different sections of the multiple switch-board and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency by means of which said latter cord circuits are completed, substantially as described.

38. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multipled to different sections of the multiple switch-board and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits

with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, substantially as described.

39. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism, including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the foresaid cord circuits and extending between the board sections and the group of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, substantially as described.

40. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism, including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for con-

necting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency by means of which said latter cord circuits are completed, substantially as described.

41. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, and apparatus for changing the electrical character of the cord circuits to cause them, when idle, to cooperate with the selective switching mechanism as if they were busy, to enable the same mechanism to pass the said into cooperation with an idle cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

42. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, and apparatus for changing the electrical character of the cord 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

cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described. 70

43. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described. 75

45. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described. 80

44. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described. 85

46. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord circuits to cause them, when idle, to cooperate with the selective switching mechanism 130

as if they were busy, to enable the said mechanism to pass the same into coöperation with an idle cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

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

48. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation

of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord circuits to cause them, when idle, to coöperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into coöperation with an idle cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

49. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord circuits to cause them, when idle, to coöperate with the selective switching mechanism as if they were busy, to enable the said mechanism to pass the same into coöperation with an idle cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

50. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord

circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

51. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

52. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the con-

necting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

53. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 in cooperation with an idle cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

54. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

55. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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

tion with an idle cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

56. A telephone exchange system including a plurality of telephone lines provided with jacks and divided into groups, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

57. 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 and provided at each of such

sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, the first group of cords corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second switch-board, and so on, said selective mechanism operating with the cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

58. A multiple switchboard telephone exchange system including a plurality of telephone lines divided into groups and multiplied to different sections of the multiple switch-board and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

59. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also

divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said circuits with calling lines, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

60. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

61. A multiple switch-board telephone exchange system including a plurality of telephone lines divided into groups and multiplied

pled to different sections of the multiple switch-board and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

62. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, the first group of cords 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 cord circuits to

connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

63. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

64. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching

mechanism to avoid busy cords, and apparatus for changing the electrical character of the cord 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 cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

65. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

66. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism

associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, the first group of cords 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 operated with the cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

67. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

68. A multiple switch-board telephone exchange system including a plurality of tele-

phone lines divided into groups and multiplied to different sections of the multiple switch-board and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

69. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the

aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

70. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

71. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the

telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are completed, the first group of cords 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 cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

72. 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 and provided at each of such sections with a jack, a plurality of cord circuits for each group of telephone lines also divided into groups and extending to cord connecting plugs at different sections of the switch-board, the connecting plugs of each group being distributed among the operators' positions at each section, automatically operated selective switching mechanism including traveling line terminals and multiplied cord contacts engaged by said terminals, said switching mechanism being associated with the telephone lines and the answering ends of the cord circuits for connecting said cord circuits with calling lines, apparatus for checking the operation of the selective switching mechanism and cord circuit apparatus governing the aforesaid apparatus to enable the selective switching mechanism to avoid busy cords, apparatus for changing the electrical character of the cord 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 cord circuit that may be used, additional cord circuits equipped similarly to the aforesaid cord circuits and extending between the board sections and the groups of telephone lines, and a distributing agency *p* by means of which said latter cord circuits are com-

pleted, the first group of cords corresponding to each group of telephone lines extending to the first switch-board section, the second group to the second switchboard section, and so on, said selective mechanism operating with the cord circuits to connect the idle cord circuits with calling lines in the order in which the groups of cord circuits are connected with the switch-board sections, substantially as described.

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

74. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting plugs for insertion within said jacks, selective switching mechanism for uniting calling telephone lines with idle cord circuits and including line terminals in addition to the line jacks, and also including contacts connected with the answering ends of the cord circuits, and apparatus governed by the cord 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 cord circuits and causing the arrest of the switching mechanism when said line terminals connect with the answering terminals of idle cord circuits, and mechanism for causing the idle cord circuits to cooperate with the selective mechanism as if said latter idle cord circuits were busy, whereby they may be passed by the selective mechanism, substantially as described.

75. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting plugs, selective switch mechanism in circuit relation with the lines for uniting calling telephone lines with idle cord cir-

5 cuits and including traveling line terminals in addition to the line jacks and also including multiplied contacts connected with the answering ends of the cord circuits, and
 10 relay mechanism connected with each cord 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 connecting plug, substantially as described.

76. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting
 15 plugs for insertion within said jacks, selective switching mechanism for uniting calling telephone lines with idle cord circuits and including line terminals in addition to the line jacks and also including contacts
 20 connected with the answering ends of the cord circuits, and relay mechanism connected with each cord circuit and governing the selective switching mechanism to release the same, said relay mechanism being jointly
 25 controlled by the apparatus of a connected subscriber and the operator's connecting plug, substantially as described.

77. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting
 30 plugs, selective switching mechanism for uniting calling telephone lines with idle cord circuits and including traveling line terminals in addition to the line jacks and also including multiplied contacts connected
 35 with the answering ends of the cord circuits, and relay mechanism connected with each cord 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 connecting plug, substantially as described.

78. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting
 45 plugs for insertion within said jacks, selective switching mechanism for uniting calling telephone lines with idle cord circuits and including line terminals in addition to the line jacks and also including contacts
 50 connected with the answering ends of the cord circuits, and relay mechanism connected with each cord circuit and governing the selective switching mechanism to release the same, said relay mechanism being jointly
 55 controlled by the apparatus of the calling subscriber and the operator's connecting plug, substantially as described.

60 79. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting plugs, selective switching mechanism for uniting calling telephone lines with idle

cord circuits and including traveling line terminals in addition to the line jacks and also including multiplied contacts connected with the answering ends of the cord circuits, and relay mechanism connected with each cord circuit and governing the selective
 65 switching mechanism to release the same, said relay mechanism being jointly controlled by the apparatus of a connected subscriber and the operator's connecting plug, said selective switching mechanism serving, when operating, to move the switch parts it
 70 operates in one direction, and, when released, to restore the said switch parts in a reciprocal direction, substantially as described.

80. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting
 75 plugs for insertion within said jacks, selective switching mechanism for uniting calling telephone lines with idle cord circuits and including line terminals in addition to the line jacks and also including contacts connected with the answering ends of
 80 the cord circuits, and relay mechanism connected with each cord 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 connecting
 85 plug, said selective switching mechanism serving, when operating, to move the switch parts it operates in one direction, and when released, to restore the said switch parts in a reciprocal direction, substantially as described.

81. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting
 90 plugs, selective switching mechanism for uniting calling telephone lines with idle cord circuits and including traveling line terminals in addition to the line jacks and also including multiplied contacts connected with the answering ends of the cord circuits, and relay mechanism connected with each
 95 cord 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 connecting plug, said selective switching mechanism serving, when operating, to move the switch parts it operates in one direction, and, when released, to restore the said switch parts in a
 100 reciprocal direction, substantially as described.

82. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting
 105 plugs for insertion within said jacks, selective switching mechanism for uniting calling telephone lines with idle cord circuits

and including line terminals in addition to the line jacks and also including contacts connected with the answering ends of the cord circuits, and relay mechanism connected with each cord 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 connecting plug, said selective switching mechanism serving, when operating, to move the switch parts it operates in one direction, and, when released, to restore the said switch parts in a reciprocal direction, substantially as described.

83. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting plugs, selective switching mechanism for uniting calling telephone lines with idle cord circuits and including traveling line terminals in addition to the line jacks and also including multiplied contacts connected with the answering ends of the cord circuits, relay mechanism connected with each cord circuit and governing the selective switching mechanism to release the same, and mechanism at the exchange for resetting the moving contacts of the selective switching mechanism to their normal or initial positions whereby the first idle cord circuit in a series is automatically selected upon the reoperation of the selective switching mechanism, substantially as described.

84. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting plugs for uniting calling telephone lines with idle cord circuits and including traveling line terminals in addition to the line jacks and also including multiplied contacts connected with the answering ends of the cord circuits, relay mechanism connected with each cord 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 connecting plug, and mechanism at the exchange for resetting the moving contacts of the selective switching mechanism to their normal or initial positions whereby the first idle cord circuit in a series is automatically selected upon the reoperation of the selective switching mechanism, substantially as described.

85. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting plugs for insertion within said jacks, selective switching mechanism for uniting calling telephone lines with idle cord circuits and including line terminals in addition to the line jacks and also including contacts

connected with the answering ends of the cord circuits, relay mechanism connected with each cord 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 connecting plug, and mechanism at the exchange for resetting the moving contacts of the selective switching mechanism to their normal or initial positions whereby the first idle cord circuit in a series is automatically selected upon the reoperation of the selective switching mechanism, substantially as described.

86. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting plugs for uniting calling telephone lines with idle cord circuits and including traveling line terminals in addition to the line jacks and also including multiplied contacts connected with the answering ends of the cord circuits, relay mechanism connected with each cord 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 connecting plug, and mechanism at the exchange for resetting the moving contacts of the selective switching mechanism to their normal or initial positions whereby the first idle cord circuit in a series is automatically selected upon the reoperation of the selective switching mechanism, substantially as described.

87. A telephone exchange system whose telephone lines have connecting jacks and have cord circuits provided with connecting plugs for insertion within said jacks, selective switching mechanism for uniting calling telephone lines with idle cord circuits and including line terminals in addition to the line jacks and also including contacts connected with the answering ends of the cord circuits, relay mechanism connected with each cord 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 connecting plug, and mechanism at the exchange for resetting the moving contacts of the selective switching mechanism to their normal or initial positions whereby the first idle cord circuit in a series is automatically selected upon the reoperation of the selective switching mechanism, substantially as described.

88. In a telephone system, a calling subscriber's line, a switch individual thereto provided with a pair of line wipers and a test wiper, operator's trunks, means including said test wiper for selecting an idle one of said operators' trunks, means for releasing said individual switch from a selected

trunk, said means including a release circuit extending through said test wiper, and a source of current associated with the operator's trunks for supplying talking battery.

89. In a telephone system, a subscriber's line, an operator's trunk circuit, an electromagnetically driven automatic switch for connecting said subscriber's line to said operator's trunk circuit, the said means including a test contact associated with the said operator's trunk, release means for disconnecting the subscriber's line from the said operator's trunk including a release circuit extending through the said test contact, and means associated with the said operator's trunk circuit for supplying talking current to the subscriber's line.

90. In a telephone system, a subscriber's line, an operator's trunk circuit, line contacts and an associated contact for said trunk circuit, electromagnetic means for connecting the subscriber's line with the said trunk circuit via said contacts, electromagnetic restoring means for disconnecting the subscriber's line from the said trunk circuit, and operator controlled means for controlling said restoring means.

91. In a telephone system, a subscriber's line, an operator's trunk circuit, subscriber controlled automatic electromagnetic means for connecting the subscriber's line with the said trunk circuit, release mechanism for disconnecting the subscriber's line from the trunk circuit, and electromagnetic means connected with the operator's cord circuit controllable by the operator for operating the said release means.

92. In a telephone system, a subscriber's line, an operator's trunk circuit, subscriber controlled automatic electromagnetic means provided with a pair of talking wipers and a test wiper for connecting the subscriber's line with said trunk circuit, operator controlled release mechanism controlled over said test wiper for disconnecting the subscriber's line from the trunk circuit.

93. In a telephone system, a subscriber's line, an operator's trunk circuit, subscriber controlled automatic electromagnetic means for connecting the subscriber's line with the said trunk circuit, release mechanism for disconnecting the subscriber's line from the trunk circuit, and electromagnetic means associated with the operator's trunk circuit and controllable jointly by the subscriber and by the operator for controlling said release mechanism.

94. In a telephone system, a subscriber's line, a switch individual thereto, a plurality of operator's trunk circuits, electromagnetic means for operating said individual switch to establish connection between the subscriber's line and an idle one of said oper-

ator's trunk circuits, a release magnet for said individual switch, and operator controlled means for operating said release magnet.

95. In a telephone system, a subscriber's line, a switch individual thereto, a plurality of operator's trunk circuits, means for operating said individual switch to establish connection between the subscriber's line and an idle one of said operator's trunk circuit, electromagnetic release means for said individual switch, operator controlled electromagnetic means for operating said release means, and a centralized source of current for operating and talking purposes.

96. In a telephone system, a subscriber's line, an operator's trunk circuit provided with a plug terminal, automatic means for connecting the subscriber's line to the trunk circuit, electromagnetic release means for disconnecting the subscriber's line and trunk circuit, and means controlled by the withdrawal of the said plug from the jack of the called subscriber's line for controlling said release means.

97. In a telephone system, a pair of subscriber's lines, an automatic switch and an operator's trunk circuit for use in connecting said lines in conversational circuit, release means for the said automatic switch, and means controlled by the disconnection of the operator's circuit from one of said lines to control the said release means to disconnect the other of said lines from the said trunk circuit.

98. In a telephone system, a subscriber's line, an automatic switch individual thereto, an operator's trunk circuit provided with a calling plug, means controlled over the calling line for operating said switch to establish connection between the subscriber's line and the said operator's trunk circuit, and electromagnetic means responsive to the disconnection of the said plug from the jack of the called subscriber's line for releasing the said switch.

99. In a telephone system, a calling subscriber's line, a switch individual thereto, a plurality of operator's trunk circuits, means controlled over the two sides of the calling line in series for operating said automatic switch to establish connection with an idle one of said operator's trunk circuits, terminal plugs for said operator's trunk circuits, and means including the said terminal plugs, for completing connection from the operator's trunk circuits to called subscriber's lines, and automatic means responsive to the disconnection of a terminal plug from a connected line for controlling the release of said switch.

100. In a telephone system, a calling subscriber's line, a plurality of operator's trunk circuits, electromagnetic means for estab-

lishing connection between said subscriber's line and an idle one of said trunk circuits, means for extending connection from the trunk circuit to a called subscriber's line, and means responsive to the disconnection of the trunk circuit from the called subscriber's line for releasing said automatic switch.

101. In a telephone system, a calling subscriber's line, an automatic step-by-step switch individual thereto; a plurality of operator's trunk circuits terminating in calling terminal plugs, means controlled over the subscriber's line for operating said switch to establish connection with an idle one of said operator's trunk circuits, a called subscriber's line provided with a jack, means for connecting the said plug to said jack to extend the connection in the direction of the called subscriber's line, and means responsive to the removal of the plug from the said jack to cause the said automatic switch to be restored.

102. In a telephone exchange system, the combination with a group of telephone lines extending from substations to an exchange, of a plurality of cord connectors at the exchange, each including a manually operated terminal plug at one end of the cord circuit and having a traveling switch at the other end of the cord circuit, means serving to arrest the operation of a traveling switch and cause it to connect a cord circuit with the telephone line of a calling subscriber, means for connecting the terminal plug with the telephone line of a called subscriber, means for preventing the connection of another of said traveling switches to said cord circuit, and means responsive to the disconnection of said terminal plug from the line of the called subscriber to render said last means ineffective.

103. In a telephone exchange system, the combination with telephone lines extending from substations to an exchange, of a plurality of cord connectors at the exchange, each including a manually operated terminal plug at one end of the cord circuit, a traveling switching appliance at the other end of the cord circuit and constituting a line terminal, a plurality of contacts for the plurality of cord circuits, with any of which the traveling terminal may make contact, means controlled by a subscriber for governing the traveling switching appliance to connect his line with a cord circuit, means for connecting a terminal plug to the line of a called subscriber, means for preventing the connection of another of said traveling switches to the said cord circuit, and means responsive to the disconnection of said terminal plug from said called line to remove the busy condition of said cord circuit.

104. In a telephone exchange system, the combination with a group of telephone lines

extending from substations to an exchange, of a plurality of cord connectors at the exchange, each including a manually operated terminal plug at one end of the cord circuit and having a traveling switch at the other end of the cord circuit, means serving to arrest the operation of a traveling switch and cause it to connect a cord circuit with the telephone line of a calling subscriber, means for connecting the terminal plug with the telephone line of a called subscriber, and means for preventing the connection of another of said traveling switches to said cord circuit, said last means being rendered ineffective upon the disconnection of said terminal plug from the line of said called subscriber.

105. In a telephone system, a calling subscriber's line, an operator's link circuit, an automatic switch provided with line wipers and a test wiper, means for operating said switch to establish connection with the said operator's link circuit, means for releasing said switch from said link circuit including a release circuit extending through the said test wiper, and means for supplying talking current to the calling subscriber's line through coils of said operator's link circuit.

106. In a telephone system, a calling subscriber's line, an operator's trunk circuit, a battery in bridge of said trunk circuit, an automatic switch provided with a pair of line wipers and a test wiper, means for operating said switch to connect said line with the said trunk, means for discontinuing said connection, said means including a release circuit extending through the said test wiper, and means for supplying talking current to the subscriber's line from said bridged battery.

107. A telephone system including a pair of connected telephone lines, a selective switch and a manual link circuit through which a conversational circuit extends, multiple test contacts for said selective switch for preventing intrusion upon the talking circuit, means for rendering said link circuit available for other connections, said last means being responsive to the disconnection of said manual link circuit from the called one of said connected telephone lines.

108. In a telephone system, a subscriber's line, a plurality of link circuits, selecting mechanism for connecting said subscriber's line to an idle one of said link circuits, movable contacts for said selecting mechanism, a relay controlling normally closed contacts connected to said movable contacts, means for disconnecting the subscriber's line from a selected link circuit, and means for energizing said relay during both of said operations.

109. In a telephone system, a subscriber's line provided with an automatic trunk se-

lecting switch, a plurality of trunk circuits, movable contacts upon said switch, stationary contacts for said selecting switch connected to said trunk circuits, means under the control of the subscriber's line for causing said movable contacts to engage the contacts of an idle trunk circuit, means for returning said movable contacts to normal, and an electromagnet for disconnecting said movable contacts during both operations of said movable contacts.

110. In a telephone system, a calling subscriber's line, a plurality of operators' trunk circuits, automatic selecting mechanism for connecting said subscriber's line to an idle one of said trunk circuits, and means for changing the electrical condition of the operator's trunk circuits to cause them, when idle, to cooperate with the selecting mechanism as if they were busy.

111. In a telephone system, a calling subscriber's line, a plurality of trunk circuits, automatic selecting mechanism for connecting said subscriber's line to an idle one of said trunk circuits, and means for changing the electrical condition of the trunk circuits to cause them, when idle, to cooperate with the selective mechanism as if they were busy.

112. In a telephone system, a calling subscriber's line, a plurality of trunk circuits, automatic selecting mechanism for connecting said subscriber's line to an idle one of said trunk circuits, and means for changing the electrical condition of the trunk circuits to cause them, when idle, to cooperate with the selective mechanism as if they were busy, to cause said selective mechanism to pass by the same and connect with an idle trunk circuit.

113. In a telephone system, a calling subscriber's line, a plurality of trunk lines divided into groups, automatic selecting mechanism for connecting the subscriber's line to an idle line in any one of said groups, and separate means for preventing the said mechanism from connecting the subscriber's line to lines of one of said groups.

114. In a telephone system, a subscriber's line, a plurality of trunks extending to a plurality of operators' positions, automatic mechanism for connecting the subscriber's line to one of said trunks, and separate means for preventing the said mechanism from connecting said subscriber's line to an idle trunk line connected to one of said operator's positions.

115. In a telephone system, a subscriber's line, a plurality of trunk lines divided into groups and connected directly to a plurality of operators' positions, other similar trunk lines connected to a distributing device, and means for distributing said last trunk lines to certain of said operators' positions, and

automatic trunking means for connecting said subscriber's line to any one of said trunk lines.

116. In a telephone system, a calling subscriber's line, a plurality of operators' trunk circuits, a normally at rest automatic switch for connecting the subscriber's line to an idle one of said trunk circuits, a calling signal associated with said trunk circuit operated upon connection of said subscriber's line to said idle trunk circuit, and a supervisory signal likewise associated with said trunk circuit under the control of said subscriber for denoting disconnection.

117. In a telephone system, a calling subscriber's line, a plurality of operators' trunk circuits, an automatic switch individual to said line for connecting the subscriber's line to an idle one of said trunk circuits, a calling signal for each of said trunk circuits operative upon such connection, means for effacing said signal, and a supervisory signal for each of said trunk circuits under the control of the calling subscriber for denoting disconnection.

118. A telephone exchange system, including telephone lines extending from stations to an exchange, link circuits for uniting telephone lines in conversation, signal devices associated with said link circuits and operable by apparatus at said stations, automatic selecting mechanism, including traveling contacts, for connecting the answering ends of said link circuits interchangeably with different telephone lines, manually manipulated terminals for said link circuits for connecting the link circuits with called lines, and supervisory devices associated with said link circuits and operable by apparatus at said stations.

119. A telephone exchange system comprising a telephone line, a plurality of link circuits extending therefrom and provided at their distant ends with manually operated connecting mechanism, automatic selecting switch mechanism associated with the said telephone line and operative to establish connections between said line and an idle link circuit, a control relay for said selecting switch mechanism normally under the control of the substation, means responsive to the energization of said relay for causing the said selecting switch mechanism to automatically pick out and establish connection with an idle link circuit, relay mechanism associated with the link circuit thus connected and under the control of the substation, means controlled by said relay mechanism to again energize the control relay of said selecting switch mechanism, and means actuated by said selecting switch mechanism for deenergizing said control relay when the switch parts have returned to normal.

120. In a telephone system, a calling sub-

scriber's line, a plurality of trunk lines divided into substantially equal groups, automatic trunking means for connecting the subscriber's line to an idle one of said trunk lines, and separate means for making certain of said trunk lines test artificially busy to said automatic trunking means.

121. A telephone system including a pair of telephone lines, a selective switch and a manual link circuit for connecting said lines in conversational circuit, multiple contacts for said selective switch for preventing intrusion upon the talking circuit, means including a relay of said link circuit for altering the electrical condition of said contacts to restore to normal said selective switch, and a centralized source of current for operating purposes and for supplying talking current to the subscribers' telephone lines through coils of said link circuit.

122. A telephone system including telephone lines, relatively movable switch contacts and an operator's link circuit through which a talking circuit between a calling and a called one of said lines extends, an auxiliary contact movable with said switch contacts but excluded from the path of the talking circuit, means for restoring said switch contacts to normal including a circuit extending through said contact and a bank contact of said link circuit, and a centralized source of current for operating and talking purposes.

123. A telephone system including a pair of connected telephone lines, a selective switch and a manual link circuit through which the conversational circuit extends, an auxiliary contact for said switch for preventing intrusion upon the conversational circuit, release mechanism for said switch, means including said release mechanism, said auxiliary contact and a relay of said manual link circuit for restoring to normal the said automatic switch, and a centralized source of current for operating and talking purposes.

124. A telephone system including a calling subscriber's line, a switch individual thereto provided with a pair of line contacts and a third contact, operators' link circuits, subscriber controlled means for operating said switch to connect said subscriber's line to said link circuit, via said line contacts, means for disconnecting said subscriber's line from said link circuit, a circuit extending through said third contact for controlling said means, and a centralized source of current for supplying talking current to said subscriber's line through impedance coils of said link circuit.

125. A telephone system including a subscriber's telephone line, an operator's trunk connected to a pair of line contacts and a third contact, an automatic switch for con-

necting said operator's trunk to said subscriber's line via said line contacts, means for disconnecting said subscriber's line from said operator's trunk, a circuit extending through said third contact for controlling said means, and a source of current associated with said operator's trunk for supplying talking battery to the subscriber's line.

126. A telephone system including a calling subscriber's telephone line, an operator's link circuit terminating in line contacts and in an auxiliary contact at one end and in a manual terminal at its opposite end, automatically controlled means for connecting said operator's link circuit to said calling subscriber's line via said contacts, release means for disconnecting said subscriber's line from said operator's link circuit, and a release circuit for said last means including said third contact, and means associated with said operator's link circuit for supplying talking current through impedance coils to said subscriber's line.

127. A telephone system including a subscriber's telephone line, a plurality of operators' trunk circuits, electro-magnetically controlled step-by-step means for connecting an idle one of said operators' trunk circuits to said subscriber's line, a release magnet for said electromagnetic means, and operator controlled means for operating said release magnet to disconnect said subscriber's line from said operator's trunk circuit.

128. A telephone system including a subscriber's telephone line, a progressively movable automatic step-by-step switch individual thereto, an operator's trunk circuit, means controlled over the calling line for operating said switch to establish a connection between the subscriber's line and the said operator's trunk circuit, electromagnetic release means for said switch for disconnecting said subscriber's line from said trunk circuit, and operator controlled means for effecting an operation of said release means.

129. A telephone system including a calling subscriber's line, operators' trunk circuits, automatic means for connecting an idle one of said trunk circuits to said calling subscriber's line, and means for changing the electrical condition of a part of said trunk circuits to cause them, when idle, to cooperate with said automatic means as if they were busy.

130. A telephone system including a calling subscriber's line, an automatic selecting switch individual thereto, groups of trunk circuits accessible to said automatic switch, and means for changing the electrical condition of the trunk circuits of one of said groups to cause them, when idle, to cooperate with said automatic switch as if they were busy.

131. A telephone system including a calling subscriber's line, a plurality of trunk circuits divided into groups, automatic selecting mechanism for connecting the calling subscriber's line to an idle trunk line, and means for preventing the said selecting mechanism from connecting the subscriber's line to trunk lines of one of said groups by artificially causing said trunk lines to test busy.

132. A telephone system including a subscriber's telephone line, automatic selecting mechanism individual to said subscriber's line, a manual switchboard, trunk lines divided into groups and extending from said automatic selecting mechanism to operators' positions upon said manual switchboard, and means for changing the electrical condition of part of the trunks of one of said groups to cause them, when idle, to cooperate with the selecting mechanism as if they were busy.

133. A telephone system including a calling subscriber's telephone line, automatic selecting mechanism for said line, a manual switchboard, groups of trunk lines accessible to said automatic selecting mechanism and terminating in operators' position upon said manual switchboard, means for connecting a trunk of one of said groups of trunks in conversational circuit, and means

for changing the electrical condition of the other trunks of said group to cause them, when idle, to cooperate with the selecting mechanism as if they were busy.

134. A telephone system including subscribers' telephone lines, automatic selecting mechanism for said lines, a manual switchboard, operators' trunk circuits divided into groups and extending from said automatic selecting mechanism to operators' positions upon said board, means for changing the electrical condition of the trunk circuits of one of said groups to cause them, when idle, to cooperate with said mechanism as if busy.

135. A telephone system including subscribers' telephone lines, a manual switchboard, link circuits appearing in operators' positions upon said switchboard, automatic selecting means for connecting said subscribers' lines to said link circuits, and means for causing the idle link circuits appearing in a certain operator's position to test busy to said automatic means, when idle.

In witness whereof, I hereunto subscribe my name this ninth day of November A. D. 1904.

FRANCIS W. DUNBAR.

Witnesses:

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."