Aug. 30, 1932. H. B. McELYEA 1,874,566

TELEPHONE SYSTEM

Filed Jan. 26, 1931 2 Sheets-Sheet 1

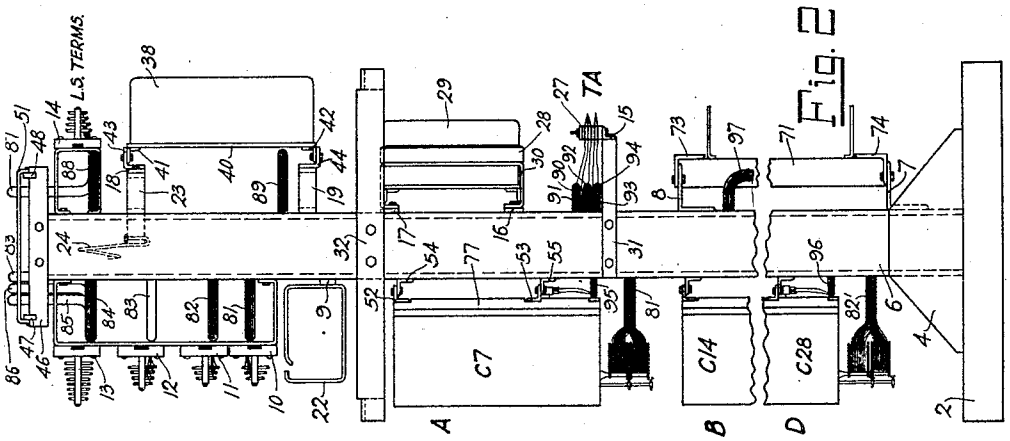


Fig. 2

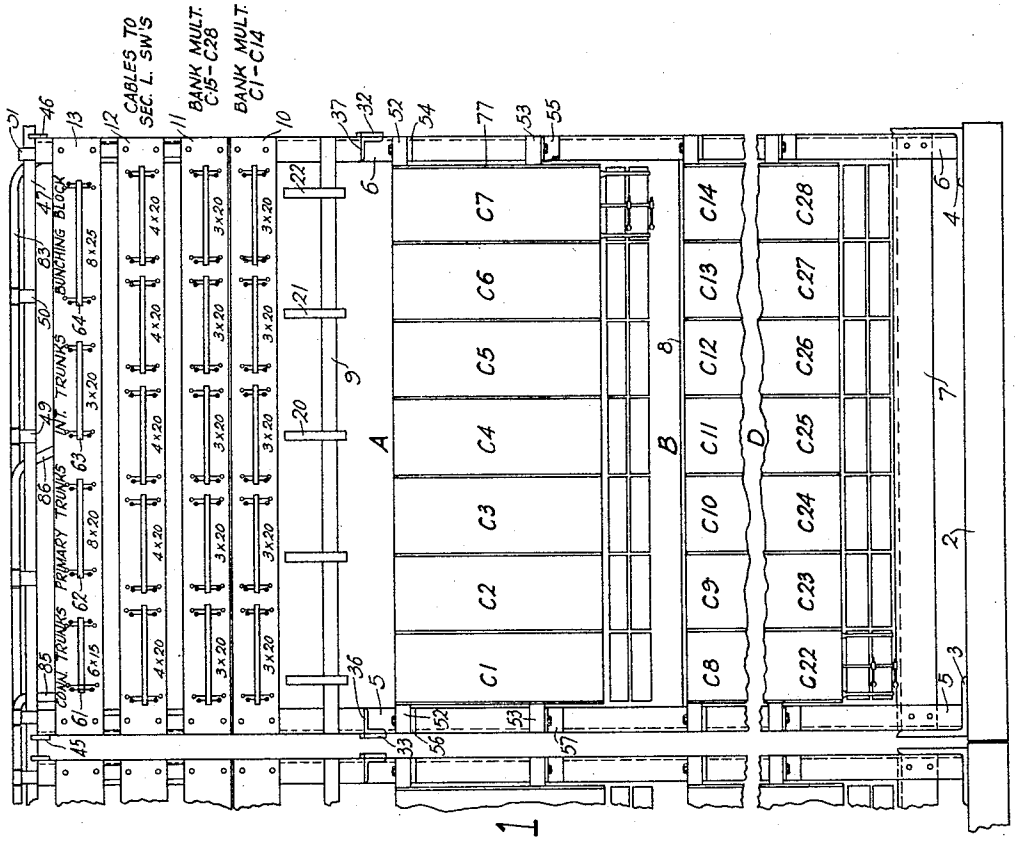


Fig. 1

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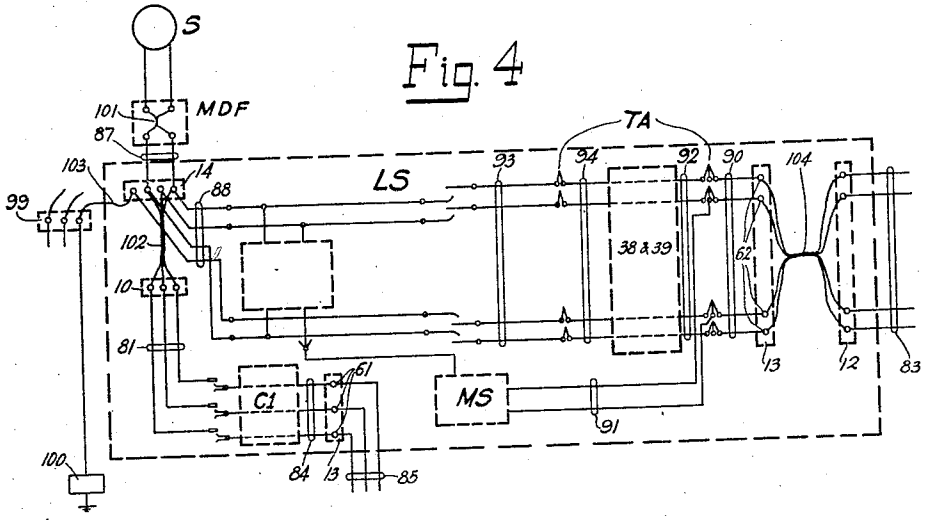
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TELEPHONE SYSTEM

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Fig. 4



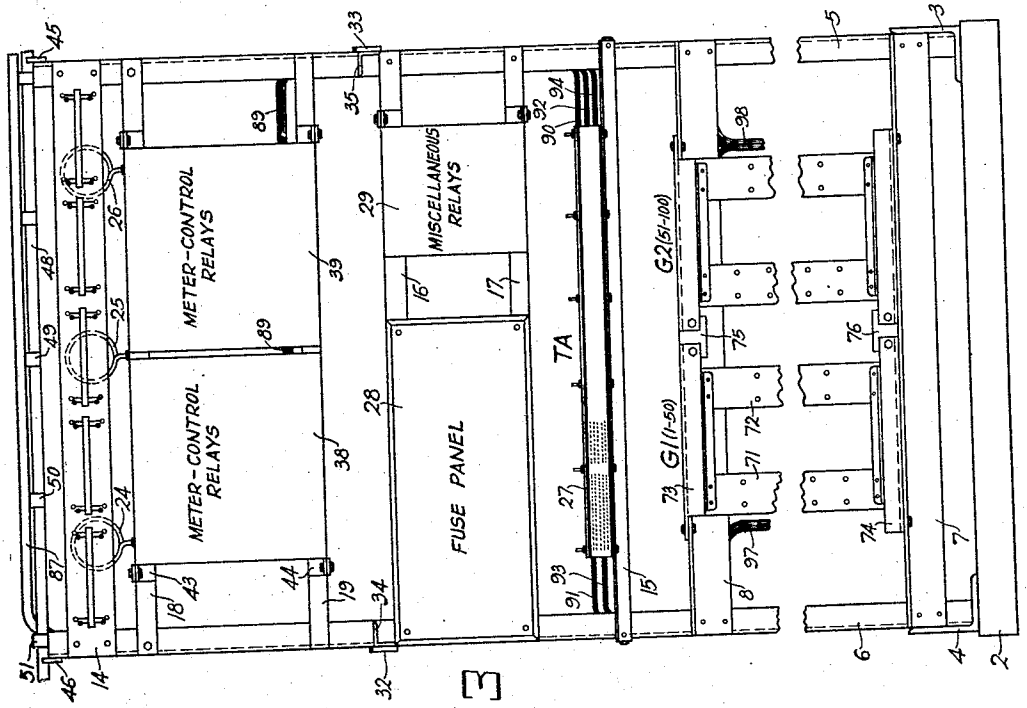


Fig. 3

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UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

Application filed January 26, 1931. Serial No. 511,175.

The present invention relates in general to telephone systems, but is concerned more particularly with the provision of a new and improved combined switchboard and distributing frame for use in an automatic telephone system. The main object may be stated to be the provision of a new and improved automatic switchboard unit arranged to serve as a mounting frame for automatic connector switches and lineswitches, and to serve as a distributing frame through which suitable interconnections may be made between the various cables outgoing from a switchboard and incoming to the switchboard and the lineswitches and connectors mounted on such switchboard, and whereby the connections between the lineswitches and connectors of the switchboard may be readily made and easily changed whenever it is desired to do so.

A specific object of the invention may be stated to be the provision of the above-mentioned arrangement on a switchboard arranged for connector switches to be mounted on one side thereof and for lineswitches to be mounted on the other side thereof.

Other objects and features of the invention will be understood best from a further perusal of the specification in connection with the accompanying drawings, comprising Figs. 1 to 4.

Referring now to the drawings, they show a sufficient amount of the apparatus of a telephone exchange constructed in accordance with the principles of the invention to enable the invention to be understood. Figs. 1 to 3 are three separate views of an automatic-switchboard unit, and Fig. 4 is a circuit diagram showing how various cables and switching units may be interconnected.

The switchboard unit shown in Figs. 1 to 3, and arranged to mount lineswitches on one side thereof and to mount connector switches on the other side thereof, is similar, generally, to the switchboard units shown at the left in Figs. 163 and 165 in Telephony, Including Automatic Switching, by Arthur Bessey Smith, published in Chicago by Frederick J. Drake & Company, copyright 1924. Figs. 164 and 167 in the above-mentioned book show opposite sides of switchboard units of this general type. In addition, the lineswitch side of such a unit is shown to the right of a power board in Fig. 187 of the above book.

Reference may also be had to Automatic Telephony, second edition, by Arthur Bessey Smith and Wilson Lee Campbell, published in 1921 by the McGraw-Hill Book Company, Inc., New York city. Plunger line-switches suitable for mounting on the unit disclosed herein are described in this book on pages 44 to 49, and master switches suitable for use with these lineswitches are described on pages 49 and 50. Figs. 44, 45, 46, and 47 of this book are photographs and circuit drawings of lineswitches and master switches. Fig. 86, page 107, shows a full view of 100 lineswitches served by two master switches, making two groups of 50 lineswitches each, for trunking purposes. And Fig. 87 shows the connector side of the same unit.

In the printed matter beginning on page 53 of the above-mentioned book and ending on page 62, connector switches are described. Various views of connector switches and parts thereof are shown in Figs. 50 to 52, and 54 to 59; and circuit drawings pertaining to a connector switch are shown in Figs. 60 and 61. In addition, Figs. 90 and 92 to 94 show various views of connector switches mounted, with covers in place, together with related apparatus.

The construction of the unit

Referring now particularly to Figs. 1 to 3, the physical aspects of the switchboard unit shown therein will be described. Fig. 1, it will be noted, shows the connector-side of a switch board unit and a fragmentary portion of the connector-side of a similar switchboard unit located immediately to the left. The switch board unit, from a structural standpoint, comprises essentially two upright channel-bars 5 and 6, disposed with their troughs toward each other and rigidly secured in vertical position. The entire assembly is mounted on the base 2, which may be of wood or other suitable material. The upright channel-bars 5 and 6 are resting on and welded to

the support members 3 and 4, which, in turn, are screwed to the base 2. The entire structure is given rigidity by the bracing effect of the angle-bars 7 and 8, Figs. 2 and 3, which are ordinarily first riveted to the upright-channel bars 5 and 6 in the proper location to enable the lineswitch gates G1 and G2, Fig. 3, to be mounted thereon, after which the angle-bars 7 and 8 are securely welded to the upright channel-bars 5 and 6.

From the illustrations in the two books hereinbefore referred to, it will be noted that a switchboard unit of the type shown herein is quite tall relative to its width and breadth. For this reason, part of the lower section of th unit has been broken out and the base has been shown brought nearer to the top portion of the unit, in order to permit the showing of the unit on a relatively larger scale, without exceeding the limits of the drawing space. Considering first the lineswitch side of the unit, two lineswitch gates G1 and G2 are shown. Each gate provides mounting space for fifty lineswitches and for two master switches, one for the lower section of the gate and one for the upper section of the gate (the upper master switch is rarely installed), making it possible to have one master switch for every twenty-five lineswitches. Each gate is hinged or pivotally mounted so that it may be swung out in the manner of a door or a gate in order to render the wiring at the rear of the gate accessible for inspection or repair.

The gate G1 comprises essentially two vertical angle bars 71 and 72, connected together by two horizontal angle bars 73 and 74. The angle bars 71 and 72 are so disposed that one web of each extends toward the other, while the bars 73 and 74 have the same relative disposition, as may be seen in Fig. 2. The gate G1 is pivotally mounted by the bolts which pass through the left-hand end of the horizontal bars 73 and 74 and through the mounting bars 8 and 7. The gate G2 is constructed and mounted in the same manner as the gate G1, except that it is pivoted to swing toward the right instead of toward the left.

The members 75 and 76 are secured to the mounting bars 8 and 7 and arranged to serve as front stops for the gates G1 and G2. The gates are secured in a closed position by being normally bolted to the front stops 75 and 76.

Considering the connector-side of the unit, shown in front view in Fig. 1 and in side view in Fig. 2, mounting space for four shelves of connectors is provided, seven connectors a shelf, giving room for twenty-eight connectors in all. The drawings show shelf A, the top portion of shelf B, and the bottom portion of shelf D; the portion of the units on which shelf C is mounted, being entirely omitted, along with the bottom portion of shelf B and the top portion of shelf D. A mounting frame for a shelf of connectors comprises essentially a pair of horizontal angle-bars such as 52 and 53, Figs. 1 and 2, having their webs disposed relative to one another as seen best in Fig. 2. They are connected together at intervals by vertical bars such as the bar 77, with space between adjacent bars of sufficient width to accommodate a connector switch. Each of the bars such as 77 is beveled in front in order to guide the individual switch cover when it is being placed on the switch.

Suitably spaced lugs, such as the lugs 54 to 57, Fig. 1, are secured to the faces of the channel-bars 5 and 6 on the connector-side of the unit to support the connector shelves. The horizontal shelf angles are bolted to the supporting lugs as shown best in Fig. 2.

Above the connectors and on the connector-side of the unit, groups of terminal blocks are provided and mounted on the so-called fanning strips 10, 11, 12, and 13. These terminal blocks are provided with pin terminals of the usual type and are mounted on the fanning strips 10 to 13 in the usual manner, the fanning strips, in turn, being screwed to brackets mounted on the upright angle-bars 5 and 6.

Between the above-mentioned terminal blocks and the connectors, a jumper-guide bar 9 is mounted on the vertical channel-bars 5 and 6 by being welded thereto. A number of jumper-guides or channel members such as 20, 21, and 22 are provided. These jumper-guides, or channel members are so placed as to line up with the corresponding jumper-guides or channel members on adjacent units so as to make a continuous jumper-channel from one end of a row of units to the other, whereby a jumper may be extended from a terminal block on any unit to a terminal block on any other unit. Each jumper-guide is split near the upper outside corner so as to permit a jumper to be placed within the jumper-channel without the necessity of placing it through each jumper-guide separately. This construction of the jumper-guides may be observed by referring to jumper-guide 22, as seen in Fig. 2.

As may be seen in Figs. 2 and 3, a row of terminal blocks is provided on the lineswitch-side of the unit, near the top, this row of terminal blocks being mounted on the fanning strip 14.

Below the fanning strip 14, two covered groups of meter-control relays 38 and 39 are mounted. Group 38 is mounted on a base plate 40, Fig. 2, to which the horizontal angle bars 41 and 42 are secured. The angle bars 41 and 42 are hingedly mounted or pivoted on the lugs 43 and 44, which are, in turn, secured to the flat horizontal mounting bars 18 and 19. Group 39 is mounted on the bars 18 and 19 in the same way.

The bar 19 is a U-shaped bar, with the ends thereof toed in and welded to the vertical channel bars 5 and 6, as may be understood

best from Fig. 2. The bar 18, on the other hand, is a flat, straight bar which is welded to the ends of the off-set U-shaped bar 23. The bar 23 extends between the upright channel bars 5 and 6 and is welded to them on the line-switch-side thereof. This bar is off-set between the channel bars 5 and 6 so that it passes along between the center lines of the two channel bars in the correct position to support the jumper rings 24, 25 and 26, Fig. 3. Jumper ring 24 may also be seen in dotted outline in Fig. 2, behind the vertical channel bar 6. The jumpers passing from the blocks mounted on fanning strip 14 to other jumper blocks on the same or other units, pass through the jumper rings 24 and 25.

The fuse panel 28 and the miscellaneous-relay group 29 are mounted below the relay groups 38 and 39 and on the bars 16 and 17. The horizontal mounting-bars 16 and 17 are secured directly to the upright channel-bars 5 and 6, and the fuse panel 28 is secured to the bars 16 and 17 by means of two brackets, of which the bracket 30 can be seen in Fig. 2. The miscellaneous-relay group 29 is secured to the bars 16 and 17 in the same way as the meter-control relay groups 38 and 39 are secured to the bars 18 and 19.

A terminal assembly TA is mounted on the lineswitch-side of the unit between the lineswitch gates G1 and G2 and the fuse panel and relay groups 28 and 29. This terminal assembly is mounted on the horizontal angle bar 15, which is, in turn, mounted on two support bars, of which the bar 31 may be seen in Fig. 2. The support bar 31, together with the corresponding bar at the other end of the angle bar 15, is secured to one of the uprights by means of bolts.

The terminal assembly consists of five flat terminal strips such as shown in Fig. 102 of Smith and Campbell's book, hereinbefore referred to. These terminal strips are superimposed in a manner shown in Fig. 103 of the book, each strip being insulated from the other and from the framework by means of suitable insulating strips. The entire assembly is held together by the six bolts and clamped between the supporting angle bar 15 and the clamping bar 27.

Just above the top line of the top connector shelf A, two cover-support bars 32 and 33 are bolted to the upright angle bars 6 and 5, as shown. The lugs 34, 35, 36, and 37 are secured to the ends of the bars 32 and 33 in order to support a suitable form of cover which fits over the equipment mounted below the bars 32 and 33; it being understood, of course, that the lineswitches and connectors are ordinarily enclosed, as may be seen upon reference to the illustrations in the publications hereinbefore referred to.

At the top of the upright channel bar 5, a runway-support bar 45 is secured. A similar runway-support bar 46 is secured to the upright angle bar 6 near the top. These two bars support the section of the cable runway immediately above the unit, it being understood that a cable runway is ordinarily provided directly above the units of a row, and that the cables leading to and from the unit pass over this cable runway. The cable runway is indicated in the drawings as comprising the longitudinal bars 47 and 48, resting in notches in the support bars such as 45 and 46, together with the lateral bars such as 49, 50, and 51, which are secured to the longitudinal bars 47 and 48 to form a ladder-like structure.

The wiring of the unit

The physical construction of the new unit having been explained, the wiring or cabling arrangement of the unit will now be taken up. As has been explained hereinbefore, this unit is arranged to accommodate four shelves of connectors indicated A, B, C, and D, of which shelf C is not shown owing to that portion of the board being broken away. The incoming machine-made, covered cable 85, Figs. 1 and 2, contains conductors which are connected to the connector-trunk block 61 on fanning strip 13, Fig. 1. From the block 61, a hand-formed cable 84, Fig. 2 extends to the connector shelves, and a branch of this cable leads to each shelf. The branch 95 of this cable leads to the jacks of the switches in shelf A, and the branch 96 leads to the jacks of the switches in shelf D, as may be seen in Fig. 2. The conductors of cables 85 and 84 which lead to the connector C1 by way of terminals in group 61, mounted on fanning strip 13, may be seen in the schematic diagram, Fig. 4.

Since fourteen connectors can ordinarily handle the traffic directed to one hundred lines or one hundred telephone numbers (several numbers being assigned to one line in certain party-line systems) the fourteen connectors, C1 to C14, of shelves A and B have their banks all connected in multiple to serve one hundred connector numbers. In the same way, the fourteen connectors of shelves C (not shown) and D are arranged to serve a separate hundred group of numbers; and, therefore, have their banks all connected in multiple.

The bank cable 81, Fig. 2, connects the multipled contacts of the banks of shelves A and B with the contacts in the blocks mounted on fanning strip 10, Figs. 1 and 2. The cable 81 extends from the right-hand end of fanning strip 10 as seen in Fig. 1 to the bank of the connector C7, the vertical portion of the cable lying within the confines of the upright angle-bar 6. From the bank of connector C1 to the bank (not shown) of connector C8, there is a multipling cable which lies within the channel of channel bar 5. The various contacts in the

blocks mounted on fanning strip 10 accordingly represent the bank contacts of any one of the connectors C1 to C14.

In the same way, the terminals in the blocks mounted on fanning strip 11 represent the respective contacts in the bank of any one of the connectors C15 to C21 (not shown) and C22 to C28. To this end, the cable 82 extends from the left-hand end of the fanning strip 11, as seen in Fig. 1, to the bank of connector C15 (not shown), while the bank cable 82′, Fig. 2, connects the bank of connector C28 to the bank of connector C21 (not shown). This cable lies within the confines of the angle bar 6, as it passes from the connector C28 to the connector immediately above.

The terminal blocks mounted on the fanning strip 14, Figs. 2 and 3 provide terminal facilities for one hundred lineswitches, four terminals a lineswitch. The four terminals of the lineswitch LS, Fig. 14, are shown in Fig. 4 serving as a terminus for the four conductors extending thereto from the lineswitch LS via the cable 88. The cable 88, as shown in Fig. 2, extends from the blocks of fanning strip 14 through the channel of bar 6 to the lineswitches mounted on gate G1, Figs. 2 and 3. The cable 88 joins with other cable conductors to be pointed out hereinafter to form the cable 97, shown in Figs. 2 and 3. The conductors of cable 88 connect to the jacks of the lineswitches on gate G1 as incoming conductors, as shown in Fig. 4. A cable (not shown) similar to cable 88 extends from the right-hand end of the fanning strip 14, as seen in Fig. 3, through the confines of the channel-bar 5 and to the lineswitches of gate G2, joining with other local cable conductors to be hereinafter mentioned to form the cable 98, Fig. 2.

In order to connect the one hundred lineswitches of gates G1 and G2 to one hundred lines of the exchange, the cable 87, Figs. 2, 3, and 4, extends from the line conductor terminals of the terminal blocks mounted on fanning strip 14 to the main distributing frame MDF, Fig. 4, whereat the necessary jumper connections are made to connect the lineswitches with the subscribers' instruments by way of the outside cable plant.

In Fig. 4 it will be noted that one of the trunk lines accessible to the lineswitch LS extends by way of the cable 93 to one of the strips in the terminal assembly TA, Figs. 2 and 3. The terminal assembly TA is provided for the purpose of enabling the relay groups 38 and 39 to be included in series with the trunks outgoing from the lineswitch banks when metered service is required and to enable the trunks to be connected straight through without the relays when metered service is not required. The terminal assembly TA also serves as a connecting point at which the master-switch bank wires are connected to the so-called release-trunk and holding conductors of the trunk lines accessible to the associated lineswitches.

Cable 93 may be seen in Fig. 2, with the wires leading therefrom to the next-to-the-bottom strip in the terminal assembly TA. Cable 93 may also be seen in Fig. 4 coming up from the lineswitch gates G1 and G2 to the terminal assembly TA. Some of its conductors are included in cable 97 extending to the gate G1, while others of its conductors extend across behind the channel bar 8 and go to make up part of cable 98 extending to the gate G2.

Upon reference to Fig. 4, it will be noted that the cable 94 extends from the terminal assembly TA to the relay groups 38 and 39. Cable 94 may be seen in Fig. 2 as the bottom one of the five cables associated with the terminal assembly TA, and its conductors may be seen connecting with the bottom strip in the terminal assembly, the terminals in the two bottom strips being bent and soldered together, as indicated in Figs. 2 and 4. The cable 94 extends up within the confines of the channel 5 (see Fig. 3) and forms part of the cable 89 leading to the meter-control relay groups 38 and 39.

In Fig. 4, cable 92 is shown leading from the relay groups 38 and 39 to the terminal assembly. This cable may be seen in Fig. 2, having its wires connected with the middle one of the five terminal strips, and it may be seen in Fig. 3 extending from the right-hand end of the terminal assembly up into the confines of the channel-bar 6. This cable joins with the cable 94 to form the cable 89 leading to the relay groups 38 and 39.

Fig. 4 shows the master switch bank-cable 91 leading to the terminal assembly TA. This cable may be seen in Fig. 2 with its conductors connected to the second terminal strip, from the top. It may be seen in Fig. 3 leading from the left of the terminal assembly TA. Cable 91 extends down within the confines of the upright channel-bar 6. One portion of this makes up a portion of cable 97, leading to the equipment mounted on the lineswitch gate G1, and the remaining ones of its conductors help to make up the cable 98, leading to the equipment mounted on lineswitch gate G2.

Fig. 4 shows the cable 90 leading from the terminal assembly TA to block 62 mounted on fanning strip 13 (see Fig. 1). The terminals in block 62 represent the primary trunks after they have been led through the relay groups 38 and 39. Cable 90 may be seen in Fig. 2, wherein its conductors are indicated as connecting with the top one of the five terminal strips of terminal assembly TA. Cable 90 is also shown in Fig. 3 as extending from the right-hand end of the terminal assembly TA and up through the channel formed by the upright bar 5.

Fig. 4 shows also the cable 83 extending from terminals in a block mounted on fanning strip 12, Figs. 1 and 2. Cable 83 is shown also in Figs. 1 and 2. This cable leads to secondary lineswitches mounted on secondary-lineswitch boards in the usual manner and having access to the regular first-selector switches of the telephone exchange.

Running the jumpers on the installed units

In order for an understanding to be had of the way in which the jumpers are run between the terminal blocks of installed units to connect the various elements together, various types of automatic telephone systems in which the new and improved units may be used will be discussed.

Individual-line service

In case the unit shown in the drawings is used in a telephone exchange serving individual lines only, instead of serving party lines or a combination of individual and party lines, the two groups of connectors mounted on one side of a unit as shown in the drawings will suffice for two hundred lineswitches, whereas there is room on the opposite side of the unit for only one hundred lineswitches. When such a condition obtains one unit out of every group of three may have lineswitches installed on both sides instead of having connectors on one side and lineswitches on the other, in which case the three units will serve to mount four-hundred lineswitches, and the four groups of connectors contained on the two connector-equipped units will provide four-hundred connector numbers, a separate connector number for each of the four hundred lineswitches. This arrangement may be duplicated in each set of three mounting units.

Moreover, a part, or all, of the lines may be arranged for operation on a metered or measured-service basis according to the system disclosed in the patent to Arthur J. Ray, 1,304,369, granted May 20, 1919, on an application filed January 26, 1915. In Fig. 1 of Ray's patent drawings, a meter M is shown individual to the line of substation A and associated with the individual lineswitch C, and the illustrated one of the trunk lines accessible to the lineswitch C is shown extending to the secondary lineswitch C2 and equipped with the meter-controlling relays 23 and 24. It is assumed that the meter 100 shown in Fig. 4 of the present drawings is similar to the meter M in the Ray patent, and that the relay groups 38 and 39 contain relays similar to the relays 23 and 24 and similarly related to the trunk lines connected through the relay groups 38 and 39 as hereinbefore described.

With the unit shown in Figs. 1 to 3 installed in a system as above outlined, the jumper connections may be made as indicated in Fig. 4. In Fig. 4, it will be noted, the line of substation S enters the exchange at the main frame MDF, and is there extended by means of a jumper and conductors in conductor cable 87 to terminal mounted on fanning strip 14, Figs. 2 and 3. In order to provide incoming service to the line of substation S from the other lines of the system, a three-conductor jumper 102 is run from three of the contacts of the set mounted on fanning strip 14 and shown in Fig. 4 to a set of connector bank terminals. The terminal set to which the jumper 102 is run depends upon the number assigned to the line of substation S. On the assumption that it is a number served by the connectors C1 to C14, Figs. 2 and 3, the jumper 102 extends to one of the contact sets in one of the jumper blocks on fanning strip 10, Figs. 1 and 2. The jumper 102 passes through one of the jumper rings 24—26, Figs. 2 and 3.

Outgoing service from the line of substation A to the other lines of the exchange is obtained through the lineswitch LS in the usual manner. When the lineswitch LS takes for use the four-conductor trunk line shown in Fig. 4 as passing through four of the conductors of cable 93, the connection extends by way of contacts of the terminal assembly TA, to the relay groups 38 and 39 by way of conductors of cable 94; and thence to the primary-trunk terminal block 62 mounted on fanning strip 13, by way of conductors of cable 92, contacts of the terminal assembly TA, and conductors in cable 90. From the contacts on block 62, Figs. 1 and 4, the connection extends by way of a four-conductor jumper 104 to a secondary lineswitch by way of contacts mounted on fanning strip 12, Figs. 1 and 2. From this point, the connection extends by way of conductors in cable 83 to a secondary lineswitch (not shown), which is operated to extend a connection to a first selector accessible thereto and in the usual manner.

In order to connect a meter, such as the meter 100, Fig. 4, so that it will register the calls made from the line of substation S, a single-conductor jumper 103 is run from the meter-actuating contact of the terminal set associated with the lineswitch LS to a contact on the block 99. It may be pointed out that the meters, such as 100, are ordinarily installed on a separate mounting frame, and that cables are extended from this mounting frame to the terminal block 99, mounted on another one of the units of the system and in the space occupied by the fanning strip 12, Figs. 1 and 2, and its terminal blocks. It will be understood, of course, that the secondary-trunk-cable mounting blocks such as those mounted on fanning strip 10 will be required in only a few of the units, as the fanning strip 10 provides for trunks to one hundred secondary lineswitches, whereas a group of

one hundred primary lineswitches makes use of only from 10 to 20 secondary lineswitches, depending upon the traffic conditions. The space occupied by the fanning strip 12 of the unit shown in the drawing may be occupied on most of the other units by fanning strips terminating meter cables and such other miscellaneous cables as may prove to be necessary or desirable.

It may be mentioned that a line such as the line of substation A may be shifted to a new lineswitch without changing the connector number by merely shifting the upper end of the jumper 102, Fig. 4, to the new set of lineswitch terminals on the same or another unit, and making a similar shift of the lower end of jumper 101 on the main distributing frame MDF to the appropriate new set of contacts corresponding to the new lineswitch.

Intercepting service

In case the number assigned to the line of substation S is changed, the jumper 102 is changed accordingly; and, in addition, a new jumper is run from the contacts formerly occupied by jumper 102 on fanning strip 10, Figs. 1 and 2, to a set of terminals of the intercepting trunk block 63 on fanning strip 13, Figs. 1 and 2. With this new jumper installed, any calls attempted to the line of substation S by way of the previously assigned number are routed by way of cable 86 to the intercepting operator's switchboard in the usual manner.

Four-party-line service

If, the system in which the new units are installed is one having all four-party lines instead of having all individual lines as previously assumed, all of the units may have connectors installed on one side and lineswitches on the other side, as shown in the drawings, except that a separate bank cable is taken to the terminal block of fanning strips 10 and 11 from each of the connector groups instead of the arrangement shown and described of taking one bank cable for the shelves A and B and another bank cable for the shelves C and D. When the connectors on one side of the unit are arranged in four groups (a separate group for each shelf) the terminal blocks mounted on the fanning strips 10 and 11 are built up six terminals high instead of three terminals high as shown in Fig. 2, thus doubling the number of terminals to care for the doubled number of bank cable wires leading from the doubled number of connector groups. With this modified arrangement, each shelf of connectors constitutes a separate connector multiple and provides for one hundred connector numbers. With four groups of connectors and only one group of lineswitches there are four connector numbers for each of the lineswitches mounted on the opposite side of the unit, and four numbers for each line, one for each party. In this case, four connector-bank terminal sets can be jumpered to a set of lineswitch terminals as shown in Fig. 4 on the fanning strip 14, one jumper from each of four connector terminals. These four terminal sets assigned to the line would, of course, be reached by as many different groups of connectors, in accordance with standard practice, so that the seizure of a line by a connector of a particular group predetermines the party on the line to be signalled, as, for example, in the case of a harmonic-ringing party-line system, wherein each connector group of a set of four groups applies ringing current of a different predetermined frequency. In such a system, of course, the so-called harmonic or tuned ringers are used on the party lines. It will be understood, of course, that the association of connector numbers and lineswitches with a line is not confined to one unit. A connector-bank terminal set on one unit may be jumpered to a lineswitch terminal set on a different unit by way of a jumper extending through the jumper channel formed by the jumper supports such as 20 to 22, Figs. 1 and 2.

It may be pointed out that the bunching block 64, mounted on fanning strip 13, Figs. 1 and 2, is used as a common connecting point for the jumpers in accordance with standard practice. The terminals on this block are multipled together in sets with three or four groups of terminals in a set in order to accommodate a jumper extending from the group to a lineswitch, and a separate jumper extending from the group to each set of connector-bank terminals through which access is had to the party line.

Standard mixed service

In the majority of actual installations, the subscribers' lines, instead of being all individual lines as in the first assumed example or all four-party lines as in the second assumed example, are usually a mixture of individual lines, two-party lines, and four-party lines. Ordinarily, then, some of the units of an installation will be as shown in Figs. 1 to 3; others will have lineswitches mounted on both sides and no connectors, as discussed hereinbefore; and still others will have lineswitches on one side and the four shelves of connectors on the other side, wired up as four separate connector groups as hereinbefore mentioned. In the regular system, therefore, the provisions for inter-unit jumpering by way of the jumper-channel formed by the jumper-guides such as 20 to 22, Figs. 1 and 2, is extensively used, as, by this means, the several formed groups of lineswitches may be arranged so that they furnish about the same traffic outgoing from the associated lines as is furnished by any other group of line-

switches. This is advantageous from a trunking and traffic-control standpoint, as is well known.

Modified line-cable arrangement

The line-conductor cables such as the cable 87, Figs. 2, 3, and 4, may be terminated on the bank multiple terminals of the connectors such as those mounted on fanning strips 10 and 11 of Figs. 1 and 2 instead of on the lineswitch terminals such as those mounted on fanning strip 14, Figs. 2 and 3, in case it is desired to have all connector numbers appearing on the main distributing frame. This arrangement, of course, requires more cable conductors in a terminal-per-station party-line system, but is favored by some operating companies on the stated ground that it results in less labor by the maintenance men in making jumper connections and alterations having to do with the balancing of the traffic on lineswitch units, the changing of numbers, and the like. With this modified cabling arrangement, a line can be shifted from a lineswitch in one group to a lineswitch in a different group by merely changing one jumper at the switch unit, whereas, in the cabling arrangement shown in the drawings, a jumper must be changed at the main distributing frame as well.

Flat-rate service

In the case of the line of substation S, Fig. 4, in case flat-rate service is to be given instead of metered service, the jumper 103 is removed and the corresponding contact on fanning strip 14 is grounded in order to secure the correct circuit operation. As an alternative way of making the change, the line may be shifted to a lineswitch in another group wherein metering relays are not provided and wherein the fourth terminals of the lineswitch terminal sets are permanently grounded, as no meters are ever to be attached.

What is claimed is:

1. A switchboard for use in an automatic telephone system, said switchboard being composed of separate switchboard units disposed in a row, connector switches mounted on one side of each unit, line switches mounted on the other side of each unit, two groups of terminals mounted on each unit, the banks of the connector switches on the same unit being multipled together and connected to one group of terminals, the lineswitches on the same unit being connected to the other group of terminals, facilities for making jumper connections between said terminal groups whereby any set of connector-bank contacts on a unit may be connected to any lineswitch on the same unit, and facilities for making inter-unit jumper connections whereby any set of connector bank contacts on any unit may be connected with any lineswitch on any other unit.

2. An automatic switchboard unit having automatic connector switches mounted on one side thereof and having automatic lineswitches mounted on the other side thereof, two groups of terminal sets, the banks of said connector switches being connected in multiple with each other and to the first of said groups of terminal sets, said lineswitches being connected to the second of said groups of terminal sets, and facilities for making jumper connections between the two groups of terminal sets.

3. An automobile telephone switchboard comprising a group of units placed in a row, a separate group of primary lineswitches mounted on each of said units, a group of terminal sets on each unit, the bank of the switches of each unit being multipled together, connections from the multipled bank contacts of said units to the respective groups of terminal sets mounted on said units, a group of secondary-lineswitch terminals mounted on one of said units, and facilities for making jumper connections from the primary lineswitch bank terminals on any one of said units to said secondary-line-switch terminals.

4. An automatic telephone switchboard unit having connector switches mounted on one side and primary lineswitches mounted on the other side, a group of connector-bank terminals, the banks of the connectors mounted on said unit being connected in multiple with each other and connected to said group of connector-bank terminals, a group of primary-lineswitch terminals, said primary lineswitches being connected with said terminals, a group of primary-line-switch-bank terminals, the banks of said lineswitches being connected in multiple with each other and to said primary-lineswitch-bank terminals, a group of secondary-line-switch terminals mounted on said unit, facilities including the said connector-bank terminals and primary-lineswitch terminals for making a jumper connection from any multipled set of connector bank contacts to any one of said primary lineswitches, and facilities including said primary lineswitch-bank terminals and said secondary-lineswitch terminals for making a jumper connection between any group of multipled primary-lineswitch-bank contacts and any group of secondary-lineswitch terminals.

5. In an automatic telephone switchboard unit having provisions for mounting automatic connector switches on one side thereof and having provisions for mounting subscribers' individual line switches on the other side thereof; a group of meter-control relays mounted on the lineswitch-side of said unit; groups of terminal blocks mounted on said unit, a subscriber's-line cable terminating in

one of said terminal blocks; cable connections from the line-cable terminal block to said lineswitches; whereby the lines and lineswitches are connected together; cable connections from the banks of said connectors to another group of said terminal blocks; a terminal assembly mounted on said unit and comprising terminals fixed in superimposed flat strips and arranged to be bent together and soldered in suitable combinations; connections from the banks of said lineswitches to another group of said terminal blocks by way of a first group of contacts in said terminal assembly, said group of meter-control relays, and a second group of contact in said terminal assembly; outgoing trunk cables extending from other blocks on said unit, facilities for running jumpers between the connector-bank-cable terminal blocks and the line-cable terminal blocks to enable connections to be extended to subscribers' lines by way of said connectors, and facilities for making jumper connections between the said terminal blocks to which the lineswitch banks are connected by way of said terminal assembly and meter-control relays to said outgoing trunk cable terminal blocks, whereby calls may be made from said subscribers' lines through said lineswitches and the trunk represented by the said outgoing trunk cables.

6. In an automatic telephone system, a group of switchboard units arranged in a row, each unit having connector switches mounted on one side and lineswitches mounted on the other side, a group of terminal blocks on the connector side of each unit terminating cable conductors extending from the connector banks, terminal blocks mounted on the lineswitch side of each unit, conductors connecting the terminal sets in the lineswitch blocks with the lineswitches on the same unit, facilities including jumper rings for running jumpers between the two sides of any unit to connect connector-bank contact-sets and lineswitches together, and facilities including jumper guides on all said units whereby a jumper may be run from any lineswitch terminals on any unit across the said any unit and through said jumper guides to a set of terminals mounted on the connector side of any other unit, in order to make inter-unit associations of connector-bank contact-sets and lineswitches.

7. An automatic telephone switchboard comprising a row of switchboard units, each unit having automatic connector switches mounted on one side and subscribers' individual lineswitches mounted on the other side, a group of terminals mounted on the lineswitch side of each unit and connected with the lineswitches on the same unit, a group of terminals mounted on the connector side of each unit and containing terminals cable-connected to the connector-bank contact sets, facilities including jumper rings for running jumpers across any unit between the said terminal groups and facilities including a jumper channel extending along the row of units and formed by jumper guides mounted on the units for making inter-unit jumper connections between terminals of different units.

8. An automatic telephone switchboard comprising a group of switchboard units placed in a row, automatic switching apparatus mounted on each of said units, a group of terminals mounted on each unit above the automatic switching apparatus thereon and cable connected to the associated apparatus on the same unit, and facilities including a jumper channel formed by jumper guides mounted on said units above the automatic switching apparatus for making jumper connections between the terminals of all said units.

9. An automatic switchboard unit having automatic switches mounted on one side thereof, a group of terminals mounted on the same side of the unit above the switches and cable connected to said automatic switches, said unit having automatic switches mounted on the other side thereof and cable connected to a group of terminals mounted on the said other side of the switchboard above the associated automatic switches, and jumper facilities including jumper rings for running jumpers between the two sides of said switchboard above the switches mounted thereon in order to connect the automatic switching apparatus on one side of the switchboard with the automatic switching apparatus mounted on the other side of the switchboard.

10. An automatic switchboard comprising a row of separate switchboard units, each unit having automatic switches mounted thereon, a group of terminals mounted on each unit above the automatic switches and cable connected to the switches on the same unit, and facilities for running jumpers between the terminals of said units, said facilities including a jumper channel formed by jumper guides mounted on said units above the automatic switches and below said terminals.

11. In an automatic switchboard unit, a pair vertically disposed main supporting bars located at opposite ends of the unit, switching apparatus mounted on each side of said unit and supported by said bars, a horizontally disposed strip of terminals mounted on one side of the unit and supported by said bars and specific to the automatic switching apparatus mounted on the same side of the unit, another horizontally disposed strip of terminals mounted on the other side of said unit and supported between said main support bars and specific to the switching apparatus mounted on the said other side of the unit, a mounting strip disposed horizontally between said main supporting bars and lying within the confines of the space included within the outer vertical edges of said bars, and jumper-guiding means mounted on said

mounting strip and arranged to guide jumpers between the two said terminal strips.

12. In an automatic switchboard unit, a pair of vertically disposed main supporting bars located at opposite ends of the unit, switching apparatus mounted on each side of said unit and supported by said bars, a horizontally disposed strip of terminals mounted on one side of the unit and supported by said bars and specific to the automatic switching apparatus mounted on the same side of the unit, another horizontally disposed strip of terminals mounted on the other side of said unit and support between said main support bars and specific to the switching apparatus mounted on the said other side of the unit, a mounting strip disposed horizontally between said main supporting bars and lying within the confines of the space included within the outer vertical edges of said bars, and a plurality of jumper rings disposed along the said horizontal bar to support jumpers passing between the two said terminal strips.

13. In an automatic switchboard composed of similar units placed end to end to form a complete switchboard, a pair of vertically disposed main supporting bars forming opposite ends of a switchboard unit, automatic switching apparatus mounted on said unit and supported between said bars, a horizontally disposed strip of terminals mounted on said unit, said terminal strip being supported on said bars and lying parallel to the face of the unit, a horizontally disposed support bar mounted directly on said main support bars above the automatic switching apparatus and below said terminals, and a plurality of jumper guides secured to said horizontal support bar to form a jumper channel through which inter-unit jumpers may be run from the said terminal strip to terminal strips on other units.

14. In an automatic switchboard composed of similar units placed end to end to form a complete switchboard, a pair of vertically disposed main supporting bars forming opposite ends of a switchboard unit, automatic switching apparatus mounted on said unit and supported between said bars, a horizontally disposed strip of terminals mounted on said unit, said terminal strip being supported on said bars and lying parallel to the face of the unit, a horizontally disposed support bar mounted directly on said main support bars above the automatic switching apparatus and below said terminals, and a plurality of jumper guides secured to said horizontal support bar to form a jumper channel through which inter-unit jumpers may be run from the said terminal strip to terminal strips on other units, said jumper guides being disposed so that they lie outside of the faces of the main support bars of the unit and within the face of the unit as defined by the outer limits of the automatic switching apparatus mounted on the unit.

In witness whereof, I hereunto subscribe my name this 21st day of January, A. D. 1931.

HARLEY B. McELYEA.