

June 10, 1941.

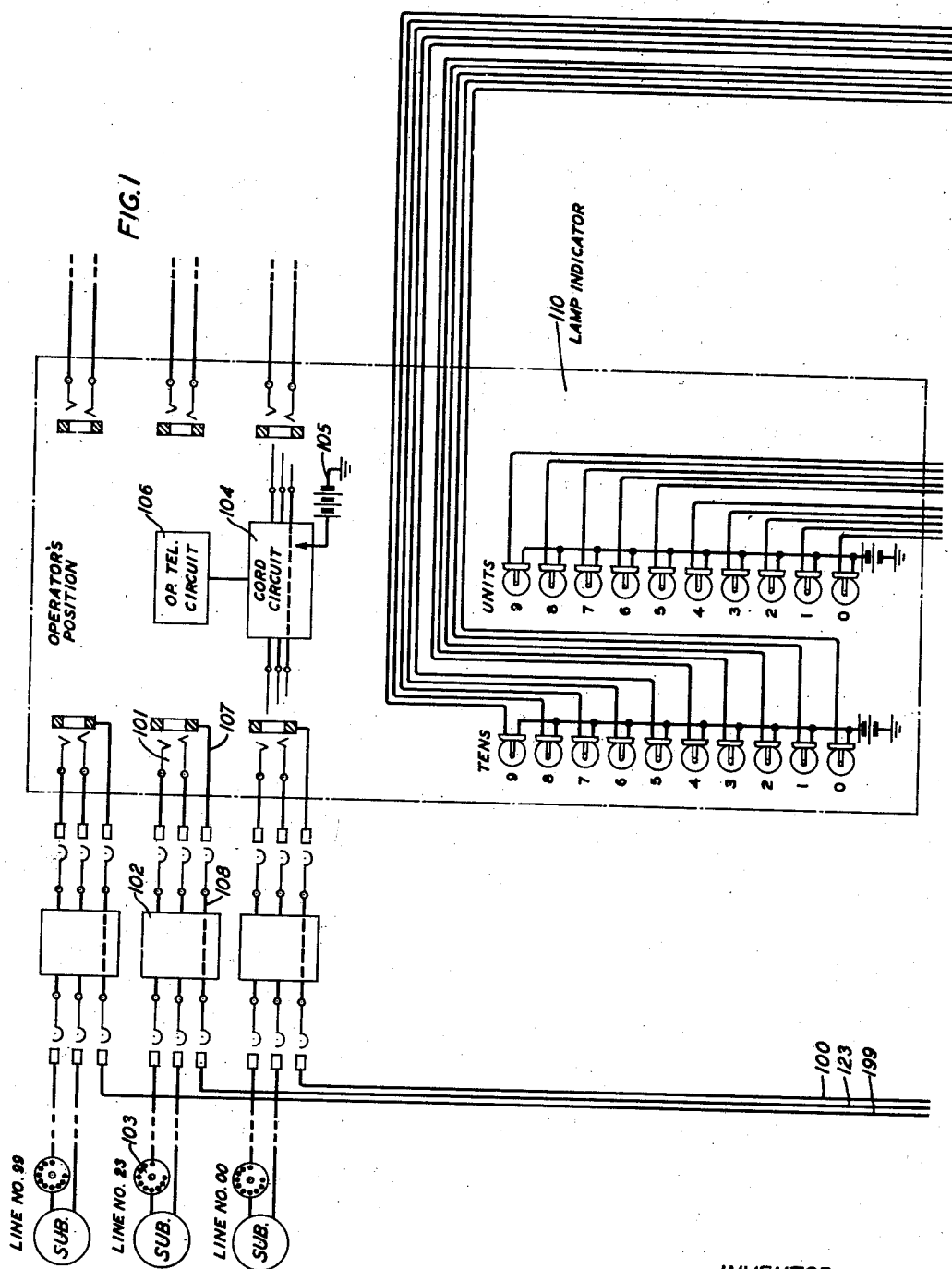
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2,244,700

TELEPHONE SYSTEM

Filed Sept. 21, 1939

2 Sheets-Sheet 1



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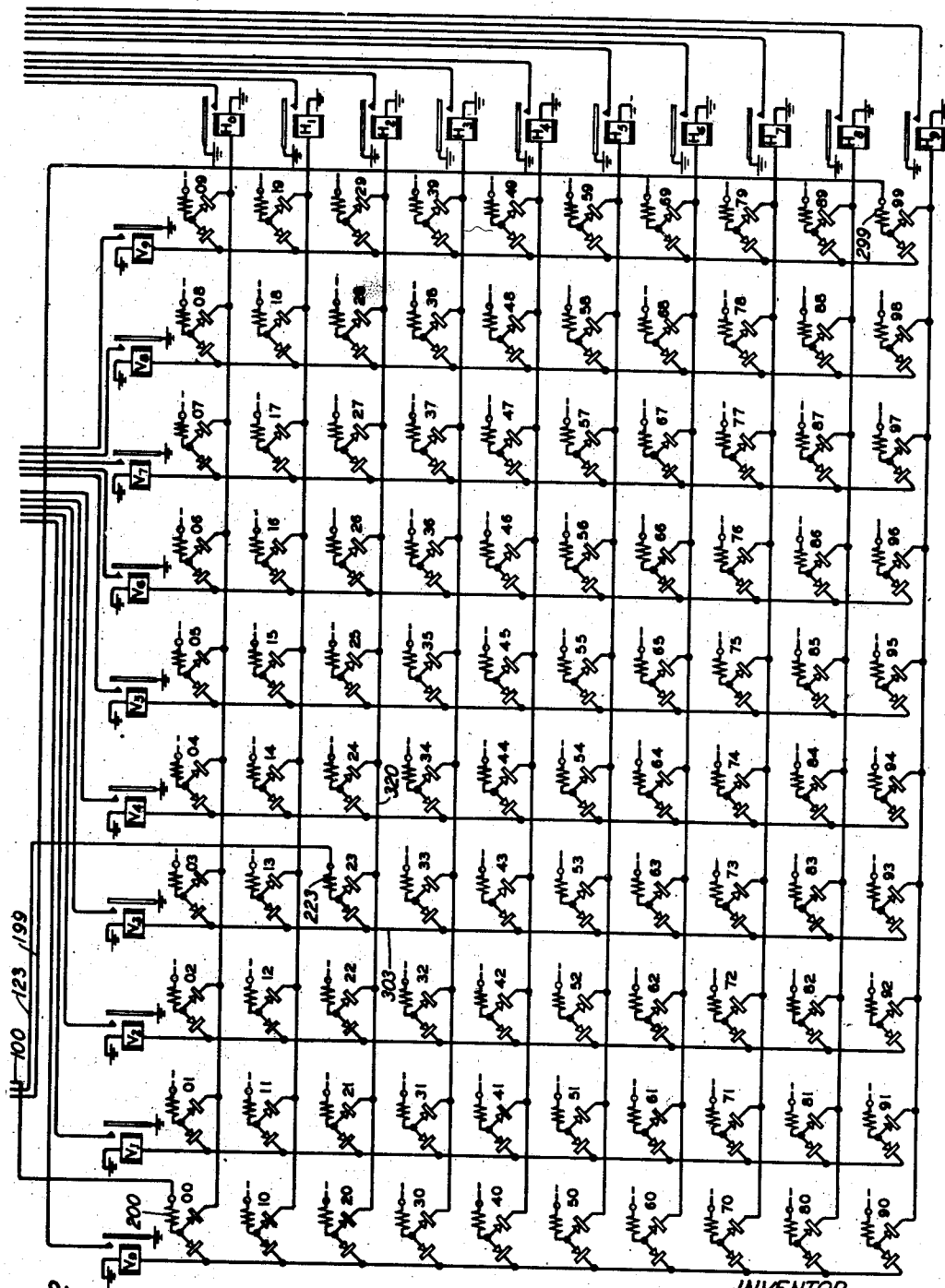
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TELEPHONE SYSTEM

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5 Claims. (Cl. 179—27)

This invention relates to telephone systems and more particularly to those systems in which the numerical indication of a calling line is automatically supplied.

It is well known that in certain types of telephone connections such as those, for instance, in which the calling line is extended automatically or otherwise to some remote station, it is necessary to ascertain the number of the calling station in order that charges for the call may be properly assessed to the station. Such connections are known as toll or long distance connections and in manual telephony the calling line is routed to its destination via the position of a recording operator where the number of the calling station is verified over a so-called checking multiple after the number has been communicated to the operator by the calling subscriber. This verification is accomplished by touching the tip of a so-called checking cord to a pin in the checking multiple that is individual to the given number, and if the number as given is correct, a tone circuit is completed over the checking cord which is heard by the operator in her telephone set, thereby verifying the accuracy of the number. On the other hand, if the number is not correct, that is, if the tip of the cord is touched to a pin other than that belonging to the calling line, the tone circuit is not completed, which indicates to the operator that the number given by the subscriber does not correspond to that of the station from which he is calling and service, therefore, will be denied until the discrepancy is rectified.

In automatic telephone systems it is desirable to have the identity of the calling station transmitted automatically to some point at which it may be recorded on settable registers for visual display of the number by the verifying operator, if the call is to be completed therethrough, or for automatic recording if the information usually obtained by the verifying operator is to be obtained automatically by printing devices responsive to the settings of registers.

The principal feature of my invention is a coordinate arrangement of rectifiers to the cross-points of each of which the identifying conductor of one of the several lines in the office is disposed for corresponding line number identification. Each row and column to which the different horizontal and vertical rectifiers belong terminates in a relay connected to one terminus of a source of potential, and the application of the other terminus of this source of potential to the identifying conductor of any line causes the

operation of the vertical and horizontal relays defined by the cross-point to which said conductor is connected. The operation of these two relays may then be utilized to control registers, lamps or other means for displaying or recording the number.

A clearer conception of the scope and purpose of the invention may be obtained from the following description, appended claims and attached drawings in which:

Fig. 1 shows an arrangement of 100 automatic subscribers' lines with switching means for extending any of said lines to an operator's position, and a lamp indicator at the position; and

Fig. 2 shows the coordinate arrangement of rectifiers together with horizontal and vertical relays arranged for operation to identify any line in a one-hundred line group.

Referring, now, first to Fig. 2, it will be seen that the identifying circuit comprises a coordinate network of 100 cross-points each made up of two unidirectional impedances of any suitable type but preferably of well-known copper-oxide rectifiers joined at one point and poled to pass current either away from or into the point of connection; and that, for the identification of each of the lines in a one-hundred line group, for example, each impedance of the pair is connected to each of the other impedances in a horizontal row of vertical column which is disposed for the passage of current in an identical direction. Each row of impedances is connected to the winding of a "horizontal" relay and each column of impedances is connected to the winding of a "vertical" relay and a relay in a row and another relay in a column, when operated in the manner described hereinafter, will mark a particular cross-point. Thus, in a network of the above type for the identification of each of the lines in a one-hundred line group, there would be ten horizontal relays H0—H9 and ten vertical relays V0—V9 through the contacts of which may be controlled a lamp circuit (as shown in Fig. 1) or a register or a printer, depending upon the manner and form in which the calling line indication is desired. Since lamp indicators, registers and printers, and the manner in which they can be respectively controlled through settable relays are all well known in the electrical arts, a lamp indicator 100 is shown as typical of all, it being understood that the invention is not limited to a lamp indicator but encompasses any known means of indicating and recording that can be controlled through settable relays.

In Fig. 1 three subscribers' lines of a one-hun-

dred line group, namely line 00, line 23 and line 99, are shown from each of which connections may be established by automatic switches or otherwise to other subscribers' lines, or, if toll connections are desired, to an operator's position from which such connections may then be completed to distant points through ordinary manual or automatic switching facilities. From the sleeve terminal of each of the lines a conductor is provided that joints, through a current limiting resistance, with the correspondingly numbered impedance cross-point reserved for the line in the identification circuit of Fig. 2. Thus the sleeve terminal of line 00 is joined to impedance cross-point 00 by conductor 100 connected to resistance 200; that of line 23 to the impedance cross-point 23 by conductor 123 that connects with resistance 223; and that of line 99 to impedance cross-point 99 by conductor 199 that connects with resistance 299. In the same way the sleeve terminal of each of the other lines in the group is connected by its own conductor to the corresponding cross-point in the network of the identification circuit.

Now when a call is initiated on any one of the lines, say line 23 for example, for connection with the operator's position, said line is extended to an operator's trunk 101 over suitable switching facilities 102 guided into selective position between the line terminals and those of the trunk by the impulses produced through the manipulation of the calling dial 103. The extension of the line to the trunk causes a signal (not shown) to be given at the position which indicates to the operator that service is desired on the trunk, whereupon information is solicited from the subscriber with respect to the wanted designation by the connection of a telephone cord 104 to the trunk, said cord being provided with a suitable telephone circuit 106 over which the operator obtains the desired information, and a controllable source of potential 105 which may be applied to the sleeve of the connection. When the operator desires to verify the identity of the calling line as given to her by the calling subscriber, said source of potential 105 is applied to the sleeve 107 of the trunk jack. Assuming that the source of potential is a battery having its negative pole grounded, the application of said source of potential to the sleeve of trunk jack 101 will establish a current flow from the positive pole of said battery, sleeve of the cord, sleeve 107 of the trunk jack, sleeve of the switching equipment intermediate said trunk jack and the terminals of the calling line, conductor 123, resistance 223, through the left-hand impedance, conductor 303, winding of relay V3 to ground and, through the right-hand impedance, conductor 320, winding of relay H2 to ground. Both relays operate in the circuits above traced, the former closing an obvious current path for lamp 3 in the units column of lamps and the latter closing an obvious current path for lamp 2 in the tens column of lamps. Both of these lamps, by lighting, apprise the operator of the fact that the calling line number is 23. If the source of potential 105 is alternating, the same operations will take place except that no current will flow on that portion of the cycle opposed to the current flow direction of the several impedances in the network. However, by using an alternating source of a suitable frequency or by using relays having slow-release characteristics, the pulsations of the current will not affect the operated relays or the circuits controlled thereover.

In the same way the extension of any line in the group to a trunk terminating in a jack at the operator's position provides the operator with facilities for ascertaining the line number through operations similar to those above indicated.

It will be noted that, due to the nature of a uni-directional impedance in not offering an infinite impedance to the flow of current in one of its directions, there will be some flow of current through the rectifiers of the row and column marked by the cross-point to which the potential is applied and thence to ground through each of the vertical and horizontal relays in all the rows and columns. This will have a tendency to operate all the relays besides the ones marking the desired cross-point. However, by the suitable selection of a comparatively high resistance for the cross-point itself, this shunting current can be kept down to negligible proportions, and by adjusting the relays to operate on a current above the maximum shunting current, false operations will be avoided.

While this embodiment of the invention has been described with reference to a line group of 100 lines and to provide a visual display of the calling line number, it is evident that the co-ordinate disposition of the rectifier pairs can be expanded by any multiple of 100 lines, in which event the vertical and horizontal relays operated to designate the cross-point of the calling line may each be arranged to give the appropriate digital designation in terms of the rows or columns in which the cross-point appears. Further, it is also evident that while the relays are shown as closing lamp circuits to provide visual designations, they can be similarly used to control registers or printer magnets in the well-known manner in the event it is desired to obtain a permanent record of the calling line.

What is claimed is:

1. An identification circuit for the lines of a telephone system comprising in combination a plurality of current responsive devices and a network of impedance cross-points in which each cross-point identifies a particular line and through which a potential applied to any cross-point produces a current flow through the impedance of said cross-point, whereby said plurality of devices are operated to identify the line corresponding to the cross-point to which the potential was applied.

2. An identification circuit for the lines of a telephone system comprising in combination a plurality of current responsive devices and a network of impedance cross-points disposed in co-ordinate pattern in which each cross-point identifies a particular line according to its numerical designation and through which a potential applied to any cross-point produces a current flow through the impedance of said cross-point but not operatively through that of any other, whereby certain of said plurality of devices are operated to identify the numerical designation of the line corresponding to the cross-point to which the potential was applied.

3. In a telephone system, a calling line identification circuit comprising, in combination with a group of line terminals, a source of potential connected to one of said terminals, a plurality of current responsive devices, and a rectifier network connected to said terminals and to said devices whereby a current path is established from said source of potential through two of said electro-responsive devices for operating said devices to

identify the terminal to which said source of potential is connected.

4. An identification circuit for the lines of a telephone system comprising a plurality of unidirectional current conducting devices arranged in pairs to form rows and columns indicative of the digital designations of said lines, a conductor extending from each of said lines to each of said pairs of devices, and means responsive to the application of a potential to any one of said conductors for indicating the numerical identity of the line to the conductor of which the potential was applied.

5. An identification circuit for the lines of a telephone system comprising a plurality of copper-oxide rectifiers arranged in pairs to form rows and columns indicative of the digital designations of said lines, a conductor extending from each of said lines to each of said paired copper-oxide rectifiers in accordance with the designation of the line, and relay means operatively responsive to the application of a potential to any one of said conductors for indicating the numerical identity of the line to the conductor of which the potential was applied.

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