Dec. 9, 1941. F. A. KORN 2,265,844

CALLING LINE IDENTIFICATION CIRCUIT

Filed July 3, 1940 5 Sheets-Sheet 1

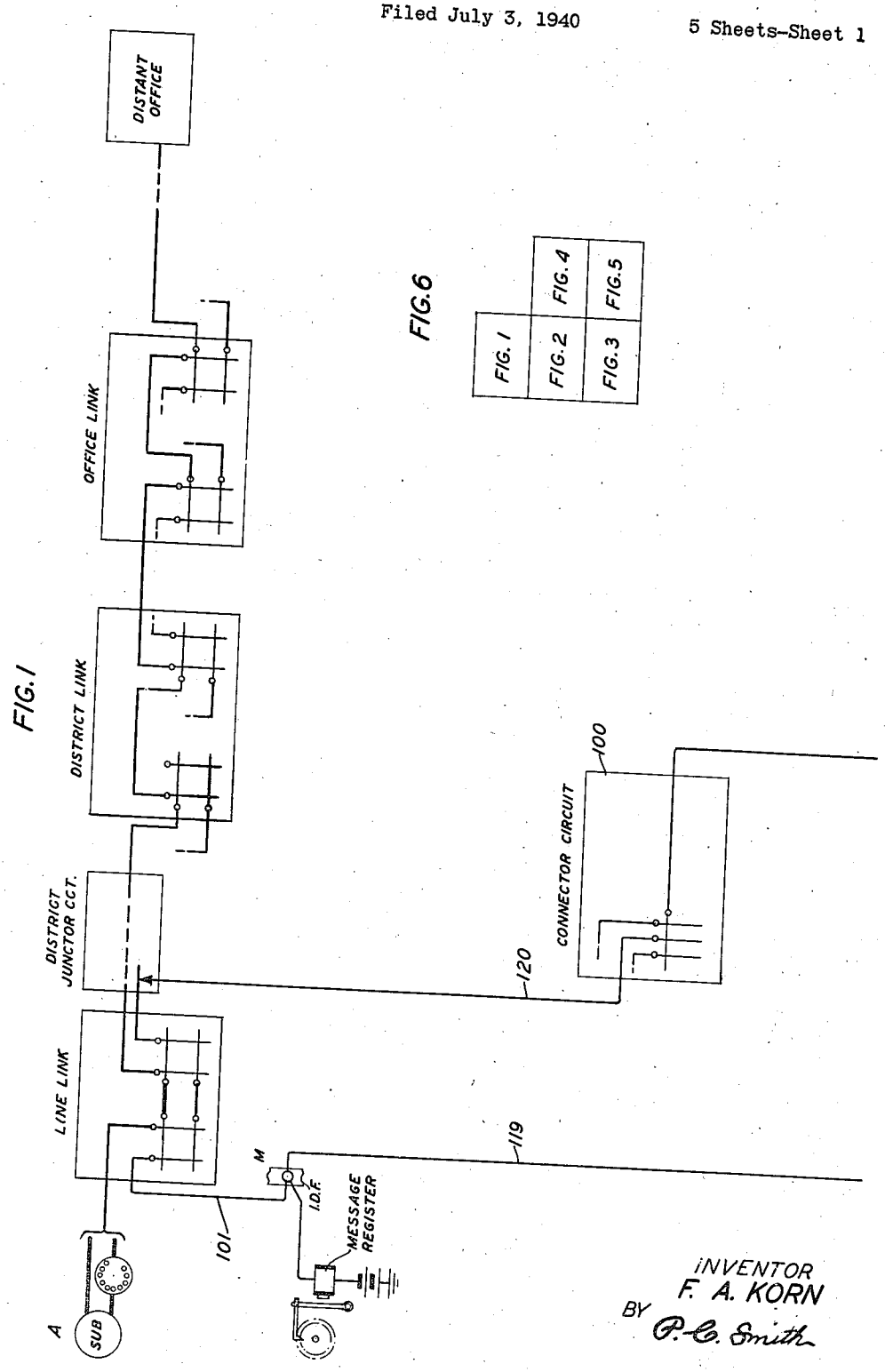

FIG. 1

FIG. 6

FIG. 1	FIG. 2	FIG. 3
	FIG. 4	FIG. 5

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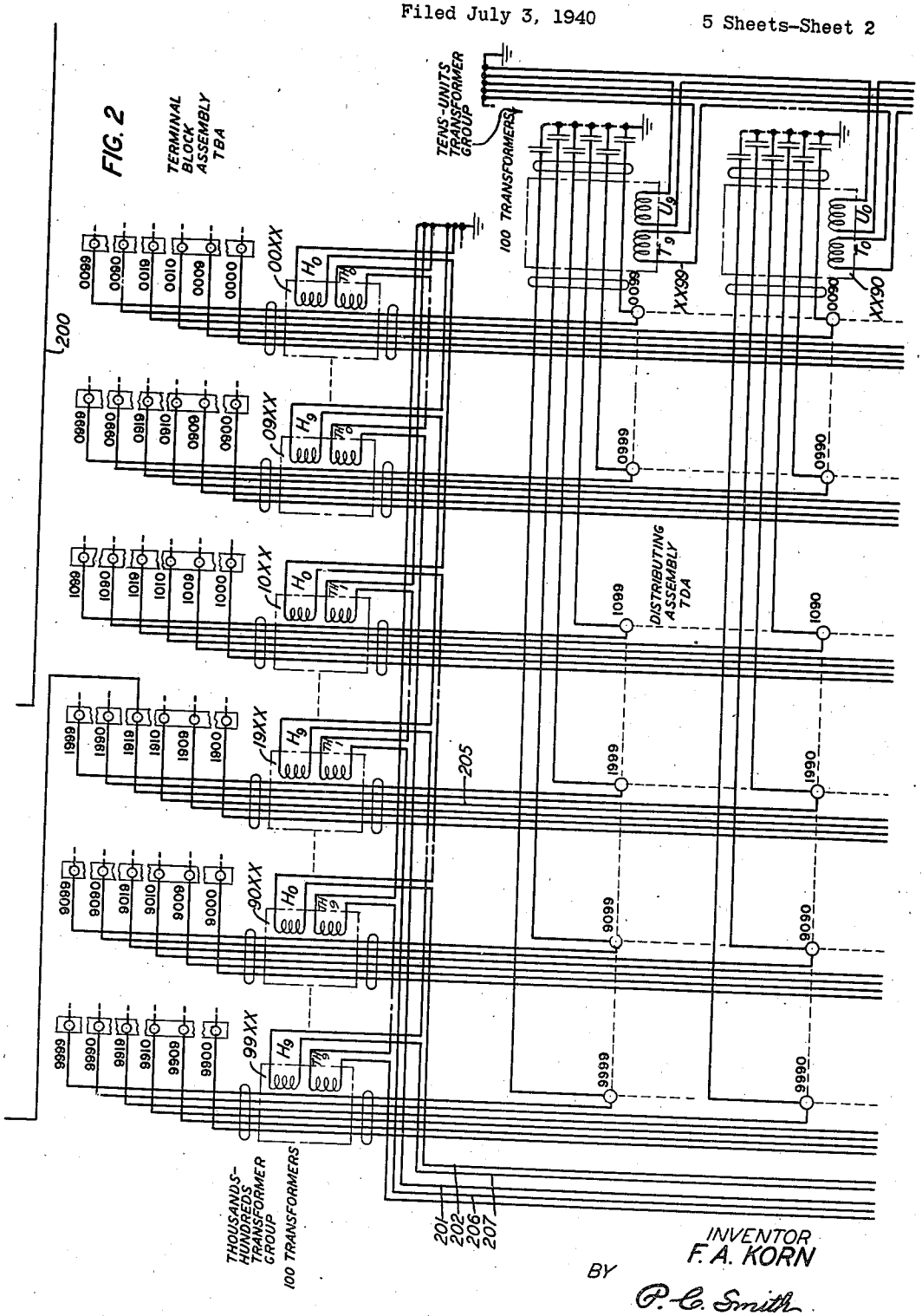
CALLING LINE IDENTIFICATION CIRCUIT

Filed July 3, 1940 5 Sheets-Sheet 2



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CALLING LINE IDENTIFICATION CIRCUIT

Filed July 3, 1940 5 Sheets-Sheet 3

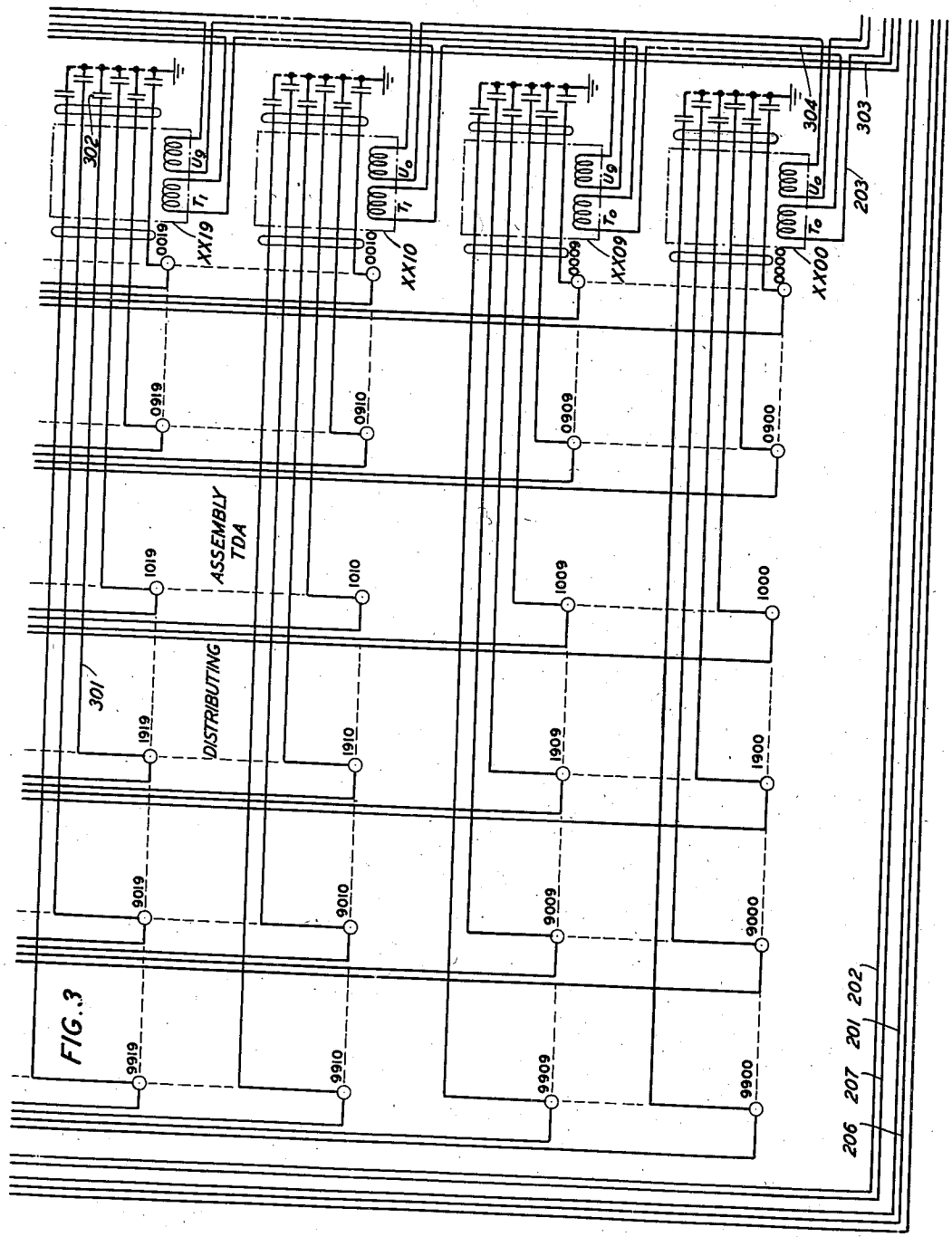

FIG. 3

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CALLING LINE IDENTIFICATION CIRCUIT

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FIG. 4A

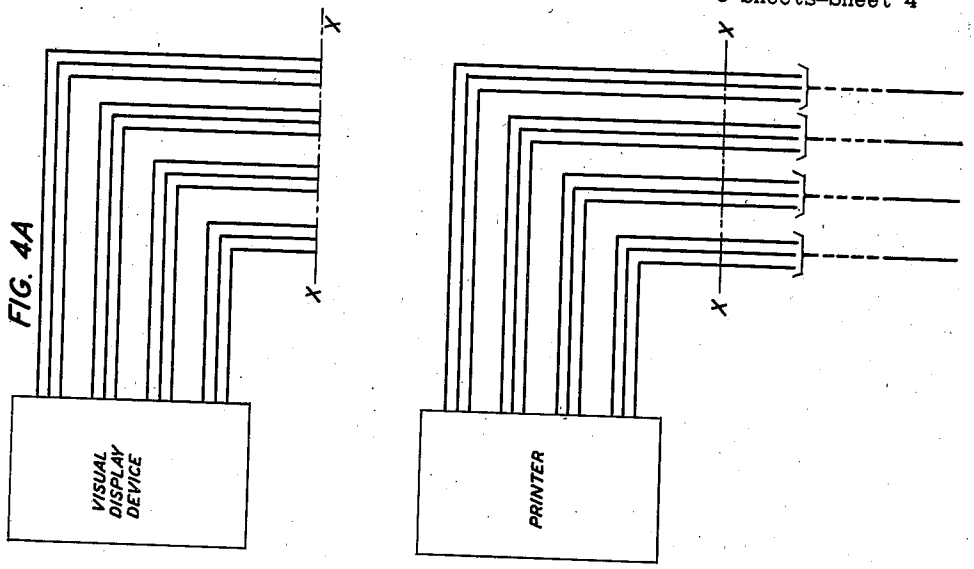
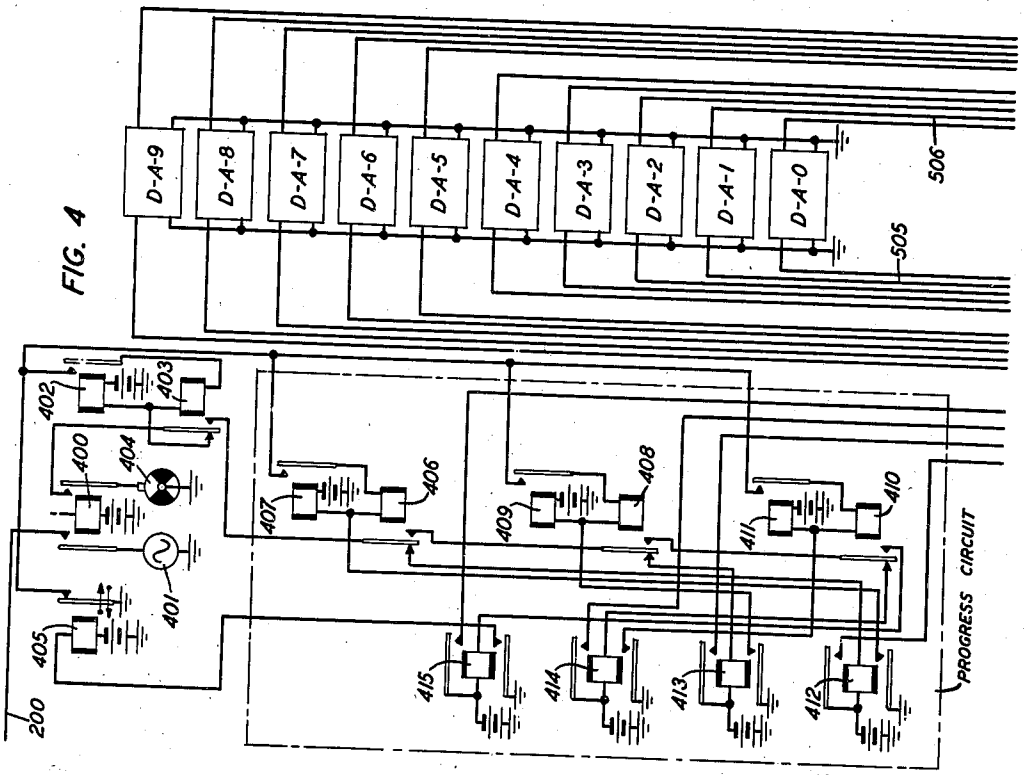


FIG. 4



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CALLING LINE IDENTIFICATION CIRCUIT

Filed July 3, 1940 5 Sheets-Sheet 5

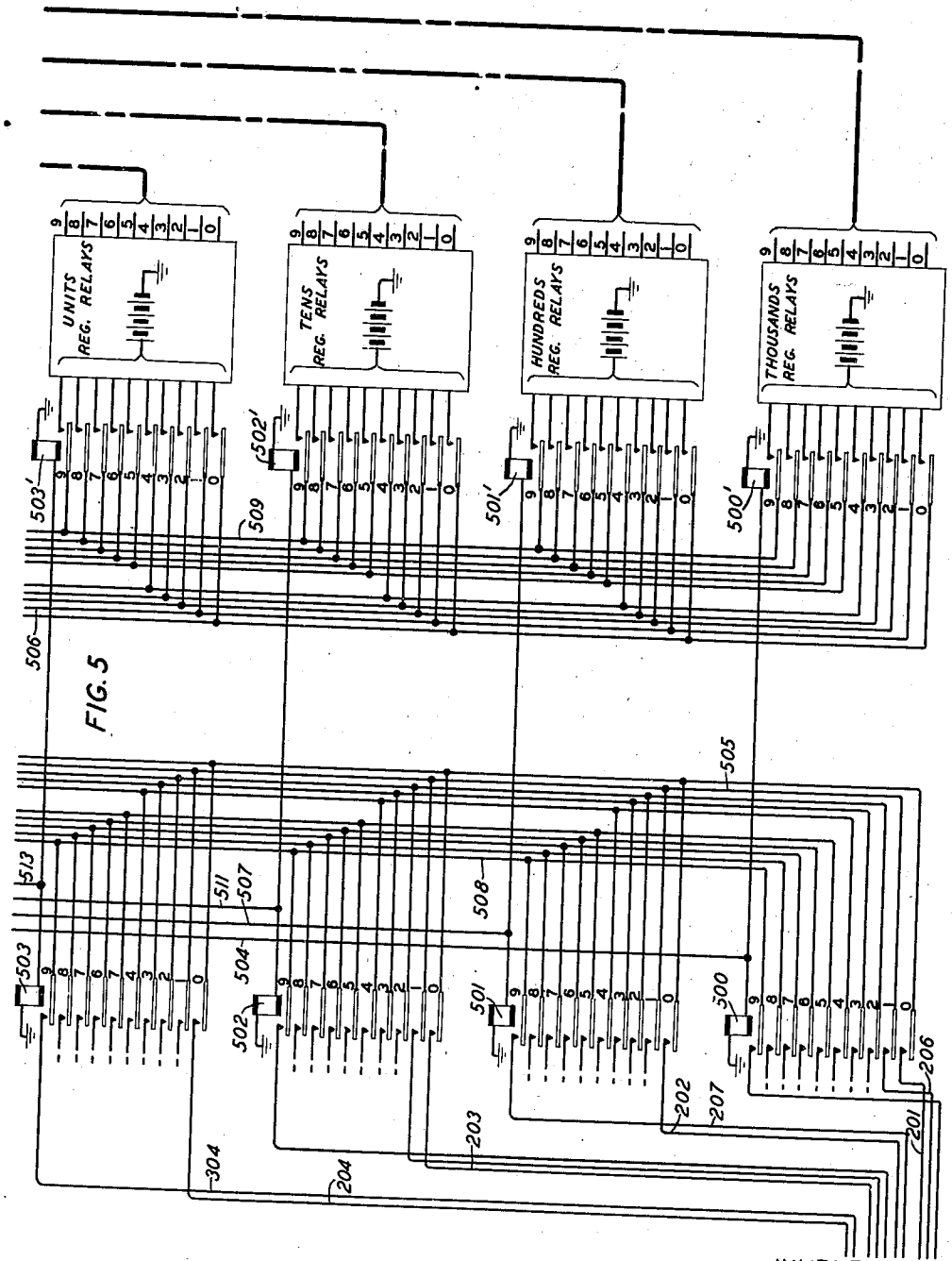

FIG. 5

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UNITED STATES PATENT OFFICE

2,265,844

CALLING LINE IDENTIFICATION CIRCUIT

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Application July 3, 1940, Serial No. 343,702

9 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 determined and made available.

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 said station. Such connections are known as toll or long distance connections and in some types of automatic telephone systems in which the calling line is routed to its destination via the position of a recording operator where, after the number has been communicated to the operator by the calling subscriber, said number is verified over a so-called checking multiple. This verification is made by touching the tip of a checking cord to a pin in the checking multiple that is assigned to the given number and if the number as given by the calling party is correct, a tone circuit is completed over the checking cord which is heard in the operator's telephone set. On the other hand, if the number as given does not correspond to that of the pin to which the tip of the checking cord has been touched, the tone circuit is not completed, which fact 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 may be denied until the discrepancy is rectified.

In automatic telephone systems, it is desirable to have the identity of the calling station ascertained and transmitted automatically to some point at which it may be recorded on settable registers for the visual display of the number, if the call is completed through an operator's position, or for automatic recording if the information is to be utilized for operating printing or other recording devices responsive to the setting of the registers.

My invention is principally concerned with the automatic identification of the calling line number and its principal feature is an arrangement of two groups of one hundred transformers, each transformer in each group being provided with a plurality of primary and two secondary windings, whereby an identifying conductor of a line connected to one of the primary windings of a transformer in each group completes a circuit upon the application of a potential thereto which produces current in the secondary windings of each transformer that may be readily utilized to identify the conductor to which the potential was applied and, therefore, the number of the line to which it belongs. The connection of the identifying conductor to a transformer in the first group depends upon the thousands and hundreds digits of the line number and the connection of this conductor to a transformer in the second group depends upon the tens and units digits of the line number. The application of an alternating current potential to the identifying conductor of the calling line induces appropriate voltages in the secondaries of the transformers involved, voltages which are utilized to actuate electroresponsive devices connected thereto that designate the number indicated by the two transformers.

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

Fig. 1 is a schematic representation of the originating office end of a cross-bar telephone system with which the present invention may be utilized by way of illustrating its arrangement and operation;

Fig. 2 shows a partial arrangement of the two groups of transformers, the line terminal block assembly to which the identifying conductors of the various lines are connected, and a part of the distributing assembly through which the identifying conductors are extended to the primary windings of the transformers of one of the two groups of transformers;

Fig. 3 shows the remainder of the terminal assembly schematic and a part of one of the transformer groups;

Fig. 4 shows, schematically, the detector amplifier circuits, the progress circuit and two forms of devices in which the identified line number may be registered;

Fig. 5 shows a group of cut-in relays by which the secondary windings of the various transformers in the two groups are operatively connected to the input side of the detector amplifiers and another group of cut-in relays by which the output side of said detector amplifiers is operatively connected with appropriate register relays; and

Fig. 6 shows how Figs. 1 to 5 should be arranged with respect to each other in order to disclose the invention completely.

Reference is here made to the application of W. W. Carpenter, Serial No. 214,356, filed June 17, 1938, for a detailed description of a telephone system of the type with which the present invention may be used, although it is understood that the invention is not limited to any

such use as it will be evident to anyone skilled in the art that application to other types of system may just as readily be made. According to the telephone system described in the above-identified application, parts of which system are schematically indicated in Fig. 1, when a subscriber originates a call, a connection is established through a line link, a district junctor and subscriber sender link circuits to an idle subscriber sender (not shown) and the digits of the desired number are dialed thereinto in the usual manner. After the office code digits have been dialed, the sender will connect with an originating marker (not shown) which will provide it with sufficient information for controlling the remote switching of the call and will set up the connection through the district and office link switches to an available trunk extending to the terminating or a tandem switching office.

According to the present invention, the marker may be easily modified to recognize that the call is one requiring calling line identification and will, in this event, signal the district junctor to seize the line identifying connector circuit **100** by which the line identifying circuit is connected to said district junctor. The connector **100** is of a structure similar to the sender link connector disclosed in the above-mentioned Carpenter application and reference is made thereto for a complete understanding of the operation thereof.

When the line identifying circuit is thus operatively associated with the district junctor, relay **400** is operated in any suitable manner under the control of connector **100** and a distinctive alternating current potential is applied from the source **401** via conductor **200** to the line identifying conductor **119** extending into the line identifying circuit. This circuit decodes the line number by the means described hereinafter, and passes this decoded information to register units from which it is transmitted to a display or recording device depending upon the character of the service.

Considering, now, the detailed arrangement of the line identifying circuit, Fig. 2 shows, in part, the manner in which the respective line identifying conductors of the various lines are connected with the primary windings of two groups of transformers. The line conductors, which may be simply conductor extensions from the individual message register terminals M at the intermediate distributing frame IDF, are connected in consecutive numerical order to the terminals of the terminal block assembly TBA which may comprise one hundred blocks of one hundred terminals each for an office of ten thousand lines. The terminal block assembly TBA might be a panel made up of well-known punching blocks which are extensively used for cross-connection purposes in telephone central offices. These blocks are arranged, as shown in Fig. 2, in one hundred columns of one hundred punchings to the column, each punching corresponding to a numbered terminal, the punchings being arranged so that each vertical column corresponds to a particular "thousands-hundreds" group and each horizontal row to a particular "tens-units" combination of digits of the several line numbers.

The identifying conductor **119** of the line A shown in Fig. 1 is connected to the line identifying circuit through a punching in the block assembly TBA having the numerical designation of the line from which the conductor is derived, whence it is carried through two transformers, one in the horizontal group of one hundred transformers partly shown in Fig. 2 and another in the vertical group of one hundred transformers partly shown in Figs. 2 and 3, and thence to a blocking condenser and ground. Two hundred transformers are required for an office unit of ten thousand lines, a group of one hundred transformers for the identification of the thousands-hundreds digits and another group of one hundred transformers for the identification of the tens-units digits. Each number in an office unit of ten thousand lines (0000 to 9999) is obviously composed of four digits, that is, thousands, hundreds, tens and units. Consequently to serve each different combination of thousands-hundreds digits, one hundred transformers will be required each having two secondary windings and identified **00XX**, **01XX**, etc., to **99XX**, as shown in Fig. 2, in which the numerical designations mark the thousands-hundreds digit combination represented by the two secondary windings of any particular transformer in the thousands-hundreds group shown in Fig. 2.

In a similar manner, one hundred other transformers, each with two secondary windings like those above, are arranged to serve for the tens and units digits, one for each combination of these digits and these transformers are designated **XX00**, **XX01**, etc, to **XX99** in which the numerical designations mark the tens-units digit combination represented by the two secondary windings of any particular transformer in the tens-units group shown vertically arranged in Figs. 2 and 3.

It follows, therefore, that by arranging two hundred such transformers into two groups of one hundred each and having a transformer in each group carry some element individual to a line terminal which is capable of producing a slight amount of energy that can be transferred to the secondary windings of these two transformers, there is present the basic essentials of a number identifying system. For example, line terminal **1919** would be wired through transformer **19XX** in the thousands-hundreds group of transformers and transformer **XX19** in the tens-units group of transformers and with means available to respond to a current produced therein, the identifying conductor **119** connected to said transformers may be easily identified.

Although not essential to the operation of the identifying circuit, it is preferable that each transformer be built, assembled and mounted to include the major part of its magnetic structure, which should be such as to contain a groove or indentation to accommodate a switchboard cable of one hundred wires for the cable from the terminal block assembly TBA or from the terminal distributing assembly TDA. The protective covering of the cable should be stripped from it when it passes through the transformer and the cable should be butted at both ends. In this manner, the primary winding of the transformer for one hundred lines can be obtained simply by stripping and butting the cable, laying it in place and then connecting a detail of the magnetic structure to the transfer for covering the cable wire to complete and improve the magnetic circuit. With this design of the transformers it is possible to avoid the installation effort and cost involved in soldering wires for the ten thousand terminals at the various transformers. It is important to note the reduction in the number of soldered connections, potential wiring hazards, etc., which can be obtained by this change from the usual method of wiring transformers.

As previously stated, the identifying conductor of each line is wired through two transformers to a blocking condenser and thence to ground. The blocking condenser is used only to prevent a direct ground from shunting the message register and interfering with its normal operation in the event that the message register terminal is used also for identifying purposes, as is assumed in the operation of the present invention. Any other element, for example a high resistance, which would not interfere with the normal functioning of the register, could be used instead.

Referring to Figs. 2 and 3, it will be noted that each transformer in the thousands-hundreds group is equipped with two "secondary" windings, designated "TH—" and "H—" respectively and that each transformer in the tens-units group is equipped with two "secondary" windings designated "T—" and "U—" respectively. Each of these windings consists of a large number of turns to provide a large voltage step-up from the identifying conductor which, passing through the transformer and magnetically coupled to the two secondary windings, functions as one of the primary windings. The numeral following the letter designation of each of the secondary windings of the transformers represents the numerical digit for identifying the transformer number. With one hundred transformers in the thousands-hundreds group, there will thus be two hundred secondary windings, ten for each of the thousands digit TH0 to TH9 inclusive, totaling one hundred windings, and ten for each of the hundreds digit H0 to H9 inclusive, also totaling one hundred windings. All the corresponding secondary windings of a group of ten transformers which are reserved for a particular thousands digit may be serially or parallelly connected together (only the series connection being disclosed) and brought to a contact of one of the ten contact pairs on the cut-in relays 500, the other end of said serial connection being connected to ground, while the respective secondary windings in corresponding transformers of each of said thousands groups reserved for the same hundreds digit are serially or parallelly connected together and connected to a contact of one of the ten contact pairs on relay 501. Thus the ten transformers 00XX–09XX are reserved for the 0 thousands digit. Hence one terminal of the lower secondary winding TH0 in transformer 00XX is connected to ground while its other terminal is joined serially to the lower secondary winding 01XX (not shown) which, in turn, is joined serially to the lower secondary winding of the next transformer 02XX, the serial connection including the lower secondary winding of the remaining transformers 02XX–09XX, one terminal of the lower secondary winding of the last transformer being joined by a condenser 201 to a contact of the 0 contact pair on relay 500. Similarly, with the lower secondary windings of the remaining nine groups of transformers reserved for the other thousands digits, each group of ten windings being connected to ground on the one side and to a conductor on the other which is connected to a contact of a contact pair on relay 500 corresponding to the numerical designation of the digit. On the other hand, the corresponding upper secondary windings in each of said thousands groups 00XX-99XX reserved to a particular hundreds digit are serially or parallelly joined togetther and connected to ground on the one side and to a contact of a contact pair of relay 501 which bears the numerical designation of the reserved digit. For instance, winding H0 in transformer 00XX of the group of transformers 00XX–09XX for the 0 thousands digit is reserved for the 0 hundreds digit. It is connected to ground on one side and to the corresponding winding H0 in transformer 10XX of the group reserved for the 1 thousands digit. The series or parallel connection is continued with the upper winding H0 in each of the transformers 20XX–90XX, the last in transformer 90XX being joined by a conductor 202 to a contact of the 0 contact set on relay 501.

The transformers for the tens-units group are similarly wired. The group of transformers XX00—XX09 are reserved for the 0 tens digit, and the left secondary winding T0 in each transformer designates this digit. Hence one end of the series or parallel chain connecting all these windings together is connected to ground and the other end is connected to a contact of the 0 contact set on relay 502 via conductor 203. The same thing is true for the remaining nine groups of transformers XX10–XX19—XX90–XX99 reserved for the other tens and units digits. On the other hand, the right secondary windings in corresponding transformers in each transformer group reserved to a particular units digit are joined serially or parallelly and connected to ground on the one side of the chain and to a contact of a contact pair on relay 503 that bears the numerical designation of the digit as, for instance, right windings U0 in each of the tens groups XX00–XX09—XX90–XX99 which are connected to ground on one side and to a contact of the 0 contact set on relay 503 via conductor 204.

To the right of Fig. 5 the control relays 500'—503' are shown which are operated in parallel with relays 500—503 from a progress circuit of any suitable design of which one type is that shown in Fig. 4, to connect the output side of the detector amplifiers DA1—DA9 in four separate stages to each of four groups, respectively, of register relays, each group being reserved for the registration of one of the four digits of the line number to be identified. These relays are not shown in detail inasmuch as each of them comprises a winding whose one side is connected to a contact on the appropriate relay 500'—503' of a contact set bearing the numerical designation of the digit to be registered by the relay, and whose other side is connected to a source of potential. Each relay further carries a set of contacts, one contact of which is connected to a source of potential and the other is connected to a conductor bearing the numerical designation of the digit registered by the relay which extends to the printing or display device shown in Fig. 4 as the case might be.

The operation of the invention in identifying the number of a calling line may now be briefly outlined and easily understood. Assume, for example, that a call is initiated on the line of station A and that the number of said line is 1919. The message register conductor 101 of this line is, of course, extended by way of conductor 119 to punching 1919 in the terminal block assembly TBA whence, by way of conductor 205, it is extended through transformer 19XX as one of the primaries thereof, said transformer being assigned to line numbers having the thousands digit 1 and the hundreds digit 9 to terminal 1919 on the distributing assembly TDA. From ter-

minal 1919 on the distributing assembly TDA a conductor 301 extends through transformer XX19 as one of the primaries thereof, said transformer being assigned to numbers having a hundreds digit 1 and a units digit 9. On the other side of said transformer, said conductor is connected to one side of condenser 302, the other side of which is connected to ground.

When the line connection has been extended to the district junctor and to the sender and marker in accordance with the teachings of the above-mentioned Carpenter application, and the dialing of the office code of the wanted number indicates a call on which calling line identification is required, connector circuit 100 is operated to connect conductor 200 of the identifying circuit with conductor 120 connecting with the third wire of the line connection. Relay 400 is then operated in any suitable manner and a circuit is thereby completed from grounded alternating current source 401, left contacts of relay 400, conductor 200, connector circuit 100, conductor 120, through the district junctor and line link connections, conductors 101 and 119, terminal punching 1919 on terminal block assembly TBA, through transformer 19XX, conductor 205, terminal 1919 in the distributing block assembly TDA, through transformer XX19, condenser 302 to ground. This circuit induces currents in both secondary windings TH1 and H9 of transformer 19XX and other currents in the secondary windings T1 and U9 of transformer XX19 when the circuit through said separate transformers is completed by the operation of relays 500—503 as described hereinafter.

At the time relay 400 operates to apply alternating potential to conductor 200, said relay also closes a circuit for relay 402 extending from ground through interrupter 404, right contact of relay 400, back contacts of relay 403, winding of relay 402 to battery. On the ground closure of the interrupter, relay 402 operates and completes a short circuit for relay 403 to ground on the contacts of slow-operate, slow-release relay 405. On the open period of the interrupter, relay 403 operates and locks in series with relay 402 to said ground, thereby transferring the interrupter conductor to the transfer contact of relay 406. On the next closure of the interrupter a circuit is then completed for the first progress relay 412 extending from ground on said interrupter, front contacts of relay 403, back contacts of relays 406, winding of relay 412 to battery. Relay 412 operates and over its lower contacts completes a circuit for relay 407 extending from ground on said lower contacts, winding of relay 407 to battery, thereby causing said relay to operate and complete a short circuit for relay 406 to aforetraced ground on relay 405. Over its upper contacts it completes a circuit for relays 500 and 500' extending from battery through said contacts, conductor 504, winding of relay 500 to ground and, in parallel therewith, winding of relay 500' to ground. Both relays operate. Relay 500 connects the ten groups of the thousands secondary windings of transformers 00XX—99XX to the input side of correspondingly numbered amplifier detectors DA1—DA9 while relay 500' connects the output side of said detector amplifiers to the correspondingly numbered relays of the thousands register. It has been noted, however, that secondary winding TH1 of transformer 19XX is one of the windings affected by the passage of alternating current through conductor 205 functioning as the primary winding of said transformer. When, therefore, relay 500 operates, the secondary winding TH1 of said transformer becomes a part of the circuit completed via conductor 206, No. 1 contacts of relay 500, conductor 505, input side of detector amplifier DA1 to ground. The signal current is stepped up through said amplifier in the usual manner and then applied from ground to conductor 506, No. 1 contacts of relay 500' to the winding of a relay in the thousands register. This relay operates and grounds conductor 1, thereby completing either a register or recording circuit over said conductor to the visual display device in Fig. 4A or printer device in Fig. 4 depending upon which is used. The signal or the record may then be locked in either of the devices and then released in any suitable manner when the complete registration or the record of the number is received.

The speed of the interrupter 404 is governed in any suitable manner by the time taken to cause all the above functions to take place, the closed circuit interval being sufficiently long to permit the signal to be locked in the display or printing equipment before the register relay may be allowed to release, while the open circuit interval should be merely long enough to release the short circuit around the windings of the relay in each counting relay pair of the progress circuit which is held short-circuited during the closed circuit interval.

When the interrupter rotates to the next insulating segment, relay 412 releases in consequence of which relays 500 and 500' also release, thereby disconnecting the input and output sides of the detector amplifiers from the transformers 00XX—99XX and from the thousands register respectively. The short circuit around the winding of relay 406 is removed, causing said relay to operate and lock serially with relay 407 to ground on the contacts of relay 405.

On the next grounded interval of interrupter 404, a circuit is completed for relay 413 extending from ground over the contacts of relay 400, front contacts of relay 403, front contacts of relay 406, back contacts of relay 408, winding of relay 413, to battery. Relay 413 operates and over its bottom contacts completes an obvious circuit for relay 409 which operates to short-circuit relay 408 to ground on the contacts of relay 405 while over its top contacts it completes a circuit for relays 501 and 501' extending from battery through said contacts, conductor 507, winding of relay 501 to ground and, in parallel therewith, winding of relay 501' to ground. Both relays operate, the former to connect the ten groups of windings H0—H9 of transformers 00XX—99XX to the input side of the detector amplifiers and the latter to connect the windings of the relays of the hundreds register to the output side of said amplifiers. Since the primary current is passing through transformer 19XX, a circuit is completed through the winding H9 extending from ground through said winding, conductor 207, No. 9 contacts of relay 501, conductor 508, input side of detector amplifier DA9 to ground. In the same manner as above explained the signal current is amplified and applied over an output circuit extending from ground through the output path of said amplifier, conductor 509, No. 9 contacts of relay 501', winding of the 9 hundreds relay in the hundreds register, to battery. The relay in the register operates and grounds conductor 9 of the hundreds register which, as before with the thousands register,

completes a circuit to the visual display device or the printer to record the hundreds digit 9.

On the succeeding open circuit interval of the interrupter **404**, relay **413**, releases, in turn causing the removal of the short circuit around the winding of relay **408** which now operates and locks in series with relay **409** to ground on the contacts of relay **405**, and further releases relays **501** and **501'** which disconnect the detector amplifiers from the transformers **00XX—99XX** and the hundreds register.

On the following closed circuit period of the interrupter, a circuit is completed for relay **414** which extends from ground as traced to the front contacts of relay **408**, back contacts of relay **410**, winding of relay **414** to battery. This relay operates and, over its lower contacts, completes an obvious circuit for relay **411** which operates to establish a short circuit for relay **410** while, over its upper contacts, it completes a circuit for relays **502** and **502'** extending from battery through the upper contacts of said relay, conductor **511**, winding of relay **502** to ground, and, in parallel therewith, winding of relay **502'** to ground. Relay **502** operates to connect the ten groups of left windings **T0—T9** of transformers **XX00—XX99** to the input side of the ten detector amplifiers while relay **502'** operates to connect the relays of the tens register to the output side of said amplifiers.

It will be remembered that conductor **301**, forming a continuation of the identifying conductor, functions as a primary for transformer **XX19** and that alternating current flows therethrough. Inasmuch as all T-windings are completed into circuit paths through the input side of the amplifiers by virtue of the operation of relay **502**, a current is induced in the circuit traced from ground through winding **T1** of transformer **XX19** and all the other windings serially or parallelly connected therewith, conductor **303**, No. 1 contacts of relay **502**, conductor **505**, input side of detector amplifier **DA1** to ground. This signal current is stepped up and the resulting output current is applied to the No. 1 relay of the tens register via conductor **506** and the No. 1 contacts of relay **502'**. As in the manner previously described for preceding digits, the tens digit 1 is either registered or recorded.

On the following open circuit interval of the interrupter, relay **414** releases, in turn releasing relays **502** and **502'** and removing the short circuit around the winding of relay **410** which now operates and locks to the aforetraced ground in series with relay **411**.

On the succeeding grounded interval of the interrupter a circuit is completed for relay **415** extending from ground as traced to the front contacts of relay **410**, winding of relay **415** to battery. Relay **415** operates and completes an obvious circuit for relay **405** and a circuit for relays **503** and **503'** which extends from battery through the top contacts of said relay, conductor **513**, winding of relay **503** to ground, and in parallel therewith, winding of relay **503'** to ground. Both relays operate, the former to connect the ten groups of right windings **U0—U9** of transformers **XX00—XX99** to the input side of the detector amplifiers and the latter to connect the units register relays to the output side of said detector amplifiers. All the U windings are completed into circuit paths through the input side of the amplifiers by virtue of the operation of relay **503**. Hence a current is induced in the circuit traced from ground through the winding of **U9** of transformer **XX19** and all the other windings serially or parallelly connected therewith, conductor **304**, No. 9 contacts of relay **503**, input side of detector amplifier **DA9** to ground. This signal current is stepped up and the resulting output current is applied to the No. 9 relay of the units register via conductor **509** and the No. 9 contacts of relay **503'**. As in the manner previously described for preceding digits, the units digit 1 is registered or recorded. With the locking-in of the units record the complete line number is thus identified.

Relay **405**, upon operating, opens the locking ground to all counting relays, causing them to release. Relay **400** is then released in any controllable manner, thereby disconnecting alternating current potential from conductor **200** and disconnecting interrupter **404** from relay **402**. The identifying circuit is thus restored to normal.

What is claimed is:

1. An identification circuit for the lines of a telephone system comprising in combination a plurality of transformers disposed coordinately relative to the lines of said system whereby a potential applied to any one of said lines causes the operation of any two of said transformers in coordinate relation to each other to identify the line to which said potential was applied.

2. An identification circuit for the lines of a telephone system comprising in combination two groups of transformers disposed coordinately relative to the numerical designations of the lines of the system, means for closing a circuit through one of said lines when calling and through a transformer in each of said group of transformers, and current devices responsive to said circuit for identifying the numerical designation of said calling line.

3. An identification circuit for the lines of a telephone system comprising in combination an identifying conductor for each line, two groups of transformers disposed in coordinate pattern in relation to the numerical designation of each of the lines of the system, each transformer in each of said groups having two secondary windings for identifying two digits of a line number and a plurality of primary windings, the primary windings of the transformers in one group being continuous with the identifying conductors of said lines and the primary windings of the transformers in the other group being continuous with the primary windings of the transformers in said one group to form a plurality of separate primary circuits therewith.

4. An identification circuit for the lines of a telephone system comprising in combination with an identifying conductor for each line, a pair of transformers for a group of said lines, one of said transformers having a primary winding for each line in said group connected to the identifying conductors thereof and two secondary windings, and the other of said transformers having as many primary windings as said first-mentioned transformer connected therewith and two secondary windings, means for applying an alternating source of potential to any one of said lines when calling whereby a circuit is completed through the connected primary windings of said two transformers and means responsive to the current induced in the secondary windings thereof for identifying the line to which said alternating source of potential was applied.

5. An identification circuit for the lines of a telephone system in which each line has a four-digit designation, comprising two transformers

for a group of said lines, an identifying conductor from each line in said group extending serially through each of said transformers to function as a primary thereof, two secondary windings in each transformer, means for applying an alternating potential to an identifying conductor whereby a current flows therethrough, and means responsive to the current induced in said four secondary windings for identifying the numerical designation of the line belonging to the identifying conductor to which said alternating potential was applied.

6. In a telephone system, a calling line identification circuit comprising in combination with a group of terminals, a source of potential connectable to any one of said terminals, a plurality of current responsive devices, and a plurality of transformers divided into two groups, the first group having primaries connected to said terminals and having secondaries connected to some of said devices, and the second group having primaries connected to the primaries of said first group and having secondaries connected to the other of said devices whereby when a current path is established from said source of potential through the primary of a transformer in each group current is induced in the secondaries of each of said transformers for operating the current responsive devices connected thereto to identify the terminal to which said source of potential is connected.

7. An identification circuit for the lines of a telephone system comprising in combination with electroresponsive devices, an identifying conductor for each line and means for applying a source of alternating potential thereto, of a plurality of transformers divided into two groups each transformer having two secondary windings, in which the identifying conductor of each line is connected to a primary winding in a transformer of one group serially with a primary winding of a transformer in the other group, and in which said electroresponsive devices are connected to the secondary windings of said transformers whereby the currents induced in the secondary windings of two transformers in consequence of the application of said source of alternating current potential to the identifying conductor which is connected to the primary windings of said transformers operate the electroresponsive devices connected to said secondary windings to identify said identifying conductor.

8. An identification circuit for the lines of a telephone system comprising a plurality of transformers each having two secondary windings and arranged in two groups whereby the secondary windings of the transformers in one group are indicative of a part of the digital designations of said lines and the secondary windings of the transformers in the other group are indicative of the remaining part of the digital designation of said lines, a conductor extending from each line through a transformer in each group to function as the primary winding thereof, electroresponsive devices, means for applying a source of alternating potential to any one of said conductors, and means responsive thereto for connecting said electroresponsive devices progressively to the secondary windings of said two groups of transformers whereby the current induced in the four secondary windings of the two transformers in consequence of the current passing through the identifying conductor which functions as the primary winding of said two transformers operates certain of said devices for indicating the numerical designation of the line identified by the conductor to which the potential was applied.

9. A transformer for an identification circuit according to claim 4 having a plurality of primary windings comprising as many insulated wires substantially parallel to each other, and two secondary windings magnetically coupled to all of said primary windings.

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