

Dec. 29, 1942.

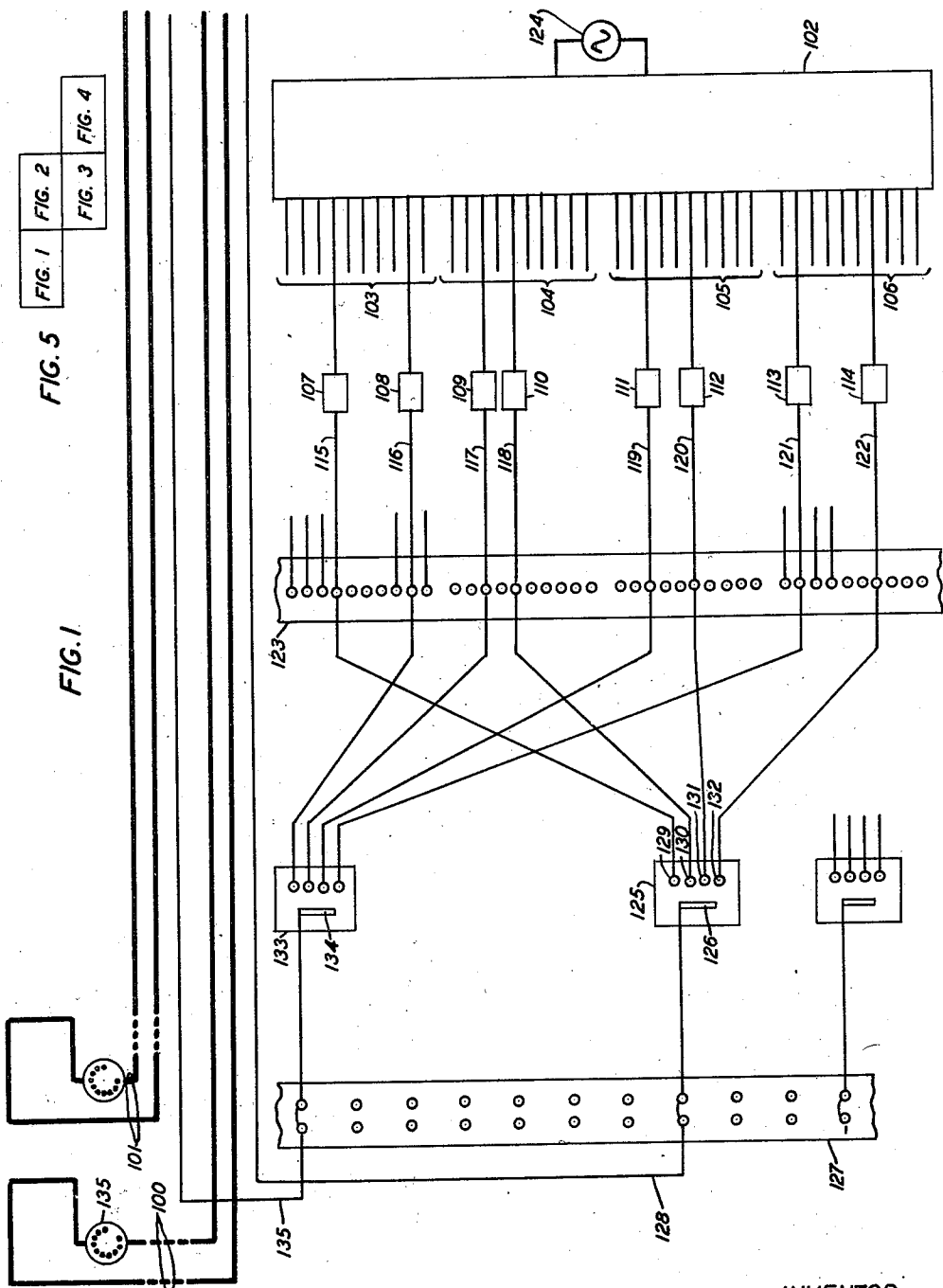
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2,306,729

SIGNALING SYSTEM

Filed June 20, 1941

4 Sheets-Sheet 1



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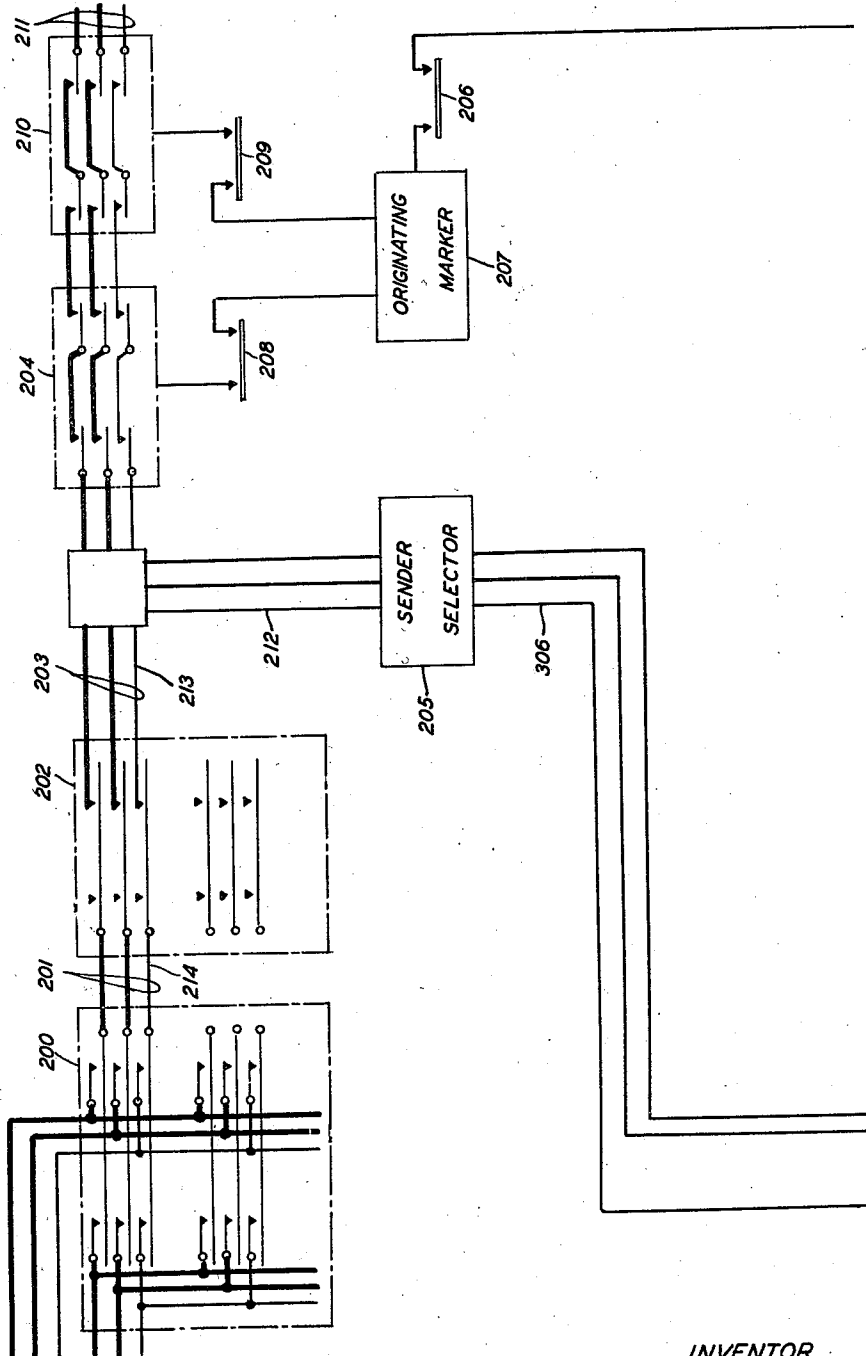
2,306,729

SIGNALING SYSTEM

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4 Sheets-Sheet 2

FIG. 2



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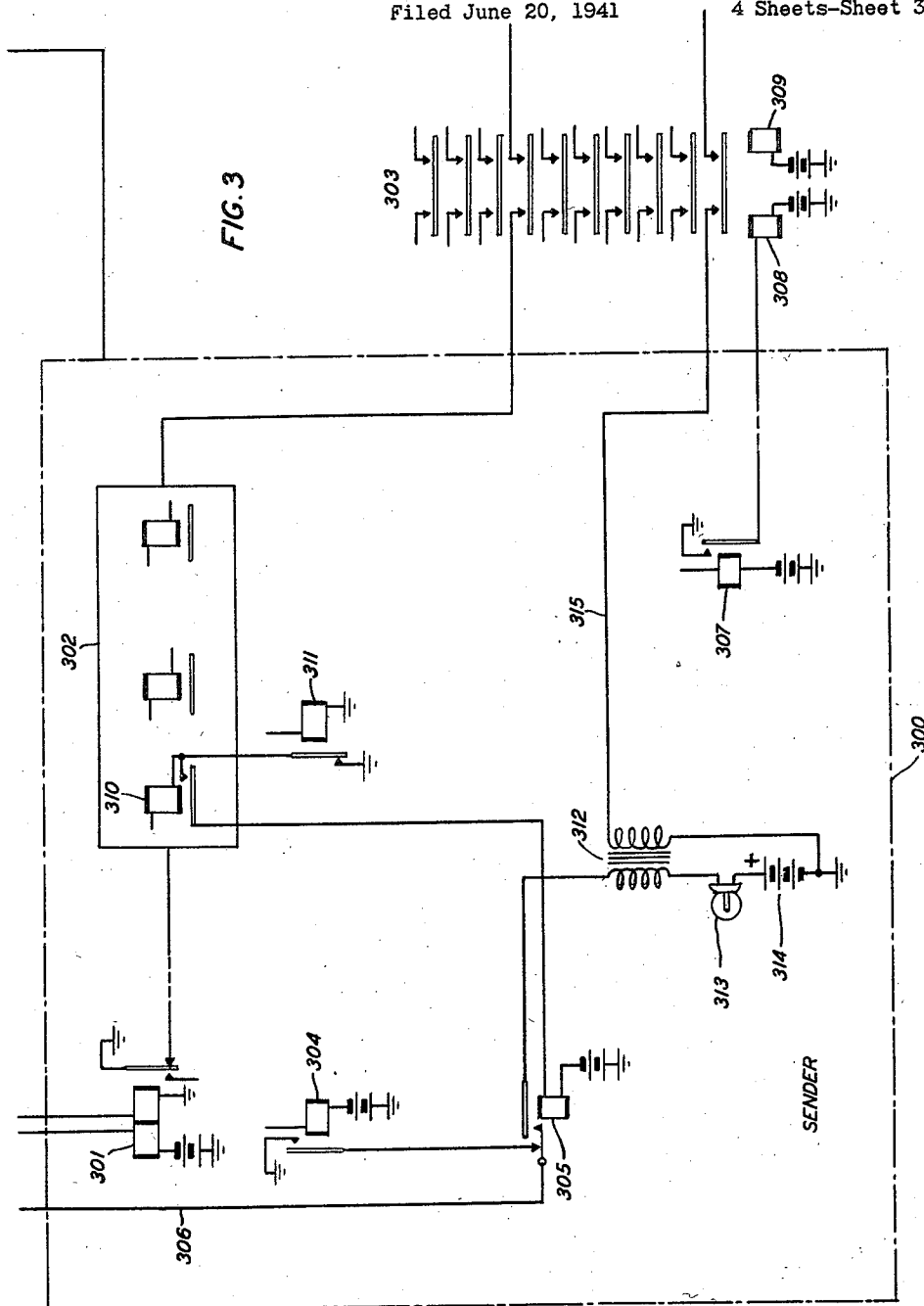
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SIGNALING SYSTEM

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4 Sheets-Sheet 3



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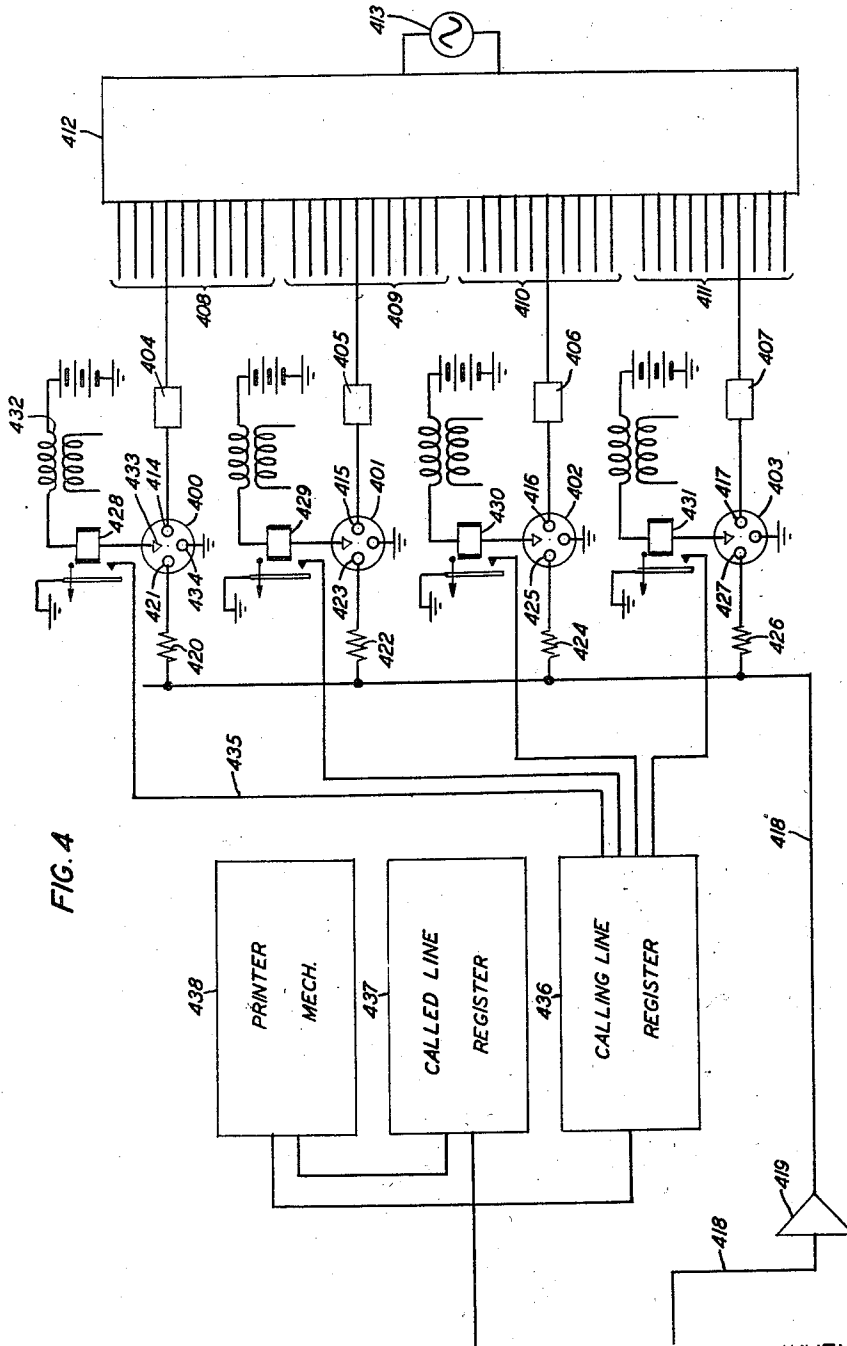
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SIGNALING SYSTEM

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4 Sheets-Sheet 4



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2,306,729

SIGNALING SYSTEM

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Application June 20, 1941, Serial No. 398,887

10 Claims. (Cl. 179-27)

This invention relates to signaling systems and particularly to systems in which a multiplicity of signals are transmitted over a single transmission line.

The objects of the invention are to facilitate the identification of lines or other circuits; to prevent the associated identifying equipment from causing electrical disturbances in said lines or other circuits; to effect the operative association of the identifying equipment with a desired line by means of space discharge tubes when the identification is to be performed; to isolate said equipment from the line at all other times; and to obtain other improvements and advantages in signaling systems of this character.

The foregoing objects are realized by means of a system in which a signal impulse transmitter, common to a plurality of subscribers' lines in a telephone office, is arranged to generate a multiplicity of impulses of a given polarity and of different phases. These impulses are applied to the sleeve conductor of the line to be identified through the multiple electrodes of a space discharge tube, said tube having a common electrode which is connected directly to the sleeve conductor of the line. If, for example, the line has a four-digit number, four multiple electrodes are provided in the discharge tube, and four impulse leads carrying impulses of different phases are connected to these multiple electrodes. Thus by providing each line with one of these discharge tubes and by connecting the phase impulse leads in different combinations of four to the multiple electrodes of the line tubes it is possible to deliver to the sleeve conductor and to each line a combination of four phase impulses which distinguishes that line from all other lines in the office. The impulses thus supplied to the sleeve conductor are transmitted through the switches involved in the connection to a receiving mechanism, which includes a plurality of discharge tubes having control electrodes to which the incoming impulses are applied. At the same time impulses of opposite polarity and of various phases are applied to the other control electrodes of these receiving discharge tubes. The particular tubes having impulses of like phase applied to their electrodes operate to register the designation of the subscriber's line involved in the connection. The registered designation may then be used to control the printing of a ticket to charge for the call being made or for any other purpose.

A feature of the invention is a system of this character in which a common register sender, serving to receive the digit impulses transmitted

from the calling subscriber's substation to characterize the called line, is provided with circuit controlling means for establishing the calling line identification circuit at some suitable time during the dialing operation. For instance, the sender may be designed to close the impulse identification circuit over the sleeve conductor through the operated switches to the electrode of the identification tube individual to the calling line as soon as the calling subscriber has transmitted the first digit of the called number. The closure of this circuit results in the ionization of the individual tube and the transmission therethrough from the multiplex impulse generator of a combination of four impulses of phases representing the calling line number. These impulses are transmitted through the common register sender to an identification mechanism where they are impressed upon the electrodes of receiving tubes, causing these tubes to operate in a combination representing the calling subscriber's line number.

One of the advantages of this invention is that the impulse generator, which is continuously producing impulses of a multiplicity of phases, is effectively isolated from the sleeve conductors of the subscribers' lines, except for the brief interval during which any particular line is undergoing identification. This isolation is accomplished by means of the individual space discharge tubes.

These and other features of the invention will be described more fully in the following specification.

In the drawings accompanying the specification:

Figs. 1 to 4, when arranged in the order shown in Fig. 5, illustrate a portion of an automatic telephone system incorporating the features of the present invention.

Fig. 1 shows the subscribers' lines entering the telephone office together with the impulse sending mechanism for sending impulses identifying these lines;

Fig. 2 shows the automatic switches for establishing connections. This figure also illustrates the sender selector and a switch-controlling marker;

Fig. 3 illustrates a portion of a central office register sender together with a connector for connecting the sender to the calling line identifying mechanism; and

Fig. 4 shows the calling line identifying mechanism.

The present invention is particularly useful in

systems in which tickets are prepared for the purpose of assessing the calling subscriber for each conversation held with other subscribers. Since these tickets are prepared automatically it is necessary to determine the number of the calling line in order that the charge be assessed against the proper party. However, the invention may be used in any type of system where it is desirable to determine automatically the identity of a line, trunk or other circuit. For example, it is often desirable to display the number of the calling party before the operator to whom the line has been extended, eliminating the necessity of the operator making an oral request or performing a number checking operation.

Referring particularly to the drawings, subscribers' lines 100 and 101 are shown appearing in primary line switch 200. The line switch 200 serves to extend a line when calling over a link circuit 201 and through to the secondary line switch 202 which serves to further extend the line over an idle trunk or junctor 203 to a first or district selector switch 204. In addition to being extended to a district selector 204, the calling line is also extended automatically by a sender selector switch 205 to an idle register sender 300. The register sender 300 receives the digit impulses transmitted from the calling subscriber's dial and registers the designation of the called line. After receiving this designation, the sender 300 associates itself through a connector 206 with an idle marker 207. The marker 207, after receiving the required information from the sender 300, connects itself, by means of frame connectors 208 and 209 with the district selector switch 204 and also with the next or office selector switch 210. The marker controls the district and office switches to extend the calling line to an idle trunk 211. Thereafter the connection is completed to the called subscriber's line, which may be located in the same or in a distant exchange.

Since the call extended over the trunk 211 may require the preparation of a toll ticket for the purpose of charging the calling subscriber, it is necessary to obtain the identity of the calling line without imposing any additional effort upon the calling subscriber. The number of the calling line is identified by transmitting signals over the connection from the subscriber's line to the register sender at some suitable time during the progress of the call. Preferably these identifying signals are transmitted during the dialing operation, at which time they are less likely to produce interference. The impulse transmitting mechanism for sending the identifying signals includes an impulse generator 102 which is designed to produce voltages of a multiplicity of phases and to apply these voltages to a corresponding number of output circuits. Although the number of output circuits from the generator 102 may be varied at will, forty of these output circuits are illustrated on the assumption that the subscribers' line numbers have four digital places. The first ten output circuits 103, on which voltages of the first ten phases appear, represent the ten different values of the thousands digit. Similarly, the second, third and fourth groups of ten output conductors 104, 105 and 106, on which voltages of the corresponding phases appear, represent respectively the different values of the hundreds, tens and units digits of the subscribers' line numbers.

Each of the forty output leads from the generator 102 appears in an impulse producing device, such as a space discharge tube. These im-

pulse devices, such as devices 107, 108, 109, 110, 111, 112, 113 and 114, respond to the voltages applied thereto from the generator 102 and produce in their output circuits 115, 116, 117, 118, 119 120, 121 and 122 momentary impulses of negative polarity. The forty impulse leads from these generating devices appear on the connecting frame 123. The phase generator 102 is energized from a suitable source of alternating current 124 of any desired frequency and produces voltages of the forty different phases for each cycle of the source 124. The generator 102 and the impulse devices 107, 108, etc., may be of any suitable type and design, such as those disclosed in the patents to W. H. T. Holden, No. 2,252,766, of August 10, 1941, and 2,235,815 of June 9, 1942, and the application of W. H. T. Holden, Serial No. 361,536, filed October 17, 1940.

Thus there appears on the forty terminals of the connecting frame 123 during each cycle of the source 124 impulses of forty successive phases, ten different phases for each of the forty digital places of any subscriber's number. These impulse supply leads are connected to the sleeve conductors of the subscribers' lines through the gaps of space discharge tubes and in combinations of four, one from each of the four groups, whereby the impulses of the four different phases that are applied to the sleeve conductor of each line characterize the designation of that line. To this end each subscriber's line is provided with an individual space discharge tube having four digit electrodes, representing the four digits of the line number, and a single common electrode. For example, subscriber's line 100 is provided with a discharge tube 125 having a common anode 126, which is connected through the cross-connecting rack 127 to the sleeve conductor 128 of line 101. The tube 125 is also provided with four cathodes 129, 130, 131 and 132 representing respectively the thousands, hundreds, tens and units digits of the number of line 100. These cathodes are connected by jumper wires to the terminals on the rack 123 corresponding to the four phases that represent the subscriber's line number. Assuming that the number of line 100 is "4567," the thousands electrode 129 is connected to the terminal corresponding to impulse lead 115 which carries impulses of phase No. 4 in the thousands group. Similarly electrodes 130, 131 and 132 are connected to terminals on the rack 123 corresponding to impulse leads 110, 120 and 122 which carry impulses respectively of phase No. 5 in the hundreds group, phase No. 6 in the tens group, and phase No. 7 in the units group.

Subscriber's line 101 is also provided with an individual discharge tube 133 having a common anode 134 connected to the sleeve conductor 135 of line 101. Tube 133 also has four digital electrodes which are connected through the rack 122 to the impulse leads on which appear the impulses of the four phases representing the number of line 101. An inspection of the connections between the digit electrodes of tube 133 and the rack 123 will show that the number of line 101 is "9332." Similarly, each of the other subscribers' lines in the office, of which there may be a total of ten thousand lines, is provided with one of these space discharge tubes, and all of these tubes are wired through rack 123 to the appropriate impulse leads.

The central office register sender 300 is equipped with an impulse receiving relay 301, which responds to the calling subscriber's dial, and

with the usual code and numerical registers 302 on which the office code designation and the number of the called line are registered as a result of the dialing operation. The sender is also provided with the usual control equipment whereby it cooperates with the originating marker 207 to cause the operation of the district and office switches 204 and 210 to select an outgoing trunk 211 together with the appropriate impulse sending mechanisms for transferring the numerical designation and any other necessary information to controlling mechanisms beyond. The sender 300 also serves to receive the calling line identification signals and to transfer them to the identification mechanism disclosed in Fig. 4 of the drawings. To this end a connector 303 is provided whereby the sender 300 at the proper time seizes an idle one of the identifying mechanisms, in case more than one of these mechanisms is provided.

The line identifying mechanism of Fig. 4, which is seized by the sender 300 when the time arrives for identifying the calling line, includes a series of forty discharge tubes 400, 401, 402, 403, etc. These receiving identifying tubes respond to the impulses transmitted from the sending equipment in Fig. 1 associated with the calling subscriber's line; they also respond to impulses of varying phases produced locally in the receiving equipment. These local impulses are generated by a series of forty impulse generating devices 404, 405, 406, 407, etc. The alternating currents of the forty different phases for energizing the impulse devices 404, 405, 406, 407, etc., are supplied by the four groups of supply circuits 408, 409, 410 and 411, and these four groups of circuits are supplied with voltages of forty different phases by the generator 412. The forty different phases produced in the supply groups 408, 409, 410 and 411 are the same as those produced in the groups 103, 104, 105 and 106 at the transmitting end, and the source 413 is of the same frequency as the source 124. If desirable a single source of alternating current may be used to energize the generators 102 and 412. The impulse generating tubes 404, 405, 406, 407, etc., are of the same type as tubes 107, 108, 109, etc., except that they are designed to produce momentary impulses of positive polarity. The output circuits of the ten impulse generating tubes 404, etc., pertaining to the thousands group 408 are connected respectively to electrodes of ten receiving tubes 400. Similarly the output circuits of the impulse generating tubes of the remaining three groups are connected respectively to the electrodes of the corresponding three groups of ten receiving tubes 401, 402 and 403. For example, the output circuit of the generating tube 404 is connected to the control electrode 414 of the tube 400 in the thousands group, the output circuit of tube 405 is connected to the control electrode 415 of tube 401 in the hundreds group, and the output circuits of generating tubes 406 and 407 are connected respectively to the control electrodes 416 and 417 of tubes 402 and 403 of the tens and units groups.

The signal conductor 418, over which the identifying signals are transmitted from the sender 300, includes an amplifier 419, if desirable, for amplifying these signals. This signaling conductor 418 after leaving the amplifier 419 is connected in multiple to the control electrodes of all forty of the receiving tubes 400, 401, 402, 403, etc. For instance the conductor 418 is connected through resistor 420 to the control elec-

trode 421 of the tube 400 in the thousands group, through the resistor 422 to the control electrode 423 of the tube 401 in the hundreds group, through the resistor 424 to the control electrode 425 of the tube 402 in the tens group and through resistor 426 to the control electrode 427 of the tube 403 in the units group. Thus all of the identifying signals incoming over the signaling conductor 418 are applied simultaneously to all of the receiving tubes. Since the voltages produced in the forty supply circuits 408, 409, 410 and 411 are in phase with the corresponding voltages produced in the forty supply circuits 103, 104, 105 and 106 at the sending end, the forty successive impulses applied to the electrodes of tubes 400, 401, 402, 403, etc., are in phase respectively with the forty impulses produced in the impulse circuits of generating tubes 107, 108, 109, etc., at the sending end for each cycle of the alternating voltage. It follows, therefore, that if any particular combination of four generating tubes 107, 108, 109, 110, etc., are connected to the sleeve conductor of the line and this sleeve conductor is extended through the sender 300 to the signaling conductor 418 associated with the forty receiving or indicating tubes 400, 401, 402, etc., the corresponding four receiving tubes will have impulses applied simultaneously to their control electrodes. Since the impulses transmitted over the signaling conductor 418 are negative in polarity and the impulses produced by the generating tubes 404, 405, 406, etc., are positive in polarity, the simultaneous application of a positive and a negative impulse to the control electrodes of a receiving tube 400 produces sufficient voltage across these electrodes to ionize the tube. Hence the four receiving tubes which correspond to the four generating tubes connected to the sleeve conductor through the medium of one of the individual line tubes 125 are ionized and cause the operation of their associated indicating relays 428, 429, 430 and 431 to identify the digital characters of the subscriber's line.

The anode circuits of the receiving tubes 400, 401, etc., include transformer windings which serve to impress alternating voltages upon the anode circuits for the purpose of quenching the tubes after they have performed their functions. For example, the anode circuit of the tube 400 may be traced from positive pole of battery through the winding of transformer 432, winding of relay 428, anode 433, cathode 434 to ground. For a more complete description of the manner in which these receiving tubes are operated and released, reference is made to the above-noted patent to W. H. T. Holden No. 2,252,766.

To further describe the detailed operation of the indicating system disclosed herein, it will be assumed that the subscriber of line 100 wishes to make a call requiring the preparation of a ticket indicating the charges assessed against the subscriber for the conversation. The call is initiated in the usual manner, and the line switches 200 and 202 operate to extend the calling line to the idle trunk 203. Also the sender selector switch 205 operates automatically to extend the calling line by way of trunk 203 to an idle register sender 300. When the sender is seized by the sender selector 205, a circuit is completed through the windings of the impulse relay 301 thence over the tip and ring conductors through the sender selector 205 through the line switches 202 and 200 to the subscriber's line 100. Also the control relay 304 operates and closes a circuit

from ground through its front contacts, normal contacts of relay 305, conductor 306 through the sender selector 205, conductor 212 thence to the sleeve conductor 213 of the trunk 203 through the contacts of switch 202, sleeve conductor 214 of link 201, contacts of switch 200 to the sleeve conductor 128 of the subscriber's line 100. The application of ground potential to the sleeve conductor serves to hold the connection under the control of the register sender 300.

Dial tone is transmitted to the calling subscriber in the well-known manner, and he proceeds to manipulate his dial 135 to transmit series of impulses representing the office code and numerical designations of the wanted subscriber's line. The impulse relay 301 responds to these impulses and operates the registers 302 of the sender to register the successive digits of the designation.

After the sender has received a number of the digits it seizes an idle marker 207 through a marker-conductor 206, and the office code designation is transferred to the marker. Thereafter the marker proceeds to test the trunks of the desired group, to select an idle trunk 211 therein, and to associate itself through frame connectors 208 and 209 with district and office switches 204 and 210 for the purpose of operating these switches to extend the trunk 203 to the chosen idle trunk 211.

At some convenient time following the seizure of the sender 300 the control relay 307 is operated to close a circuit for operating the connector magnet 309. Magnet 309 is also operated thus completing the connection from the sender 300 to the identification mechanism shown in Fig. 4.

It will be noted that a connection has been completed from the sleeve conductor 128 of the subscriber's line 100 through to the register sender 300. However, this sleeve circuit is completely isolated from the impulse generator 102 by means of the space discharge tube 125, which is in a de-ionized condition. Thus, although voltage impulses are constantly being applied to the digit conductors 129, 130, 131 and 132, they are not transmitted over the sleeve circuit to the sender since the voltage of these impulses is not sufficient to cause the ionization of the gap between these digit electrodes and the common anode 126. Accordingly no impulses are transmitted to identify the calling line until the subscriber has completed the dialing of the first digit. At that time relay 310 associated with the first register operates, and a circuit is closed from battery through the winding of relay 305, contacts of relay 310, normal contacts of relay 311 to ground. Relay 305 operates and modifies the sleeve signaling circuit so that it now leads through the front contacts of relay 306, primary winding of transformer 312, resistance lamp 313 to the positive pole of battery 314. The positive potential of the battery 314 on the sleeve conductor serves to continue the holding condition of the switches 200 and 203 and for the sender selector switch 205. Furthermore, the potential of battery 314 is applied to the anode 126 of the tube 125. Therefore, each time thereafter that a negative impulse is applied to the electrodes 129, 130, 131 and 132, the tube 125 ionizes, and these impulses are transmitted over the sleeve signaling circuit through the primary winding of the transformer 312. Accordingly impulses of the same phase and direction are induced in the secondary winding of the transformer 312 and are transmitted over conductor 315 through connector 303, conductor

413 and in multiple to the control electrodes of all forty tubes 400, 401, etc. Since the impulses transmitted over this signaling circuit from the digit electrode 129 of the tube 125 are of the No. 4 phase, they are impressed simultaneously on the tube 400 with impulses of like phase from the impulse generating tube 404. Accordingly the single tube 400 ionizes, and current flows in the main anode-cathode discharge circuit causing the operation of the slow-release relay 423. Relay 423 applies ground potential to conductor 435 to cause the operation of the register 436 to register the thousands digit 4. Since the impulses transmitted over the signaling circuit from the hundreds digit electrode 130 are of phase No. 6 in the hundreds group, these impulses are impressed simultaneously upon the single tube 401 with impulses of the same phase from the generating device 405. Accordingly tube 401 operates to the exclusion of all other tubes in response to these impulses, and relay 429 is energized to cause the registration of the hundreds digit 5 in the register 436. In like manner the impulses transmitted from the electrodes 131 and 132, of phases No. 6 and No. 7 of the tens and units groups, respectively, cause the operation of tubes 402 and 403. The operation of these tubes results in the energization of relays 430 and 431, which cause the registration respectively of the tens and units digits 6 and 7 in the register 436.

After the called subscriber's line has been fully registered in the register 302 of the sender 300, this registration is transferred through the connector 303 to a called line register 437 in the mechanism of Fig. 4. Also at some suitable time the control relay 311 is operated to release relay 305, thus disconnecting the sleeve signaling circuit from the transformer 312 and restoring it to the ground connection at the front contact of relay 304. The disconnection of the battery 314 from the sleeve conductor 128 causes the tube 125 to cease discharging in response to the impulses from the impulse generator 104. Thus the generator is again completely isolated from the conductors of the calling subscriber's line, and no interference can take place with conversation on this line or with conversations occurring on adjacent lines.

At the proper time in the progress of the connection being established the marker 207 and the sender 300 are released, and the connection is held in the usual manner under the control of the subscriber's station.

The designations of the calling and called lines are now registered on the registers 436 and 437. These registrations may now be used to control the operation of a printing mechanism 438 to print a ticket for charging the call against the calling subscriber. If desirable, the printer mechanism may also be controlled in the well-known manner to measure the time during which conversation is ensuing to assess the charge on the basis of the duration of the call as well as its destination.

Although the invention has been illustrated as applied to an automatic system in which the numbers of the subscribers' lines are identified for the purpose of preparing message tickets, it will be understood that it may also be used for identifying the numbers of lines at operators' positions or for other purposes.

The automatic switches illustrated herein are assumed to be switches of the crossbar type although it is obvious that any type of switch may be used for extending the subscribers' lines. For

a full understanding of the operation of the system in which crossbar switches are employed together with register senders and switch-controlling markers, reference may be made to the patent to Carpenter, No. 2,235,803 of March 18, 1941.

What is claimed is:

1. In a signaling system, a plurality of lines each of which has an identifying designation, means for generating a multiplicity of signal impulses of different characters, connecting means including space discharge devices between said generating means and said lines for applying to each line a plurality of said signal impulses in a combination of characters representing the line designation, a circuit for transmitting the impulses pertaining to a particular one of said lines, and means for receiving and utilizing the transmitted impulses to identify said particular line.
2. In a signaling system, a plurality of lines each of which has an identifying designation, each line having a signal transmitting conductor, a plurality of multielectrode discharge tubes, one for each line, each of said tubes having one of its electrodes connected to the transmitting conductor of the associated line, means for generating signal impulses of a multiplicity of different phases, connecting means for applying to a plurality of the electrodes of any one of said tubes impulses from said generator in a combination of phases representing the designation of the associated line, said impulses causing the discharge of said tube and the transmission of signals over the transmitting conductor of said line, and means for receiving and utilizing the transmitted signals to identify said line.
3. In a signaling system, a plurality of lines, each line having a signal transmitting conductor, a plurality of multielectrode discharge tubes, one for each line, each of said tubes having one of its electrodes connected to the transmitting conductor of the associated line, means for extending a connection including a particular one of said lines and for establishing a signaling circuit including the signal transmitting conductor of said line, means for generating signal impulses of a multiplicity of different phases, connecting means for impressing a combination of said phase impulses representing the designation of said particular line upon the electrodes of the tube associated with said line to cause the discharge of said tube and the transmission of corresponding signals over said signaling circuit, and means for receiving and utilizing the signals transmitted over said circuit to identify the designation of said particular line.
4. In a signaling system, lines each having a different designation, each of said lines having a signal transmitting conductor, a plurality of discharge tubes, one for each line, each tube having a plurality of digit electrodes representing respectively the digital places of the line designation and also having a common electrode connected to the transmitting conductor of the associated line, means for generating a multiplicity of impulses of different characters, connecting means for applying impulses of a combination of characters representing the designation of a particular line to the digit electrodes of the associated discharge tube, said impulses causing the discharge of said tube and the transmission of signals over the transmitting conductor of said line, and means for receiving and utilizing the transmitted signals to identify the designation of said line.
5. In a signaling system, lines each having a different designation, each of said lines having a signal transmitting conductor, a plurality of discharge tubes, one for each line, each tube having a plurality of digit electrodes representing respectively the digital places of the line designation and also having a common electrode connected to the transmitting conductor of the associated line, means for generating impulses of a multiplicity of different phases, circuit connections between said generating means and said tubes for impressing upon the digit electrodes of each tube impulses in a combination of phases selected to represent the designation of the associated line, means for altering the potential of the common electrode of the tube associated with any particular line to cause the discharge of said tube and the transmission over the transmitting conductor of said line of signal impulses of the corresponding phases, and means for receiving the transmitted impulses and for utilizing them to identify the designation of said particular line.
6. In a signaling system, a plurality of lines each having an identifying designation, each line having a signal transmitting conductor, automatic switches, a common register sender responsive to impulses transmitted over any one of said lines for controlling the operation of said switches to establish a connection, means for extending a particular one of said lines to said register sender, discharge tubes, one for each of said lines, each of said tubes having as many digit electrodes as there are digital places in the designation of the associated line and having a common electrode connected to the transmitting conductor of the associated line, generating means for producing impulses of a multiplicity of different phases, connecting means between said generating means and said tubes for applying to the digit electrodes of each tube impulses in a combination of phases characterizing the designation of the associated line, means in the register sender for closing a signaling circuit including the signal transmitting conductor of said particular line, the closure of said circuit causing the discharge of the associated tube and the transmission over said signaling circuit of impulses of corresponding phases, and means responsive to the impulses transmitted over said signaling circuit for identifying the designation of said particular line.
7. In a signaling system, a plurality of lines each of which has an identifying designation, each line having a signal transmitting conductor, a plurality of multielectrode discharge tubes, each of said tubes having one of its electrodes connected to the transmitting conductor of one of said lines, means for generating signal impulses of a multiplicity of different phases, connecting means for applying to a plurality of the electrodes of any one of said tubes impulses from said generator in a combination of phases representing the designation of the associated line, said impulses causing the discharge of said tube and the transmission of signals over the transmitting conductor of said line, and a receiving mechanism comprising a plurality of discharge tubes selectively responsive to said transmitted signals for identifying the designation of said line.
8. In a signaling system, a plurality of lines each of which has an identifying designation, each line having a signal transmitting conductor, a plurality of multielectrode discharge tubes, one for each line, each of said tubes having one

of its electrodes connected to the transmitting conductor of the associated line, means for generating signal impulses of a multiplicity of different phases, connecting means for applying to a plurality of the electrodes of any one of said tubes impulses from said generator in a combination of phases representing the designation of the associated line, said impulses causing the discharge of said tube and the transmission of signals over the transmitting conductor of said line, a receiving mechanism comprising a plurality of discharge tubes, a second impulse generating means for generating impulses of different phases and applying them to the electrodes of said receiving tubes, and means for applying to the electrodes of said receiving tubes the impulses transmitted over the transmitting conductor of said line to selectively operate said receiving tubes.

9. In a signaling system, a plurality of lines each having an identifying designation, an impulse transmitter at the substation of each of said lines, each line having a signal transmitting conductor, automatic switches, a common register sender responsive to impulses transmitted by the substation transmitter of any of said lines for controlling the operation of said switches to establish a connection, means for extending a particular one of said lines to said register sender, discharge tubes, one for each of said lines, each of said tubes having as many digit electrodes as there are digital places in the designation of the associated line and having a common electrode connected to the transmitting conductor of the associated line, generating means for producing impulses of a multiplicity of different phases, connecting means between said generating means and said tubes for applying to the digit electrodes of each tube impulses in a combination of phases characterizing the designation of the associated line, means in the register sender responsive to the impulses transmitted from the substation transmitter of said particular line for closing a signaling circuit

including the signal transmitting conductor of said particular line, the closure of said circuit causing the discharge of the associated tube and the transmission over said signaling circuit of impulses of corresponding phases, and means responsive to the impulses transmitted over said signaling circuit for identifying the designation of said particular line.

10. The combination with a plurality of lines each having an identifying designation of an impulse transmitter for each of said lines, each line having a signal transmitting conductor, automatic switches, a common register sender responsive to successive series of impulses sent over any calling one of said lines by the impulse transmitter thereof to register the designation of a desired line, said sender serving to control the operation of said automatic switches in accordance with the registered designation to establish the desired connection, means for extending the calling one of said lines to said register sender, discharge tubes, one for each of said lines, each of said tubes having as many digit electrodes as there are digital places in the designation of the associated line and having a common electrode connected to the transmitting conductor of the associated line, generating means for producing impulses of a multiplicity of different phases, connecting means for applying to the digit electrodes of each tube impulses in a combination of phases characterizing the designation of the associated line, means in said register sender responsive to any particular one of the series of impulses transmitted thereto over said calling line for closing a signaling circuit including the signal transmitting conductor of said calling line, the closure of said circuit causing the discharge of the associated tube and the transmission over said signaling circuit of impulses of corresponding phases, and means responsive to the impulses transmitted over said signaling circuit for identifying the designation of said calling line.

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