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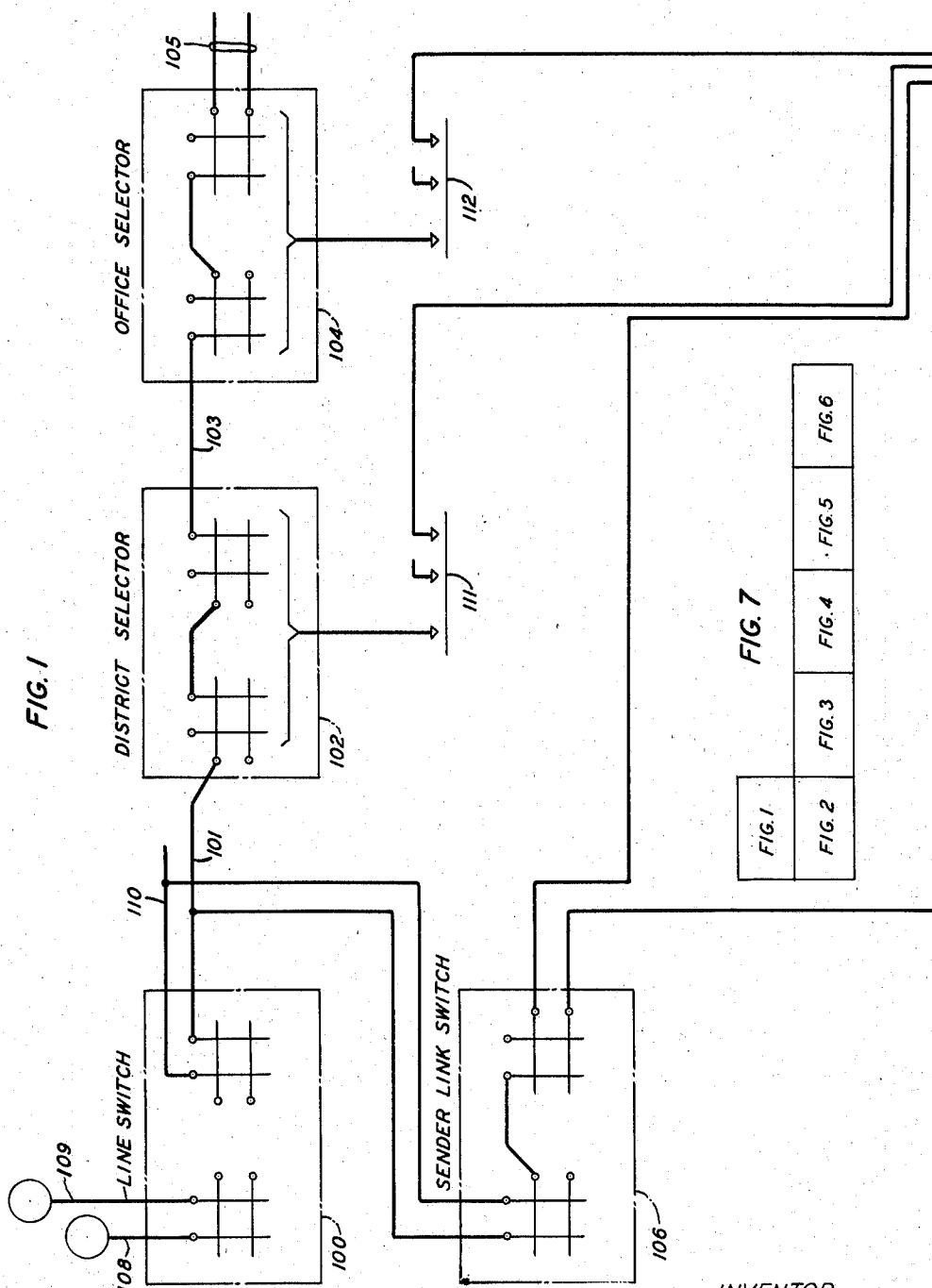
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2,299,897

SIGNALING SYSTEM

Filed April 26, 1941

6 Sheets-Sheet 1



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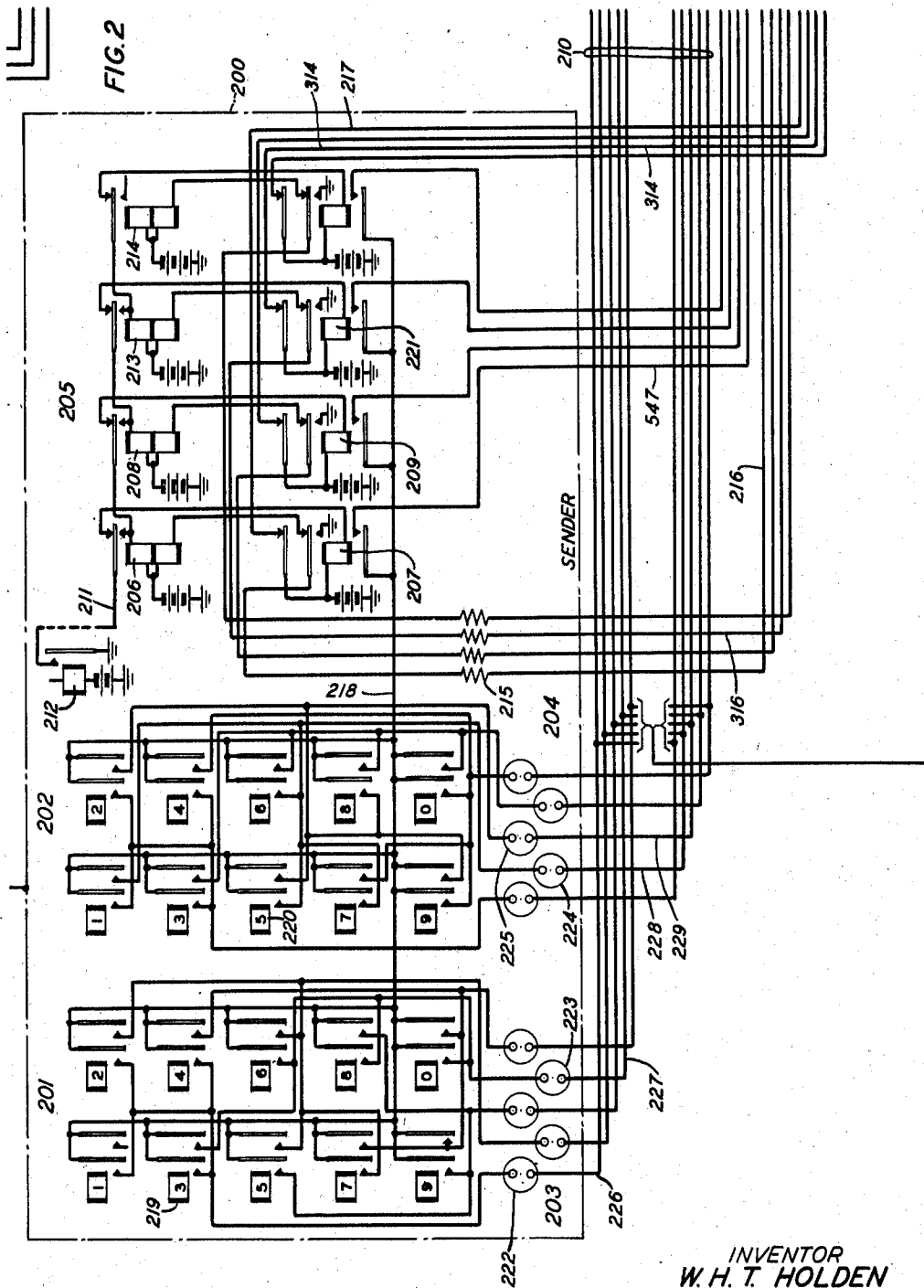
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SIGNALING SYSTEM

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6 Sheets-Sheet 2



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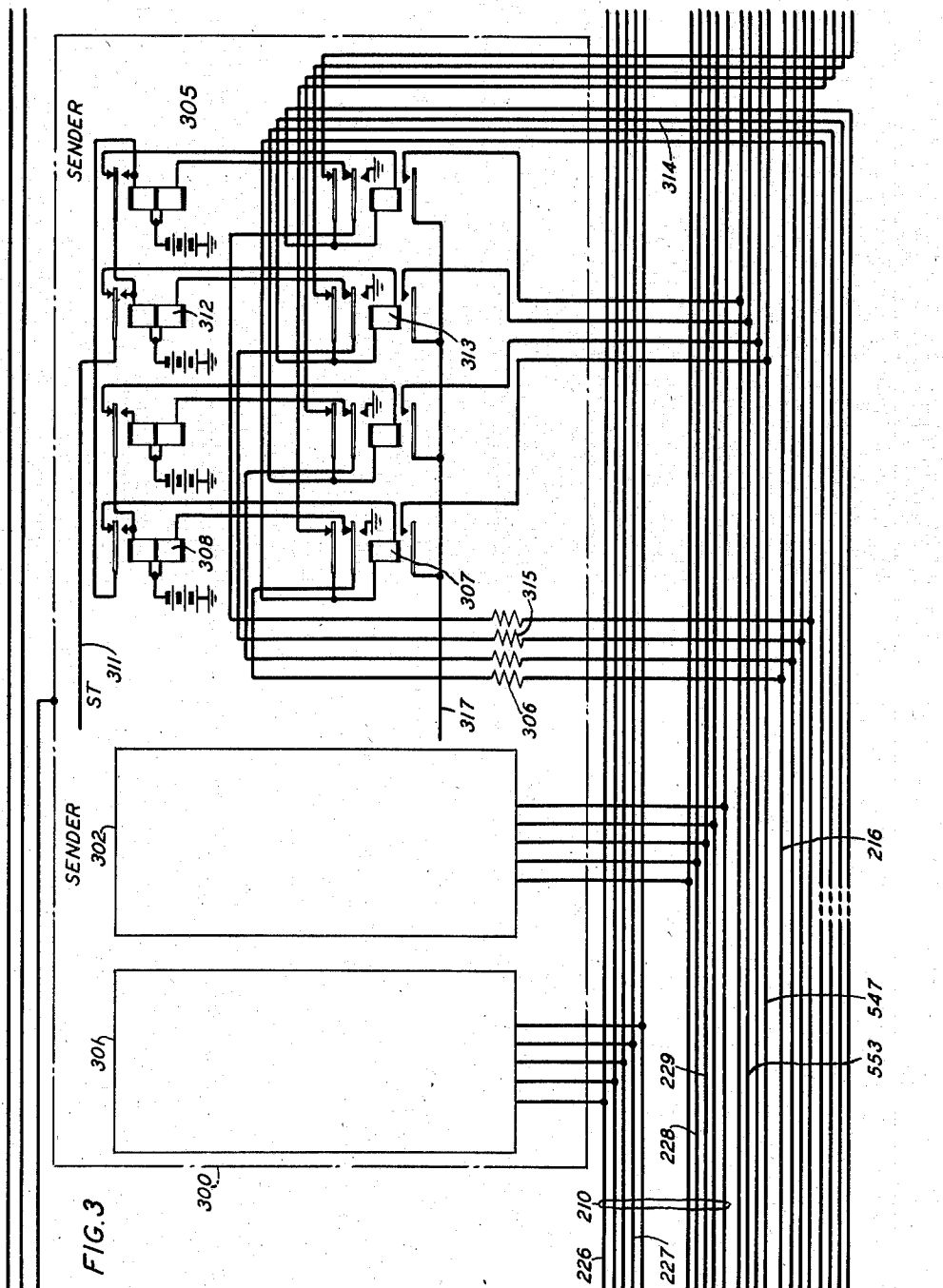
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SIGNALING SYSTEM

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6 Sheets-Sheet 3



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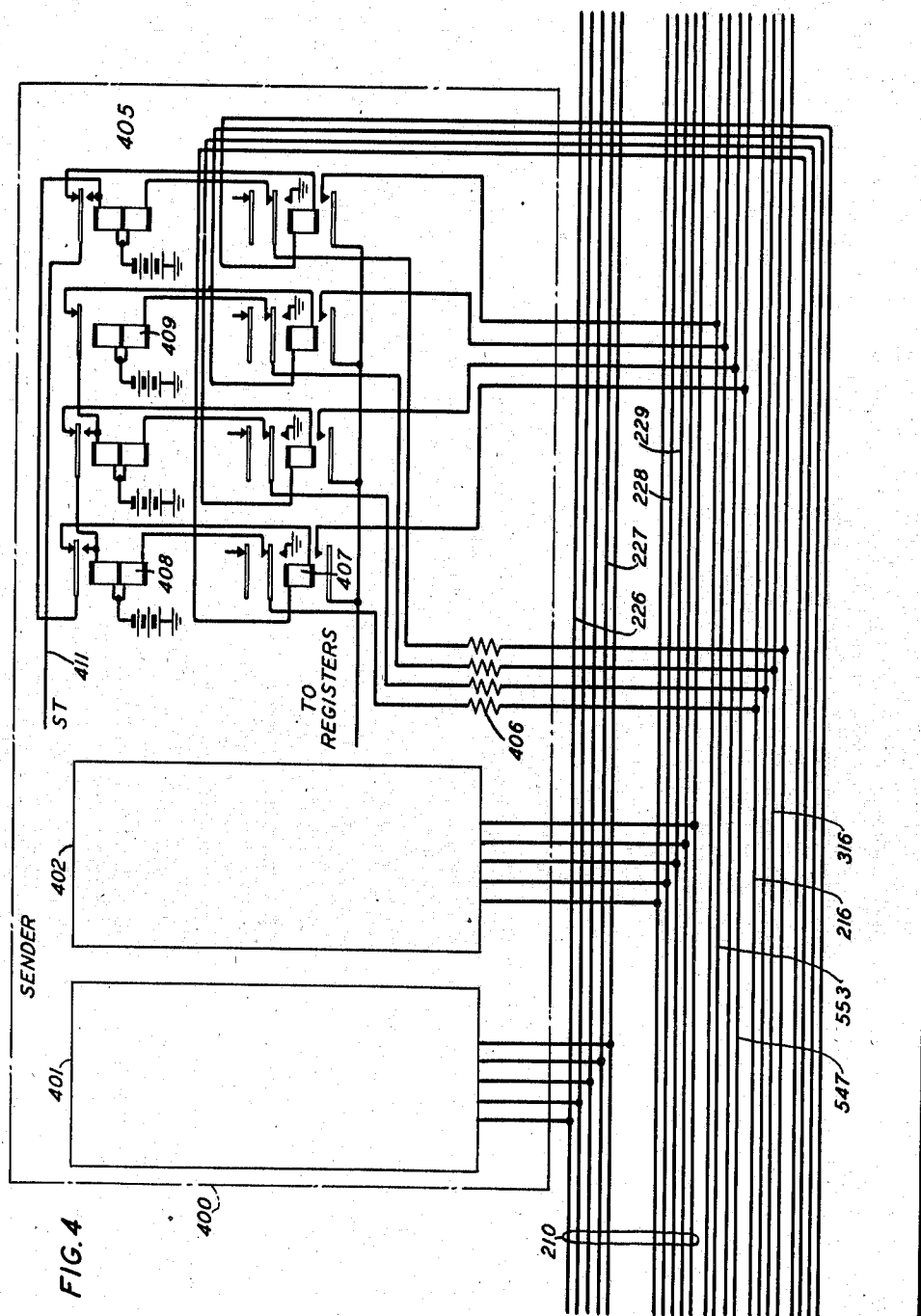
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SIGNALING SYSTEM

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6 Sheets-Sheet 4



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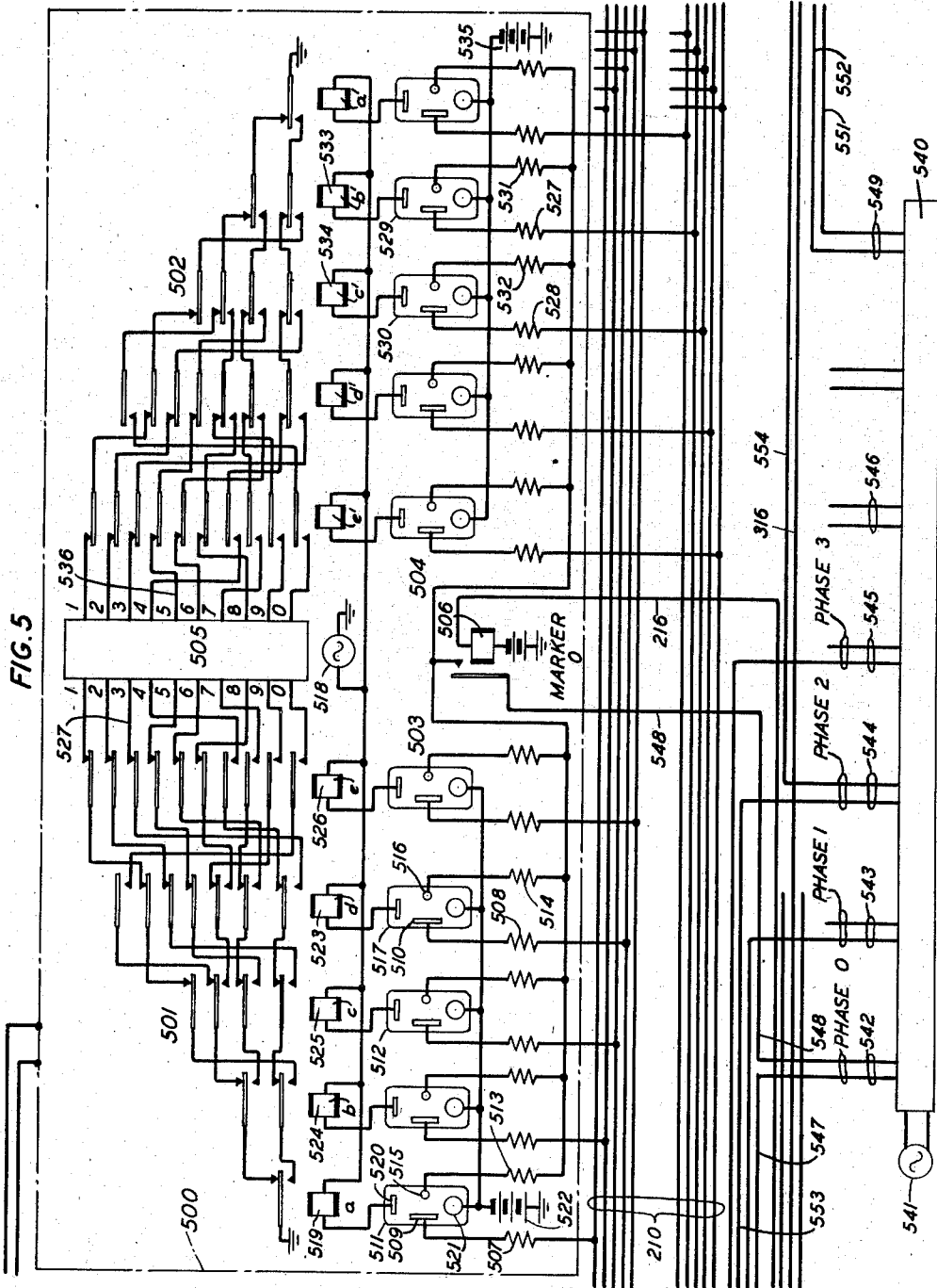
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SIGNALING SYSTEM

Filed April 26, 1941

6 Sheets-Sheet 5



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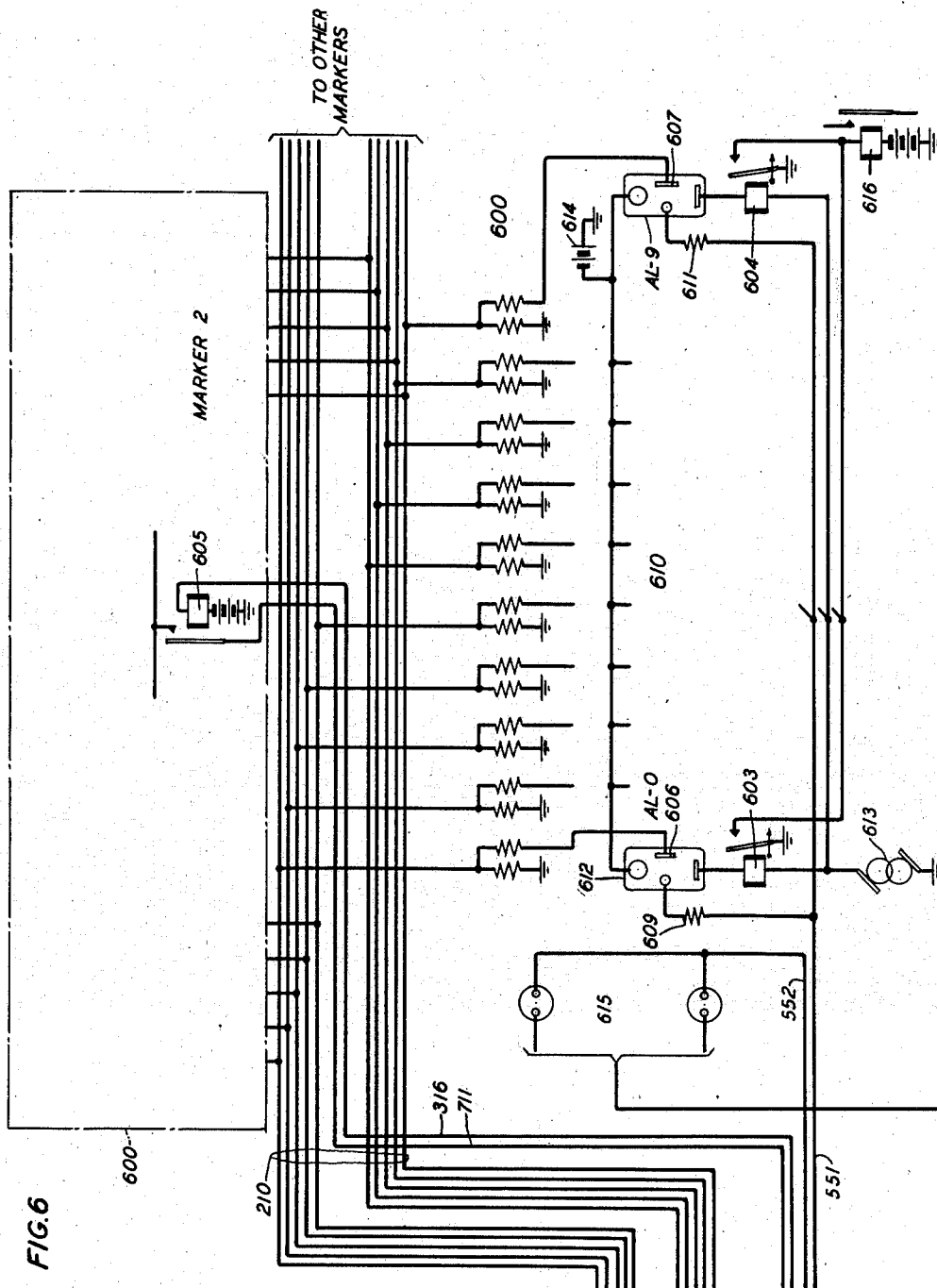
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SIGNALING SYSTEM

Filed April 26, 1941

6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

2,299,897

SIGNALING SYSTEM

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Application April 26, 1941, Serial No. 390,456

9 Claims. (Cl. 179-18)

This invention relates to electric signaling and particularly when used in automatic telephone or other communication systems.

The objects of the invention are to simplify the transfer of signal information from one part of a signal system to another; to eliminate much of the connecting equipment heretofore used for establishing the signaling circuits; to utilize the same transmitting paths for sending a plurality of sets of signals simultaneously; to increase the speed of transmitting signal information; and in other respects to improve signaling systems.

It has been the practice heretofore in automatic telephone systems to provide connectors for establishing individual connections between the mechanisms of one group, such as senders, and the mechanisms of a second group, such as switch controlling markers. By providing these connecting devices it is possible to establish a plurality of electrically separate simultaneous connections between a number of senders and a corresponding number of markers. These connectors, however, are expensive since they involve a large amount of equipment, particularly if the sender and marker groups are large. If multi-contact relays are employed for establishing the connections, it is usually necessary to provide a relay for each sender in the sender group and one for each marker in the marker group. Similar connecting devices are also required in other parts of an automatic telephone system. For example, in a system of the crossbar type these connectors are used to establish controlling circuit connections between the switch frames and the common controlling mechanisms or markers.

In accordance with the present invention substantial savings and other advantages may be realized over these prior systems by eliminating to a large extent the connecting equipment between the different controlling mechanisms and by establishing these connections on a permanent basis. More specifically the foregoing objects of the invention are realized by means of a signaling system in which the individual mechanisms of a group, such as a sender group in an automatic telephone exchange, are connected permanently to all of the individual controlling mechanisms of a second group, such as the group of switch controlling markers, and in which a system of multiplex signaling is employed for transmitting information concurrently from any number of senders in said group to the corresponding markers which have been selected to serve the respective senders. By means of a relatively simple selecting circuit arrangement each calling sender seizes

for its use an idle one of said markers. The signal information is transferred from the sender to the marker by means of impulses, each of the markers being served by the impulses of a particular phase. When, therefore, a marker is seized by a calling sender, impulses of the corresponding phase are transmitted from the sender over the common connecting medium between all senders and markers and are received and recognized only by the associated markers. Therefore, several signaling channels may exist concurrently between senders and markers, and the information pertaining to each sender and its associated marker is transmitted over the common connecting medium without interference with other channels.

Another feature of the invention is a system in which the common signaling medium between the group of senders and the group of markers is constantly undergoing a test to determine whether it is in proper condition for the transmission of signals between the senders and the markers.

The foregoing and other features of the invention will be discussed more fully in detail in the following specification.

In the drawings accompanying the specification:

Figs. 1 to 6, when arranged as illustrated in Fig. 7, disclose an automatic telephone system incorporating the features of the invention;

Fig. 1 illustrates in diagrammatic manner the line switch and certain of the selector switches of an automatic telephone exchange and also a sender link switch for associating the calling lines with idle common register senders;

Fig. 2 shows a portion of one of the common register senders;

Figs. 3 and 4 illustrate two more of the common register senders;

Fig. 5 illustrates a portion of one of the common switch controlling markers. This figure also shows a common impulse generator for supplying impulses to transfer the designations from the senders to the markers; and

Fig. 6 illustrates a second one of the common markers and also discloses alarm equipment common to all of the senders and markers.

The present invention in its broader aspects relates to the transfer of signal information over a common medium between the senders or other devices of one group and receivers or other devices of a second group, and it should be understood that said invention is not limited in its application to telephone systems or to systems of

any other particular type. It is, however, especially useful in automatic telephone systems where registered designations and other kinds of information must be transferred from one part of the system to another during the controlling operations incident to the establishment of the desired connections. Therefore, the invention has been illustrated herein when applied to the common register senders and the common switch controlling markers of an automatic telephone exchange system of the well-known crossbar type. For a better understanding of the various operations involved in these systems and of the details of the equipment used, reference may be had to numerous patents, including the patents to W. W. Carpenter No. 2,093,117, September 14, 1937, and No. 2,235,803, March 18, 1941.

Referring to the drawings, the subscribers' lines appear in the crossbar line switches 100 and through these switches have access over trunks 101 to the district selector switches 102. The district selectors have access over trunks 103 to office selector switches 104, and these in turn have access to the groups of outgoing trunks 105. The calling lines also have access through sender link or selector switches 106 to the common register senders which receive and store the telephone designations.

Three of these senders 200, 300 and 400 are illustrated in the drawing, and as many more would be provided as are needed to handle the traffic through the office. The senders are seized at random in response to calling lines, and receive and register the designations transmitted from the calling substations. Thereafter the senders transfer these registered designations to the common switch controlling markers, which in turn make use of the designations received from the senders to determine and control the selective operation of the automatic switches. Two of the common switch controlling markers 500 and 600 are shown in the drawings, and as many more may be provided as are needed.

In the systems of the prior art, as hereinbefore mentioned, connecting devices are required for selectively connecting a calling sender with an idle one of the common markers. If, for example, four or five senders are in use concurrently, each serving a calling line, these connecting devices serve to establish individual and separate connections between each of the calling senders and each of the associated markers. In this way the designation information may be transmitted at the same time from as many of the senders as there are markers to the corresponding markers, and no interference results because the connections are separate from each other. In the present system, however, these intermediate connecting devices between senders and markers have been eliminated, and a common transmitting medium comprising the conductors 210 is connected permanently and in multiple between all of the senders 200, 300, 400, etc., and all of the common markers 500, 600, etc. As above mentioned, and as will be explained more fully hereinafter, the signal information for a plurality of senders, which may be taken for concurrent use, is transmitted over the common medium 210 to the respective markers without mutual interference by the use of impulse signals having different phases or time periods.

Each of the register senders includes registers for the office and numerical portions of the telephone designations, means for transmitting the

office registration over the common medium to the associated marker, the usual means for transmitting the numerical designations to distant senders, together with controlling relays and circuits. Two office code registers 201 and 202 have been shown in full in the sender 200, the assumption being that the office part of the designation consists of two letters or other characters. Two groups of transmitting tubes 203 and 204, associated with the registers 201 and 202, respectively, serve to transmit the office registration over the conductors of the common medium 210 to the associated marker. These tubes are of any suitable type, such as those having two electrodes and envelopes filled with some inert gas. The purpose of these tubes is to prevent the formation of sneak circuits resulting in interference between the senders and markers. Since the senders and markers are all multiplied to the common set of conductors 210 it would be possible, with two senders having the same registration and concurrently associated with the respective markers, to trace a circuit through the contacts of the operated register relays in both senders through the corresponding register tubes of both markers in series with the impulse circuits of the two phases representing said markers. In this case both phases would be effective in operating the register tubes in both markers. To prevent this interference the transmitting tubes 203 and 204 are inserted in the transmission leads associated with the register relays of each sender. Although the circuit above mentioned still exists it includes two of these transmitting tubes in series, whereas the voltage applied is sufficient to operate only one tube. Therefore, in any phase position the transmitting tube of the corresponding sender and marker is operated to effect the transmission of the registration between that sender and marker without interference with other senders and markers that may be in use concurrently.

In a similar manner the remaining senders 300, 400, etc., are equipped with office code registers and transmitting tubes. These registers and tubes 301, 302 in sender 300 and 401, 402 in sender 400 are illustrated diagrammatically.

Although the information passes from senders to markers over a permanently established common medium, it is necessary to associate each sender that is taken in use with only one of the markers. Any marker may be taken by a calling sender, provided the marker is idle; and, once it has been taken by a particular sender, it cannot be seized or appropriated by any other sender until it has performed its function. Accordingly, each of the senders is equipped with a marker allotting mechanism comprising a plurality of pairs of relays, one for each of the markers to which the sender has access. Four of these relay pairs are illustrated in the allotter mechanism 205 of the sender 200. The first pair of relays, relays 206 and 207, are individual to the No. 0 marker 500; the second pair of relays, 208 and 209, are individual to the No. 1 marker not shown; relays 213 and 221 are individual to the No. 2 marker 600; and the remaining pairs of relays are individual to the remaining markers, respectively. In like manner, the senders 300 and 400 are provided with marker allotting relays 305 and 405. The senders are also provided with start wires 211, 311 and 411 which enter the allotter relay chains at different points so that the senders have different preferences for the markers.

The marker 500 (and the same is true of each of the other markers) is equipped with two relay registers 501 and 502 for registering the office code digits and with corresponding sets of tubes 503 and 504 for receiving from the sender the designation signals which operate these registers. These tubes may also be of the gas-filled type or of any desired type. It will be noted that each tube has a separate starting gap, comprising starting anode and cathode, as well as a main anode and cathode. The marker 500 is also provided with a routing and controlling mechanism 505, which is operated in accordance with the digits received by the registers 501 and 502, and which then serves in the well-known manner to determine the selective operation of the district and office switches 102 and 104.

The phase impulses by which the signal information is transferred from the senders to the markers are produced by a common impulse generator 540. The energy for this generator is supplied from an alternating current source 541, and the generator in response to each cycle of the source 541 produces impulses of a given phase in each one of the output circuits 542, 543, 544, 545, 546 etc., the impulses in each circuit being of a phase differing from that in each of the other circuits. Each one of the output circuits from the generator 540 corresponds to and identifies a particular one of the markers; there is, therefore, an output circuit for each marker to be served by the generator. For example, the impulse circuit 542 pertains to the marker 500; and, when some one of the senders has seized the marker 500, the phase impulses produced in the conductor 547 of circuit 542 are transmitted from the sender, in accordance with the settings of the impulse registers, over the common medium 210 to the receiving tubes 503 and 504 of the marker. These impulses are effective to operate these tubes, since impulses of the same phase are also being applied to said tubes over the other conductor 548 of the impulse circuit 542. Although the impulses transmitted from the impulse conductor 547 through the calling sender and over the common medium are also applied to the receiving tubes of all other markers at the same time, the tubes in the other markers are unresponsive because they are not receiving impulses of the same phase from conductor 548. In like manner the impulses produced in the conductors of circuit 544 are transmitted over the common medium from a sender to the marker 600, provided this marker is engaged by some one of the senders. The impulses on the circuit 544, however, are in a phase differing from those of the other impulse circuits; therefore, the information transferred to the marker 600 does not interfere with or cause the false setting of any of the other markers. Similarly, the impulse circuits 543, 545, 546, etc., serve the corresponding markers.

The impulse generator 540 may be of any suitable type whereby brief impulses of positive and negative polarity in each of a plurality of phases are generated during each cycle of the exciting source 541. Generators of this type are illustrated in the application of W. H. T. Holden, Serial No. 361,536, filed October 17, 1940; and the patents to W. H. T. Holden, No. 2,285,815 of June 9, 1942, and No. 2,252,766 of Aug. 19, 1941.

The conductors constituting the common transmitting medium 210 between the senders and the markers undergo a continuously repeated test to verify that they are intact and in proper condi-

tion for transmitting the designation signals. To this end each of the ten conductors 210 is connected through one of the resistors 600 to one of the electrodes of the corresponding one of the group of ten discharge tubes 610. The other starting electrodes of these tubes are connected in multiple to the impulse conductor 551 of the phase impulse circuit 549. The other conductor 552 of the impulse circuit 549 is connected in common to the electrodes of a group of ten discharge tubes 615; and the other electrodes of these tubes are connected at a point near the senders to the ten conductors respectively of the transmitting medium 210. By selecting the phase circuit 549 of the generator 540, which is not used for transmitting signals to the markers, an impulse is transmitted once per cycle of the source 541 through the tubes 615 and over the respective conductors 210 to the control gap electrodes of all ten of the tubes 610. The control or start gaps of these tubes are ionized in response to each impulse received, and current flows in the main discharge gaps of the tubes at each ionization thereof. The main discharge circuits of the tubes 610 are provided with individual slow release relays 603, 604, etc., and these relays remain operated as long as the ionizing impulses continue to appear on the respective conductors 210. If, however, any one of these condensers is broken or becomes defective in other respects and the impulses cease to appear thereon, the corresponding tube 610 remains deionized, and the associated relay releases and closes an alarm circuit.

The tubes of the groups 610 and 615 may be of the same types as the tubes disclosed in Figs. 2 and 5, respectively.

The transmitting conductors 210 are also connected respectively to ground through individual resistors in the group 600. The purpose of these terminating resistors is to stabilize the voltages on the transmitting conductors 210 and to prevent false signaling due to the accumulation of potentials that might otherwise appear thereon.

The operation of the transmitting system will now be explained in detail. For this purpose it may be assumed that a call is made by the subscriber of line 108. The call by this subscriber causes the operation of the line switch 100 to extend the line over an idle junctor 101 to the district selector 102 and also through the sender selector switch 106 to an idle one of the register senders, such as the sender 200. Upon the seizure of the sender the start relay 212 operates and applies ground to the start conductor 211. If at this time all of the markers are idle, the allotter relays 206, 208, 213 and 214 are in their normal deenergized condition. The grounded start conductor 211 therefore is extended through the contacts of relay 206 and the winding of relay 207 to battery. Relay 207 operates and closes a circuit from ground through its inner upper front contact, resistor 215, conductor 216, thence in parallel through resistor 306, normal contacts of relay 307, lower winding of relay 308 to battery and through resistor 406, normal contacts of relay 407, lower winding of relay 408 to battery and over corresponding parallel circuits through the make-busy relays of the allotters in all other senders. The relays 308 and 408 in senders 300 and 400 operate and extend their start wires to the relay individual to the next marker. Relay 207 at its uppermost back contact removes battery potential from conductor 217 to prevent operation of the corresponding relay in any of the other senders. Relay 207 also extends the phase impulse con-

ductor 547, which is individual to the associated marker 500, over conductor 218 to the armatures of all relays of the registers 201 and 202. The operation of relay 207 also closes a circuit from ground over conductor 216 and through the winding of relay 506 of the marker 500. Relay 506 operates and prepares the receiving tubes 503 and 504 for receiving the signal impulses from the sender. Thus the sender 200 has been seized by the calling line 108, and the sender in turn has appropriated or seized the first idle marker, namely, the No. 0 marker 500. The seized marker 500 is guarded against seizure by other senders by the operation of the relays 308, 408, etc., in said other senders.

The calling subscriber 108 now proceeds to operate his dial to send the wanted designation to the sender 200, including the office code digits and the usual numerical digits. The two code digits cause the operation of the registers 201 and 202 in the well-known manner, and a combination of the relays of these registers are operated to register the particular digits involved. Assume that the office code is represented by the digits 3 5, in which case the relay 219 of register 201 and relay 220 of register 202 are operated, and all of the other relays of these registers remain deenergized.

It will also be assumed that the subscriber of another line, such as line 109, initiates a call at about this time. Line 109 is extended over the line switch 100 to an idle junctor 110 and through the sender selector switch 106 to the next idle sender in the group, such as the sender 300. The seizure of sender 300 causes the closure of the start circuit over conductor 311, back contacts of relay 312, assuming the third or No. 2 marker 600, to which relay 312 is individual, is idle, winding of relay 313, conductor 314, normal contacts of relay 221 to battery. Relay 313 operates in this circuit and closes a circuit from ground through its inner upper front contact, resistor 315, thence over conductor 316 and over multiple circuits to battery through the windings of relays 213, 409, etc., to render the marker 600 non-selectable to the allotter circuits 205, 405, etc., of the senders. The grounded conductor 316 is also extended through the winding of relay 605 of the marker 600. Relay 313 connects the phase impulse conductor 553, which is individual to the marker 600, over conductor 317 to the armatures of all relays of the registers 301 and 302; and relay 605 of the marker 600 prepares the receiving tubes for receiving the signal impulses from the sender 300. Thus a second sender 300 has been seized concurrently with the seizure of the first sender 200, and the second sender has appropriated a second idle marker 600. If other calls arrive during this period, other senders are seized to serve these calls, and these senders in turn seize idle markers. In other words, a plurality of senders and associated markers may be in use concurrently, and the records established in these senders may be transferred during the common seizure period over the common transmitting medium 201 without interference.

As soon following the operation of the register relays 219 and 220 as the generator 540 reaches its No. 0 phase, a positive impulse of this phase is delivered over conductor 547, contacts of relay 207, conductor 218 and thence in parallel through the closed contacts of register relays 219 and 220 to the transmitting tubes 222, 223, 224 and 225. From the tubes 222 and 223 the impulse circuits

may be traced over conductors 226 and 227 and thence through resistors 507 and 508 to the control electrodes 509 and 510 of receiving tubes 511 and 517, respectively. From the tubes 224 and 225 the impulse circuits may be traced over the conductors 228 and 229 through resistors 527 and 528 to the control electrodes of tubes 529 and 530 of the group 504. At the same time a negative impulse of No. 0 phase is applied over conductor 548 through the contacts of relay 506 and thence through resistors 513 and 514 to the control electrodes 515 and 516, respectively, and also through the resistors 531 and 532 to the control electrodes of the tubes 529 and 530, respectively. The sum of the positive and the negative impulses applied to the control electrodes of tubes 511, 517, 529 and 530 is sufficient to ionize their control gaps.

Generator 518 supplies current to the anodes of the tubes 503 and 504, and it is in phase with the impulses delivered to the impulse conductor 547. Therefore, each time the control gap 509—515 of tube 511 ionizes, current flows from the generator 518 through the winding of slow-release relay 519, anode 523, cathode 521 to the negative pole of battery 522. These successive impulses flowing through the relay 519 operate it and hold it in its operated position as long as ionizing impulses are delivered to the tube 511. In like manner the tube 517 ionizes in response to the application thereto of impulses of phase No. 0, and current flows from the generator 518 through the winding of slow-release relay 523, anode and cathode of tube 517 to the negative pole of battery 522. Relay 523 operates, and the circuit may be now traced from ground through the front contacts of the operated relay 519 through the back contacts of relays 524 and 525, front contacts of relay 523, back contacts of relay 526 thence over conductor 527 to the route and control mechanism 505.

In like manner the tubes 529 and 530 of the group 504 ionize and current flows from the generator 518 to the slow-release relays 533 and 534, anodes and cathodes of tubes 529 and 530 to the negative pole of battery 535. Relays 533 and 534 operate and close a circuit which may be traced from ground over conductor 536 to the mechanism 505. Thus the grounded conductors 527 and 536 cause the selection and operation of relays in the mechanism 505 to indicate the route represented by the code designation 3 5.

Concurrently with the transfer of the registration from sender 200 to marker 500 the registration in sender 300 is also transmitted over the common medium 210 to the associated marker 600. As above explained, the registration from sender 200 is transmitted by impulses of phase No. 0 delivered by the impulse circuit 542. The registration in sender 300 is transferred by impulses of phase No. 2, which are delivered by the impulse circuit 544. Each time, therefore, the generator 540 enters its No. 2 phase positive impulses are transmitted over conductor 553 thence through the closed contacts of relay 313 in the sender 300, representing the seized marker 600, conductor 317 through the contacts of the operated register relays 301, 302, thence through a set of transmitting tubes similar to tubes 203 and 204 to the corresponding conductors 210. These positive impulses appearing on conductors 210 are applied to the starting electrodes of the receiving tubes of all markers, including the tubes of the associated marker 600. At the same time

negative impulses of the No. 2 phase are applied over conductor 554 through the contacts of relay 605 to the other control electrodes of the receiving tubes of marker 600. The tubes of marker 600 operate to the exclusion of the tubes of any other marker, and the registration of the sender 300 is transferred to the marker 600 where it causes the operation of a route relay or other device representing the destination of the call.

In like manner any number of simultaneous connections may be made between senders and associated markers and the individual registrations transferred over the common medium 210 without mutual interference.

Following the operation of a route relay in the routing and controlling mechanism 505 of the marker 500, this marker connects itself through frame connectors 111 and 112 with the district and office selectors 102 and 104, and these switches are operated to extend the calling line 108 over the junctor 101, junctor 103 to an idle one of the outgoing trunks 105.

At the proper time in the sequence of controlling operations the start conductor 211 in the sender 200 is opened to permit the release of relay 207. The release of relay 207 opens the holding circuits of relays 308, 408, etc., and these relays release to render the marker 500 free for subsequent selection by one of the senders. Also at the proper time the sender 200 is released, and the sender selector switch 106 is restored to its normal condition.

Once per cycle of the generator 541 a test is made of the common transmitting conductors 210. This test is made by impulses delivered by the circuit 549, which may occur in the No. 8 phase position of the generator 540. Each time the generator enters the No. 8 phase position positive impulses are transmitted over conductor 552 through the ten tubes 615 thence to the corresponding ten conductors of the medium 210. These impulses are transmitted over the conductors 210 toward the markers where they are applied through resistors 600 to the starting electrodes 606, 607, etc., of the ten tubes 610. At the same time impulses of negative polarity of phase No. 8 are applied over conductor 551 through resistors 609, 611 to the corresponding start electrodes of the ten tubes 610. These tubes all ionize, provided the conductors 210 are intact and the positive impulses all appear on the electrodes of the tubes. When tube 612 ionizes, a circuit is closed from the generator 613, which is in its positive half cycle when the generator 540 is in its No. 8 phase, winding of slow-release relay 603, anode and cathode of tube 612 to the negative pole of battery 614. Discharge current flows in this circuit, and relay 603 operates and attracts its armature. Likewise each of the other tubes discharges, and the corresponding relay in the anode circuit operates to attract its armature. As long as all of the relays 603, 604, etc., are energized the circuit of alarm relay 616 is maintained open. As soon, however, as any one of the conductors 210 fails to deliver an impulse to the corresponding tube 610, this tube fails to discharge its main gap, and the corresponding relay releases its armature. The released relay closes an obvious circuit for energizing the alarm relay 616. The alarm relay 616 gives notice to the exchange attendant that trouble exists in the transmitting conductors 210.

It will be noted that the marker allotting relays 206, 208, etc., have locking windings which serve to prevent them from releasing while the start

wire 211 is grounded in the process of making a new selection of an idle marker. This is an old and well-known feature in start wire circuits. Also provision may be made for opening the start wire in case a new call comes in when all marker allotter relays are energized. This makes it possible for one of the relays to release as soon as a busy marker becomes idle.

What is claimed is:

1. The combination in a signaling system of a group of sending mechanisms and a group of receiving mechanisms, each of said mechanisms having means for registering information therein, a common signaling medium permanently connecting all of said sending mechanisms with all of said receiving mechanisms, means for seizing said sending mechanism for use, means for causing each one of said sending mechanisms taken in use to seize any idle one of said receiving mechanisms, means for producing signaling currents, one for each of said receiving mechanisms, each of said currents having a different characteristic, means for sending over said common medium from said sending mechanisms to all of said receiving mechanisms the signal currents characterizing respectively the seized receiving mechanisms to transfer the information registered in the respective associated sending mechanisms, and means in each receiving mechanism for selecting from said common medium the signaling current of the corresponding characteristic to register therein the information transferred from the associated sending mechanism.

2. The combination in a signaling system of a group of sending devices, a group of receiving devices, each of said devices having means for registering information therein, a common signaling medium connecting all of said sending devices with all of said receiving devices, means for seizing said sending devices for use, means for effecting coexisting seizures between the sending devices concurrently in use and respective idle ones of said receiving devices, any one of said sending devices being capable of seizing any idle one of said receiving devices, means for producing signaling currents of different characters, said currents representing respectively the receiving devices, means for sending over said common medium from said sending devices to said receiving devices the signal currents representing the seized receiving devices for the purpose of transferring the information registered in the associated sending devices, and means in each receiving device for selecting from said common medium the signaling current representing said receiving device to register therein the information transferred from the associated sending device.

3. The combination in a signaling system of a plurality of sending devices, a plurality of receiving devices, each of said devices having means for registering information therein, a common signaling medium permanently connecting said sending devices with said receiving devices, means for seizing said sending devices for use, means for effecting coexisting seizures between the sending devices concurrently in use and respective idle ones of said receiving devices, a source of alternating current, means for producing in each cycle of said source a plurality of impulses of successive phases, said phases characterizing respectively said receiving devices, means for sending over said common medium within a cycle of said source phase impulses characterizing the seized receiving devices for the purpose of transferring over said medium

the information registered in all of the associated sending devices, and means in each receiving device for selecting from said common medium the signal impulses of the corresponding phase to register therein the information transferred from the associated sending device.

4. The combination in a signaling system of a plurality of sending devices, a plurality of receiving devices, each of said devices having means for registering information therein, a common signaling medium permanently connecting said sending devices with said receiving devices, means for seizing said sending devices for use, means for effecting coexisting seizures between the sending devices concurrently in use and respective idle ones of said receiving devices, a source of alternating current, means for producing in each cycle of said source a plurality of impulses of successive phases, said phases characterizing respectively said receiving devices, means for sending over said common medium within a cycle of said source phase impulses characterizing each seized receiving device and in codes representing the information in the sending device that has seized said receiving device, and means associated with each receiving device for selecting the code impulses of the phase characterizing said receiving device to register therein the information transferred from the sending device.

5. The combination in a signaling system of a group of sending devices, a group of receiving devices, each of said devices having means for establishing signaling information therein, a common signaling conductor joining all of said sending devices in a continuous connection with all of said receiving devices, means for seizing a variable number of said sending devices for concurrent use, means for causing each one of the sending devices taken in use to seize any idle one of said receiving devices, means for producing signalling currents of different characteristics, said currents serving respectively the receiving devices, means for sending over said common signaling conductor from said sending devices to said receiving devices the signaling currents characterizing respectively the seized receiving devices for the purpose of transferring the information established in the respective sending devices, and means in each receiving device for selecting from said common signaling conductor the signaling current of the corresponding characteristic to establish therein the information transferred from the associated sending device.

6. The combination in a signaling system of a group of sending devices, a group of receiving devices, means in each of said devices for registering signaling information, a common signaling conductor joining all of said sending devices in a continuous connection with all of said receiving devices, means for seizing a variable number of said sending devices for concurrent use, means for causing each sending device taken in use to seize the next idle one of said receiving devices, means for producing impulses of a plurality of phases, said phases corresponding respectively with said receiving devices, means for sending over said signaling conductor from each of the sending devices in use impulses of the phase corresponding to the seized receiving devices for

the purpose of transferring over said conductor the information registered in all of the sending devices in concurrent use, and means in each receiving device for selecting from said common conductor the signaling impulses of the corresponding phase to register in said receiving device the information transferred from the associated sending device.

7. The combination in a switching system of a group of senders, a group of switch controlling markers, each of said senders and markers having means therein for registering signal information, a common signaling conductor permanently joining each of said senders with each of said markers, means for seizing a variable number of said senders for use, means for effecting coexisting seizures between the senders taken in use and respective idle ones of said markers, means for producing signaling currents of different characters, said signaling currents serving respectively the different markers, means for sending over said common conductor from the senders to the markers signaling currents representing the seized markers for the purpose of transferring over said conductor the information registered in the senders in use, means for each of said markers for selecting from said common conductor the signaling current of the corresponding characteristic for registering in said marker the information transferred from the associated sender, automatic switches, and means controlled by said markers in accordance with the information registered therein for causing the selective operation of said switches.

8. The combination in a switching system of a group of senders, a group of switch controlling markers, means in said senders and markers for registering signaling information, a common signaling medium connecting all of said senders with all of said markers, means for seizing a number of said senders for concurrent use, means for causing each one of the senders taken in use to seize an idle one of said markers, means for sending signaling currents over said common medium to transfer the information registered in the senders to the associated seized markers, and means for continuously applying impulses to said signaling medium to determine if it is in condition for the transmission of said signaling currents from the senders to the markers.

9. The combination in a switching system of a group of senders, a group of switch controlling markers, means in said senders and markers for registering signaling information, a group of signaling conductors joining in a permanent and continuous connection all of said senders and markers, means for seizing a number of said senders for concurrent use, means for causing each one of the senders taken in use to seize an idle one of said markers, means for sending signaling impulses of a plurality of different phases over said signaling conductors to transfer the information registered in said senders to the associated seized markers, and means for sending impulses of a phase other than the phases used for said signaling impulses over said conductors for determining whether they are in condition for the transmission of the signaling impulses between the senders and the markers.

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