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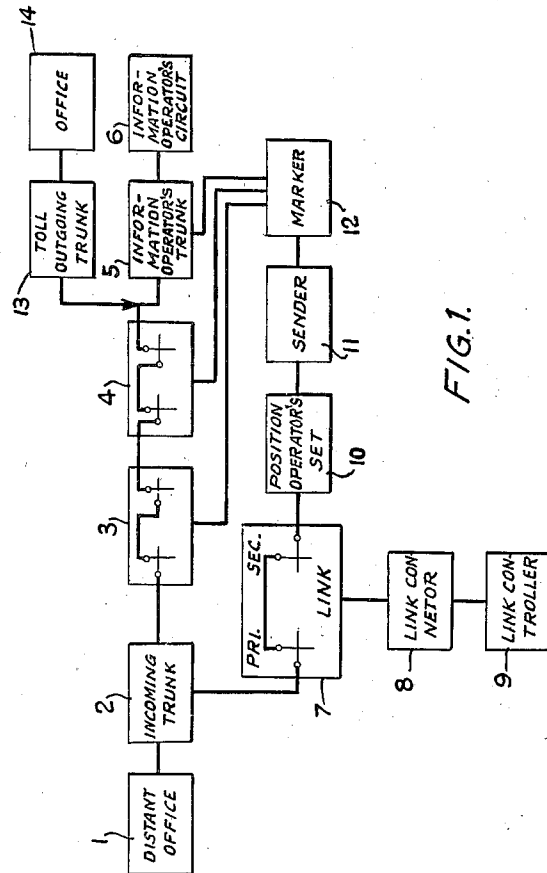
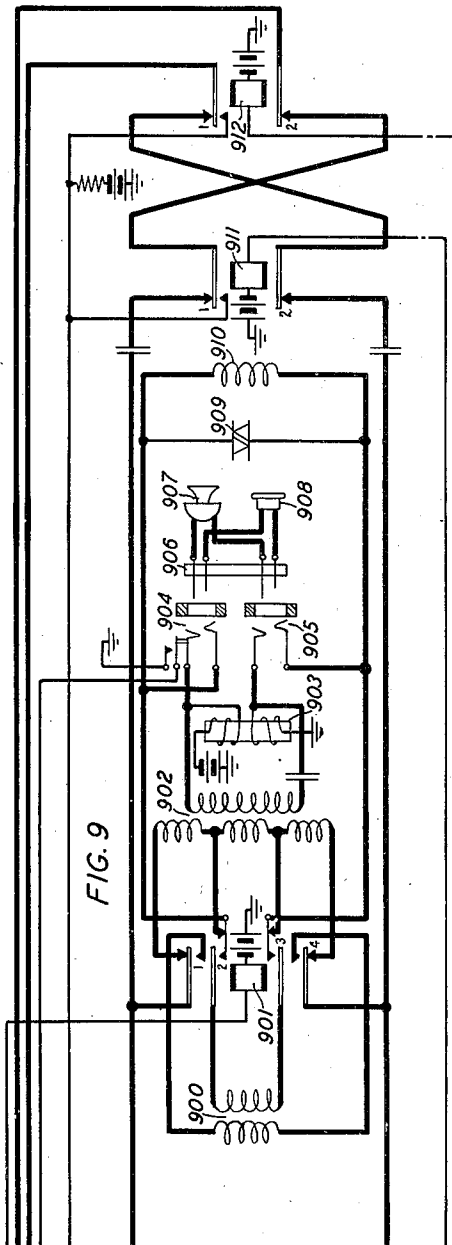
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2,262,947

TELEPHONE SYSTEM

Filed Jan. 5, 1940

8 Sheets-Sheet 1



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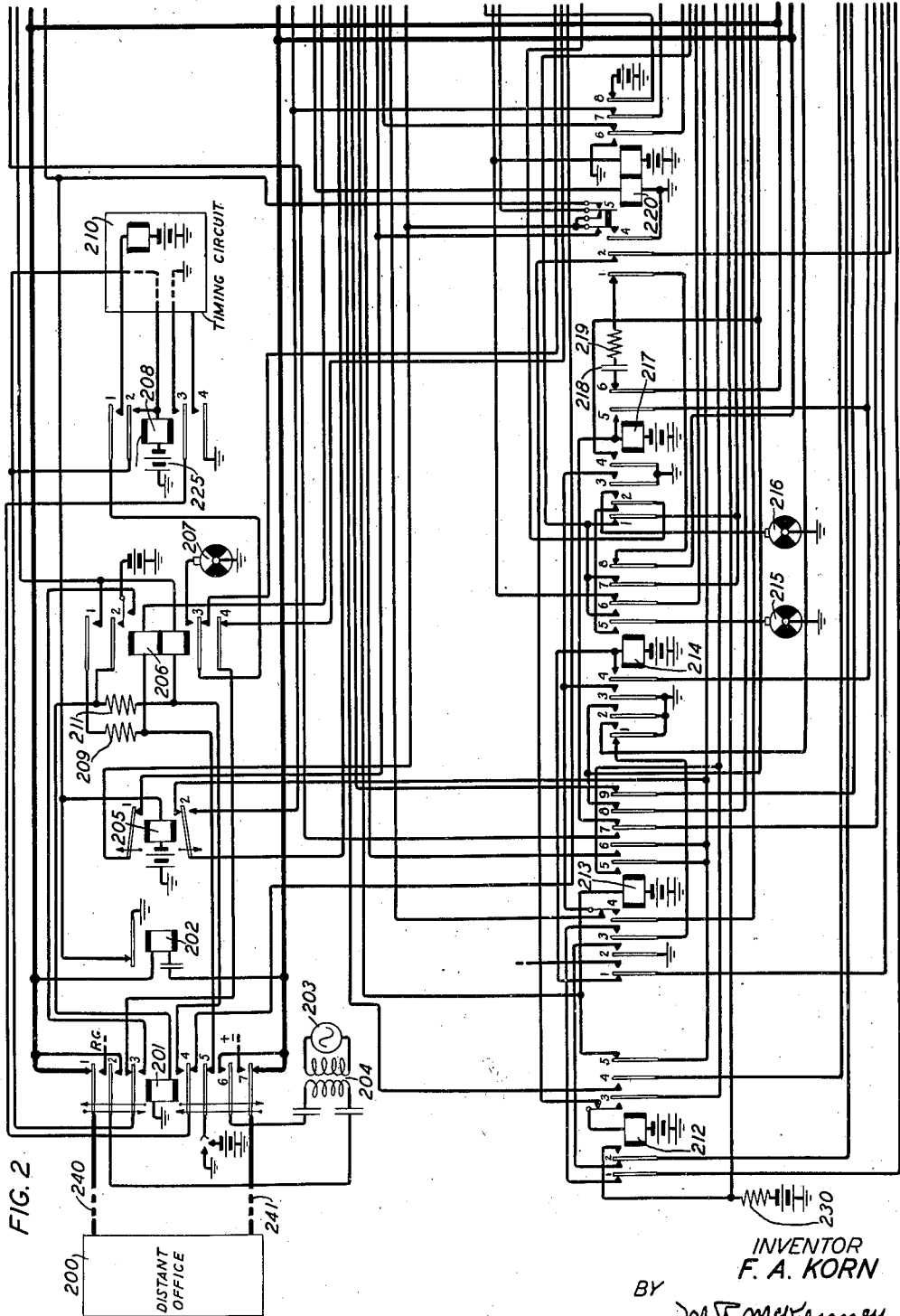
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TELEPHONE SYSTEM

Filed Jan. 5, 1940

8 Sheets-Sheet 2



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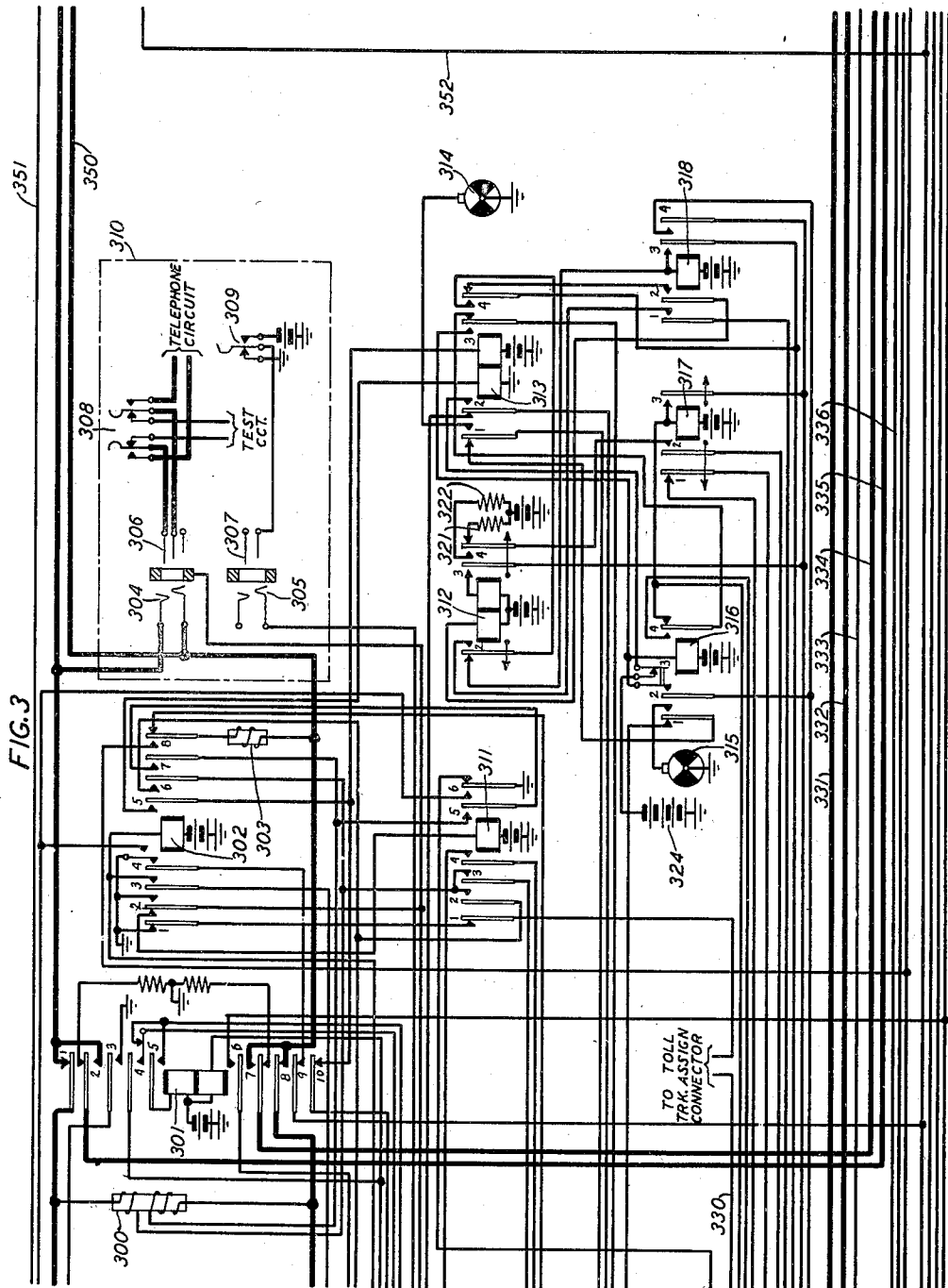
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TELEPHONE SYSTEM

Filed Jan. 5, 1940

8 Sheets-Sheet 3



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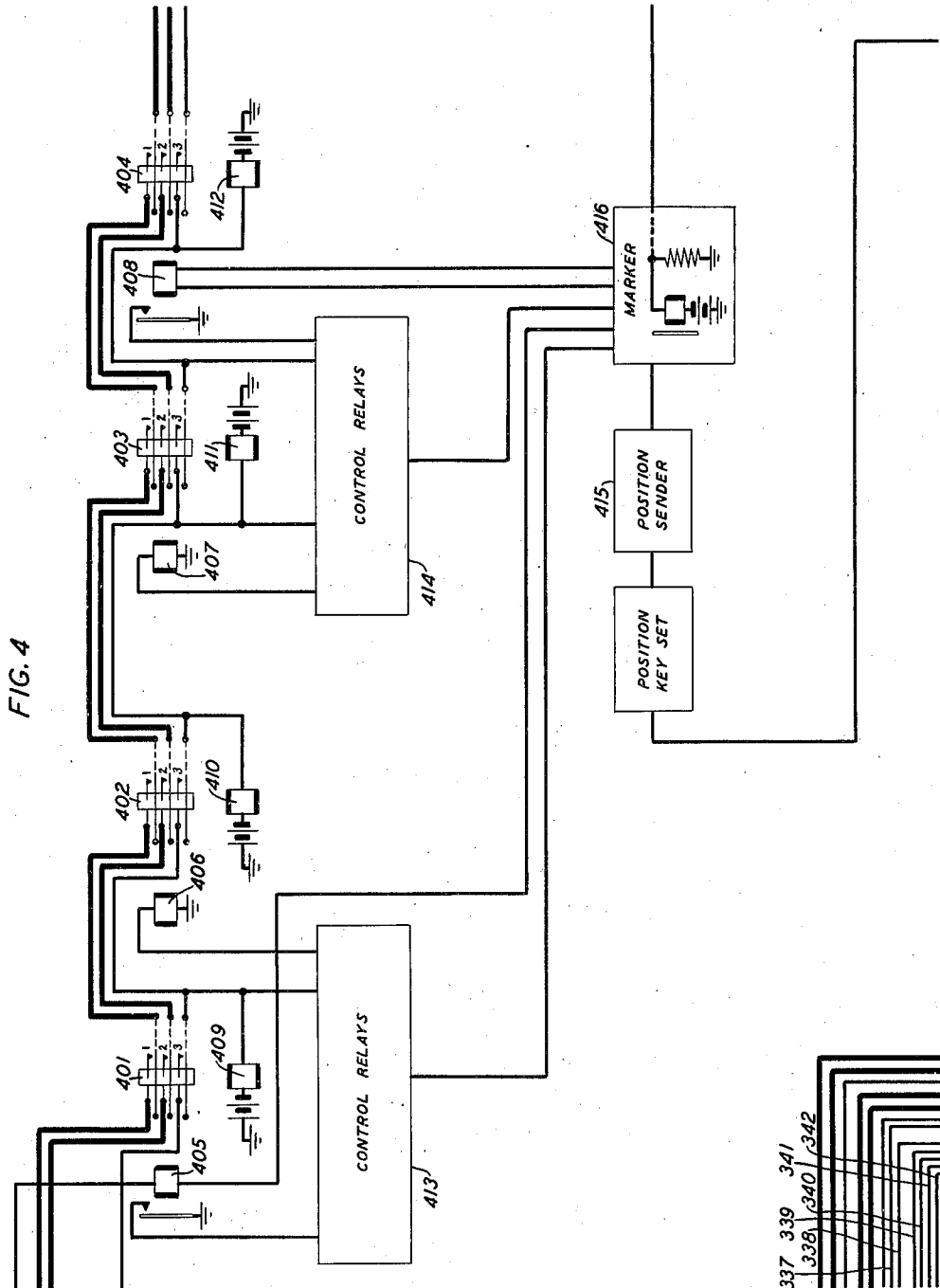
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Filed Jan. 5, 1940

8 Sheets-Sheet 4



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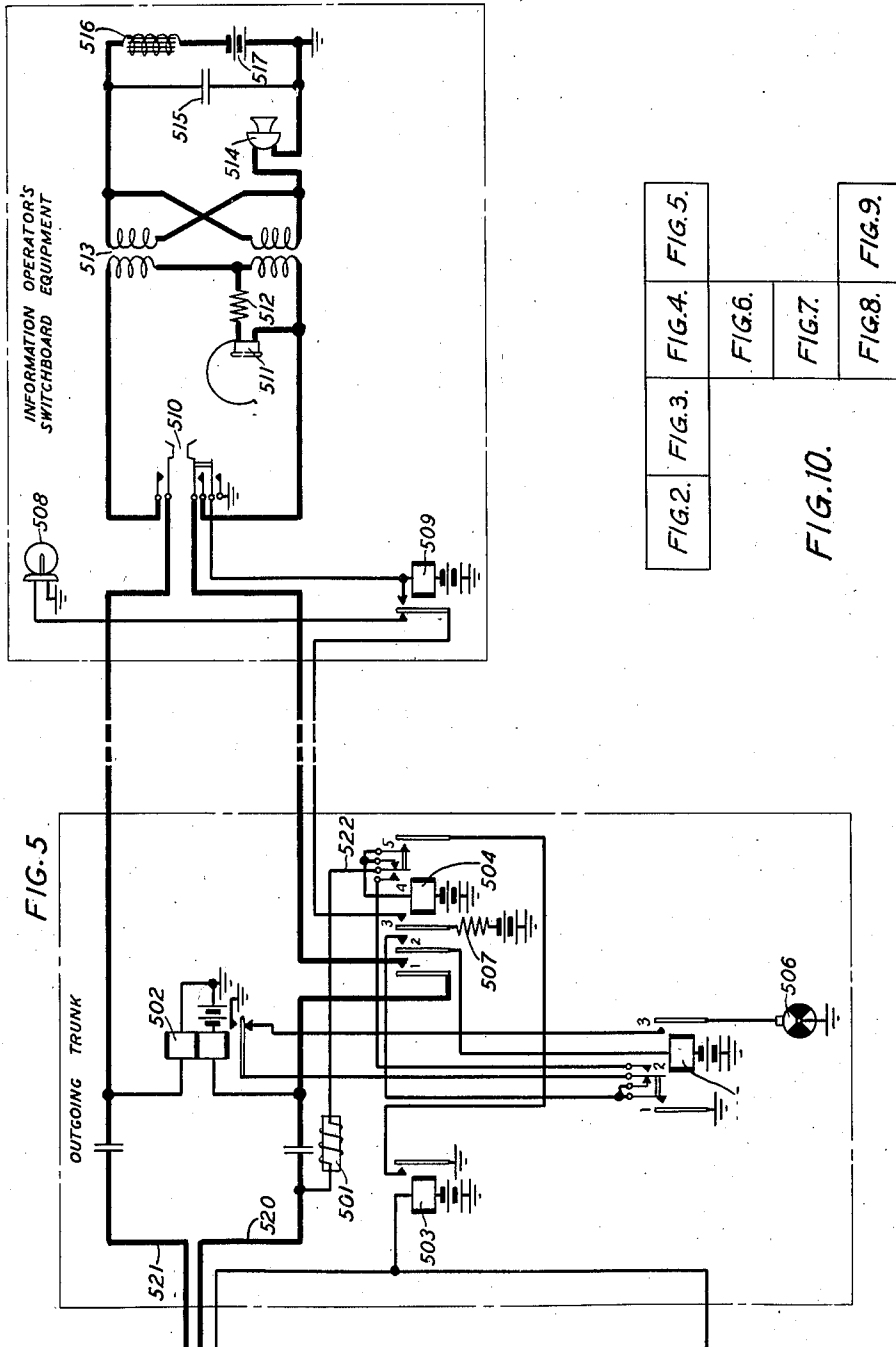
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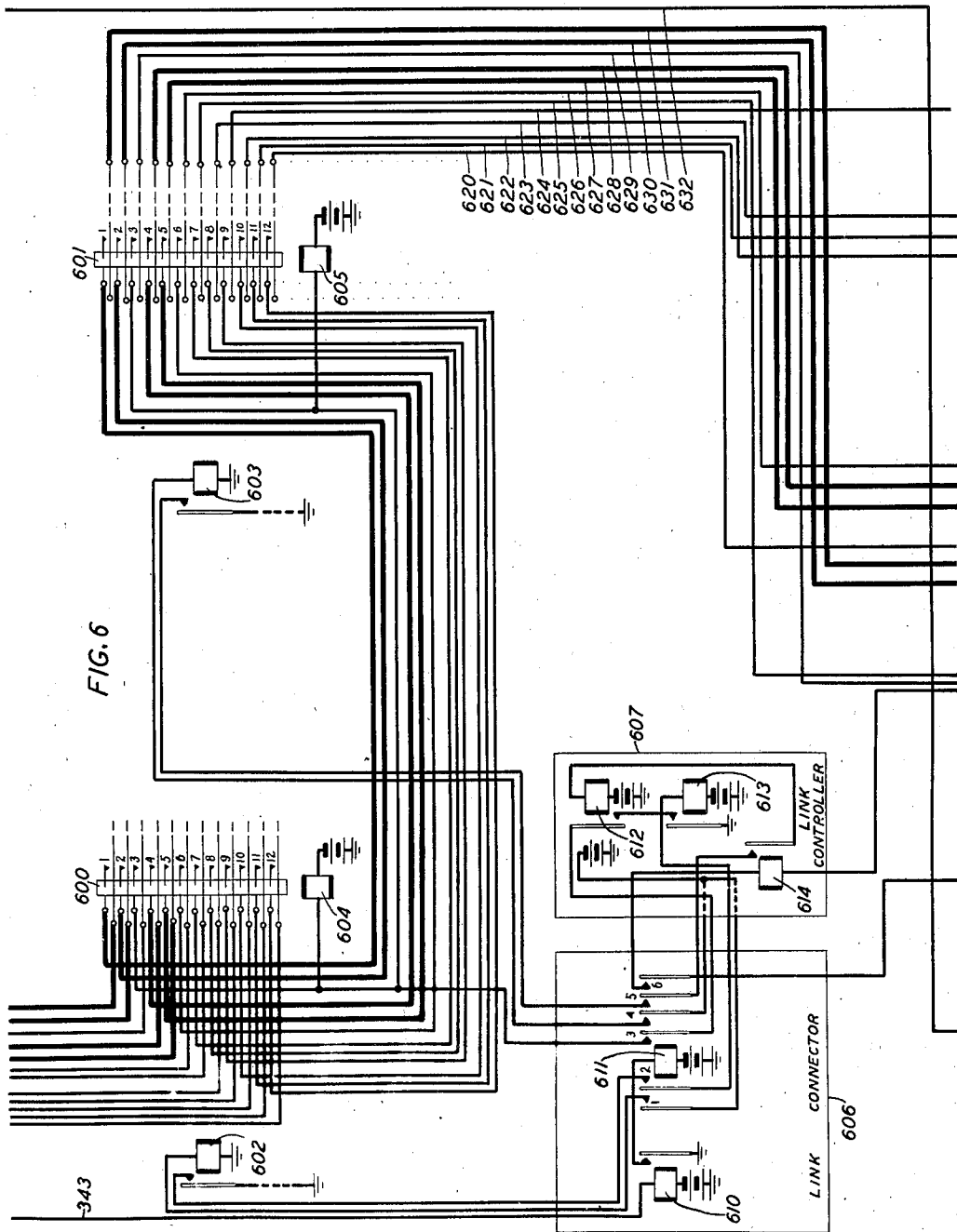
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8 Sheets-Sheet 6



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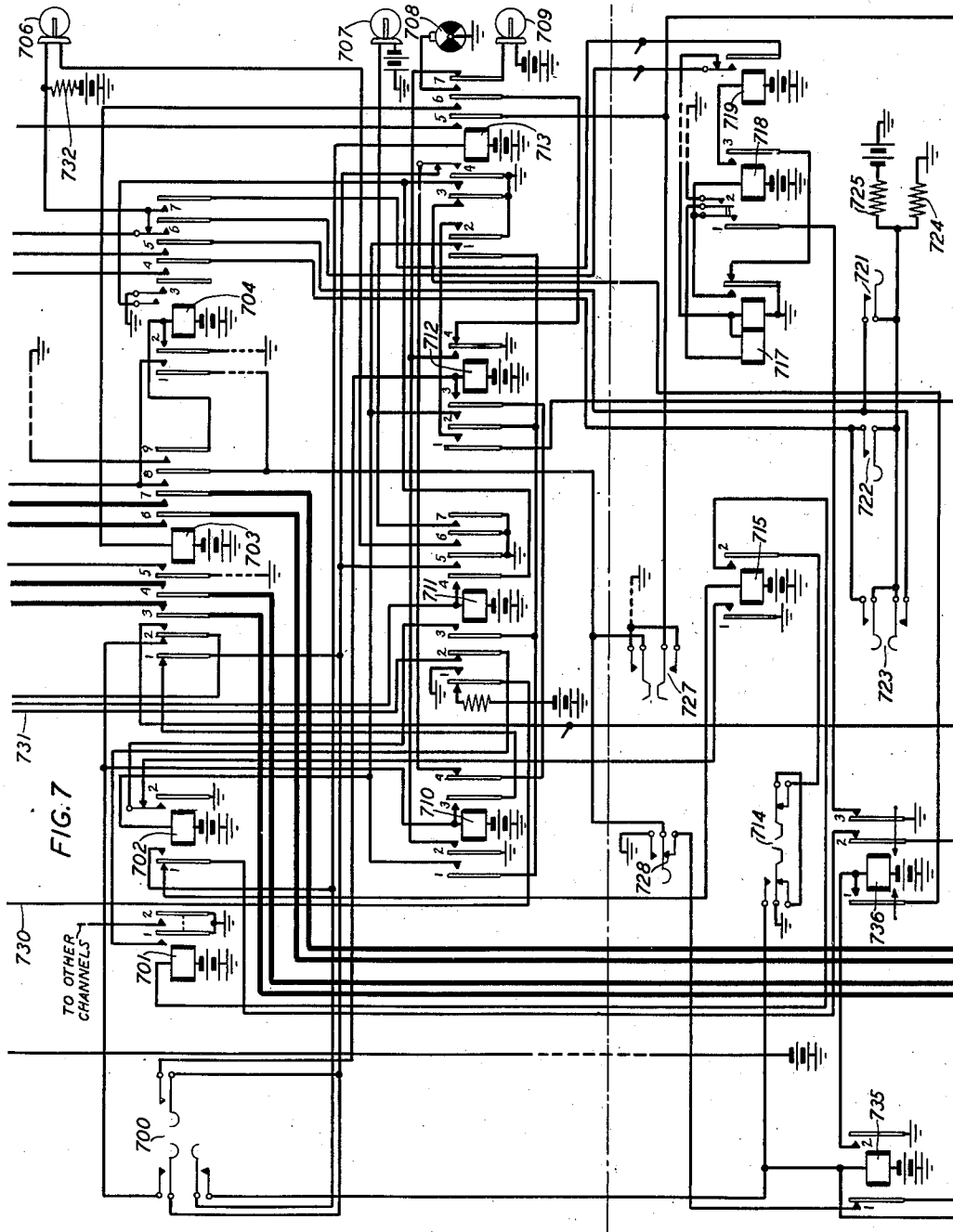
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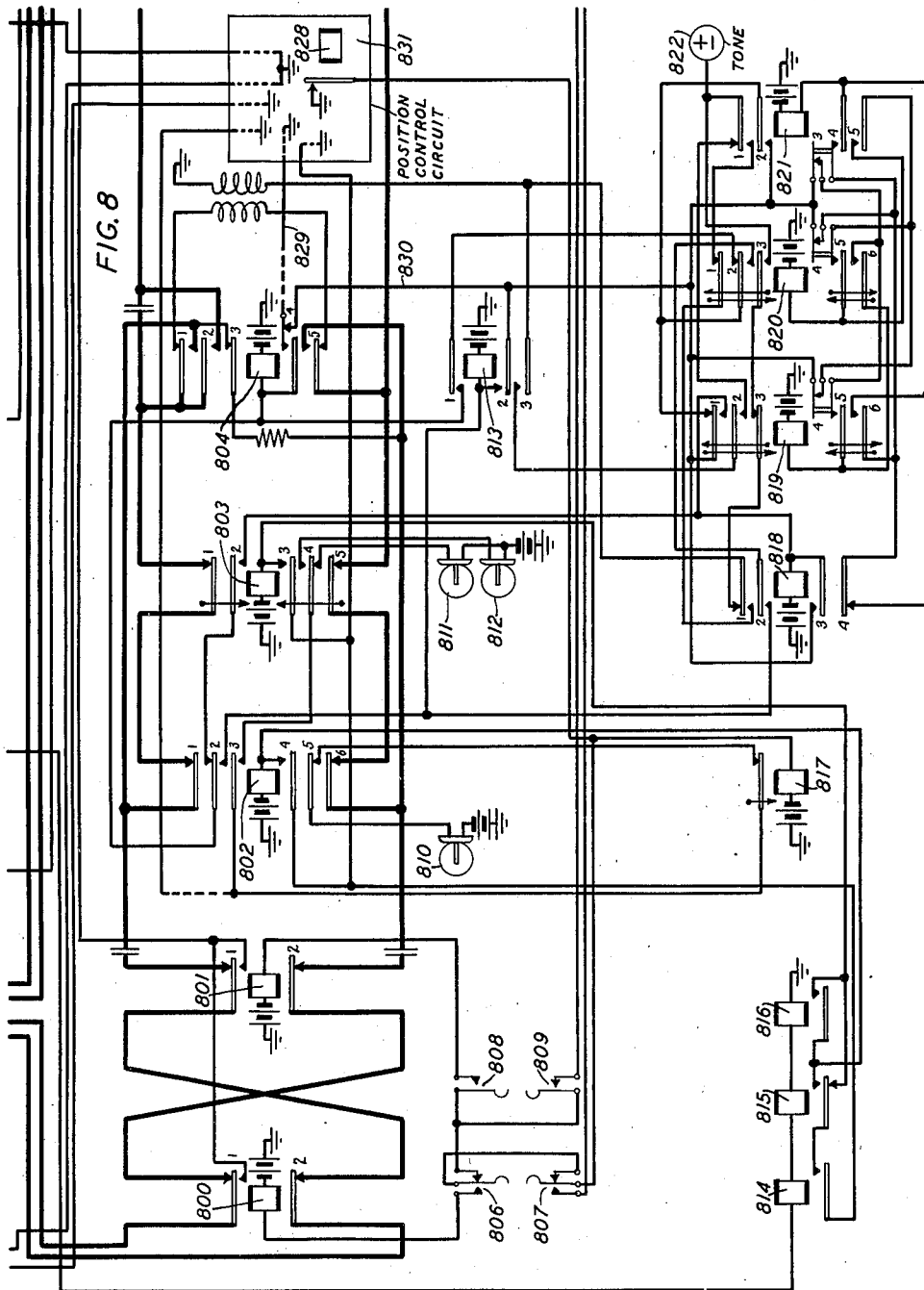
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8 Sheets-Sheet 8



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UNITED STATES PATENT OFFICE

2,262,947

TELEPHONE SYSTEM

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Application January 5, 1940, Serial No. 312,452

8 Claims. (Cl. 179—27)

This invention relates to automatic telephone systems and more particularly to information service in such systems.

Experience shows that in the practical operation of large telephone exchange areas, many calls are made each day that need to be routed automatically or manually to an information operator before a connection can be completed to a wanted telephone station. Information is required on a substantial percentage of calls from one city or town to another since many calls are made without the knowledge of the station number of the wanted subscriber. Because of the extra effort involved in this service, which includes the holding of lines, each information operator is provided with an extensive directory, but in view of the large percentage of stations in the country, this directory must have a limit. On calls to a distant locality information is usually provided by an information operator in the toll office area having the wanted subscriber's station therein and thus on some calls an extensive connection of toll lines may be held while information is transmitted from one toll office to an operator in another toll office where the call was originated. In many instances a connection of this character may involve the use of toll lines of highest transmission efficiency extending long distances. Ordinarily a toll telephone connection is reestablished by the originating operator to obtain the services of a distant toll operator after the information is received. It is necessary for the originating operator to be acquainted with all data for each call and supervise the call after connection is made to the wanted party.

The object of this invention is, therefore, to reduce the holding time of toll lines when information is required by automatically reconnecting an incoming toll line to the toll operator in the toll area having the wanted subscriber therein, immediately after the information is given to the originating toll operator in order to obviate the necessity of a resignal from the originating operator.

According to the present invention the originating operator may set up a toll connection to a distant toll office and request that a connection be completed to an information operator's switchboard office. This connection is made by a toll operator in an automatically operable toll office by manipulating apparatus which automatically connects the incoming toll line or trunk to an outgoing trunk extending to the information operator switchboard office. A signal

is given to the information operator who responds and supplies the code designation and number of the wanted party. This information is given to the distant originating toll operator so that this operator may make a record of the call designation. When the information operator disconnects from the outgoing trunk extending to her switchboard, apparatus is energized in this trunk circuit which causes the reconnection of the incoming toll line with the toll operator in the area having the wanted subscriber station therein and a signal is given to this operator indicating the type of call to be answered. The originating operator then gives the code and number designation of the wanted subscriber to the toll operator in the area in which the wanted subscriber's station is located. This obviates the necessity of reconnecting or resignaling for completing the toll connection.

A feature of the invention is in a system in which a telephone call can be completed to an information operator and automatically reverted to a completing operator by the disconnection of the information operator from the calling incoming trunk.

Another and related feature resides in transmitting pulses from an information switchboard trunk circuit to an associated incoming trunk circuit responsive to the disconnection of the information switchboard circuit from the information trunk circuit which actuates the apparatus in the incoming trunk circuit for interconnecting a calling and a called operator.

Another and related feature resides in a system of reenergizing a link connector responsive to the disconnection of the information switchboard circuit from the information trunk circuit for interconnecting a calling and a called operator.

Another and related feature is a system of signals for indicating the connection of a trunk from a distant office with a cordless toll operator's position responsive to the disconnection of the information operator's switchboard circuit from the information switchboard outgoing trunk.

These and other features will be discussed more fully in the following description.

To illustrate the features of the invention, reference may be had to accompanying drawings in which:

Fig. 1 illustrates diagrammatically the association of the different circuits comprising the system disclosed;

Figs. 2 and 3 illustrate an incoming intertoll

trunk circuit connected to a distant toll office;

Fig. 5 illustrates an outgoing trunk circuit to an information switchboard office in the left portion of the drawing and a diagrammatic showing of the apparatus in an information switchboard in the right portion of the drawing;

Fig. 4 illustrates cross-bar switches for interconnecting an incoming trunk with an outgoing trunk and also illustrates diagrammatically the controlling devices for selecting and operating the switches and outgoing trunks;

Fig. 6 illustrates the switches of an automatically operable link circuit along with the link connector and link control circuit;

Fig. 7 illustrates a channel in a cordless toll operator's position and part of the position equipment;

Figs. 8 and 9 illustrate cordless toll operator's position equipment including the operator's telephone set.

The drawings when arranged, as shown in Fig. 10, illustrate the detail structure of this system.

GENERAL DESCRIPTION

The elements of a system in which the invention may be incorporated are illustrated diagrammatically in Fig. 1 which shows a distant toll office 1 interconnected by trunk conductors with the incoming trunk 2 of an automatically operable toll office. Only one distant toll office is shown, but there may be a large plurality of offices entering the toll office through a large plurality of incoming trunks. The automatic operable toll office comprises a plurality of incoming trunks which are associated with toll call completing operator's positions 10 through link switches 7 under the control of selectable link connectors 8 and selectable link control circuits 9. A large plurality of outgoing trunks are included in this toll office for reaching other offices and subscribers associated therewith or for reaching information operators for obtaining subscribers' call designations. An outgoing trunk to another office 14 is shown at 13 and an outgoing trunk to the information operator 6 is shown at 5. Switches 3 and 4 are shown for connecting incoming trunks to outgoing trunks either extending to the information operator's position or to the distant offices. These switches are under the control of the toll operator's position 10 by the registration of a code designation in the sender 11. These registrations control the marker 12 for operating the switches for connecting the incoming trunk to either an information operator's outgoing trunk or an outgoing trunk to a toll office selected by the marker according to the registrations therein.

When a subscriber connected with the distant office 1 has called for a wanted party in another city, a connection is completed to a toll office in this other city which may have equipment as diagrammatically shown. The toll operator in the distant office 1 actuates the apparatus of the incoming trunk 2 which automatically causes the association of a link 7 between this incoming trunk circuit and a cordless operator's position 10. An automatically operable link which may be used for such connection is disclosed in the patent application to King-McKim-Myers, Serial No. 295,010, filed September 15, 1939 issued as Patent No. 2,236,246, March 25, 1941 and in the patent application to Busch-Scudder, Serial No. 295,012, filed September 15, 1939. This character of link is actuated by a calling incoming trunk for associating therewith, a common link con-

ductor 8, and control circuit 9 for selecting an idle channel entering one of a plurality of toll operator's positions 10. Each toll operator's position may have a plurality of channels entering the position circuit so that more than one calling incoming trunk may be associated with the position equipment at the same time. For example, an operator may receive a call over one channel and set the registers in the sender for completing this call. The operator may then immediately disassociate the calling trunk from the common position equipment and associate another incoming trunk with the position equipment for answering another call. During this period the registrations made in the sender for the first call have been transferred to the marker and the marker has accordingly set the switches 3 and 4 for connecting the incoming trunk to an outgoing trunk as designated. As soon as the connection has been completed by the marker the sender 11 and the position channel may be released from the connection. This channel is then free for another incoming call to the position 10. When the channel is released the operator's position 10 is entirely disassociated from the calling incoming trunk and the telephone connection which has been completed through this trunk to an information operator or a distant office.

It may be assumed for this disclosure that the calling subscriber entering the distant office 1 does not know the wanted subscriber's telephone number and that therefore the operator in the distant toll office 1 requests the toll position operator 10 to extend the connection to the information operator 6. The registers of the sender are set by the toll operator in position 10 according to the code of an outgoing trunk extending to the information operator's position. This registration is transferred to the marker 12 along with other registrations which automatically designate the character of the calling incoming trunk to the marker. This marker functions according to the registrations for selecting an idle outgoing trunk 5 extending to the information operator's switchboard 6 and operates the correct switches 3 and 4 for connecting the calling incoming trunk with the information operator's outgoing trunk. A signal is lighted in the information operator's switchboard to indicate that information is required by a calling subscriber or calling toll operator. After the request is made by the distant toll operator 1 the information operator refers to her directory and supplies the designation and number of the wanted subscriber's line to this distant toll operator. The information operator now disconnects the information switchboard apparatus from the information operator's outgoing trunk 5. By this time the toll operator's position equipment and the channel in position 10 may have been disconnected from the incoming trunk so that the operator in position 10 may handle other calls entering the channels of the position. The link switches 7 may also have been restored to normal so that at this time there is no connection between the calling incoming trunk and the toll operator's position 10. The operator in toll office 1 is given the information so that a record of the called party's designation may be made by the originating operator.

According to the present invention the disconnection of the information switchboard operating circuit from the information operator's outgoing trunk 5 energizes equipment in this out-

going trunk for reconnecting the calling incoming trunk to a channel of one of the toll operator's positions such as 10. The equipment of the information operator's outgoing trunk immediately energizes apparatus in the incoming trunk for actuating link switches such as 7 to obtain a channel into an idle operator's position. This reassociates the distant toll operator 1 with a toll operator in an idle position 10 so that the distant operator 1 may immediately transmit the wanted subscriber's designation to the toll operator in position 10. On certain types of toll calls supervision is retained by the toll operator in position 10 and under this condition the link may be automatically locked between the toll position and the incoming trunk. Under this type of traffic the equipment of the outgoing trunk energizes the equipment in the incoming trunk for giving the toll operator in position 10 a distinctive signal to indicate that the information operator has transmitted the called party's designation and that the distant toll operator again requires her attention for completing the telephone connection. It is well understood that the usual procedure for obtaining information has been different. The originating operator after obtaining the wanted subscriber's telephone designation from the information operator would again set up the telephone connection the same as when making the original call to obtain access to this information operator, which necessitates a loss of time and undue retention of the toll lines.

When the toll operator in position 10 has received the party designation from the distant office 1, registrations are again set up in sender 11 for selecting an outgoing trunk 13 to an office having the wanted subscriber therein. These registrations are transferred to the marker 12 in the same manner as for obtaining an outgoing trunk to the information operator and switches 3 and 4 are energized for associating the incoming trunk with the outgoing trunk 13 extending to the distant office. The subscriber in office 14 is then connected to the calling subscriber entering the distant toll office 1.

DETAIL DESCRIPTION

The assumption is made that a call has been received by a toll operator in the distant toll office 200 and that the subscriber making this call does not know the call designation of the wanted party and that the operator in the distant office 200 does not have a directory covering the subscribers' designations and station numbers in the distant city where the station is located. This toll operator in the office 200 will, therefore, establish a connection to the toll office in the area in which the called party is located and obtain the called party designation from an information operator in that city. Under present traffic conditions this connection is made to the information operator in the distant city, who transmits the called party designation to the originating toll operator. A second connection is then completed from the toll office 200 to the same toll office for completing a call to the wanted party but, as previously stated, according to the present invention, only one call to this toll office is required for reaching both the information operator and for completing the connection to the wanted party. In the present disclosure the distant office 200 is connected to the toll office having the wanted party therein by a ring-down intertoll trunk which is energized by transmitting ringing current from office 200 over toll

trunk conductors 240 and 241 to the incoming trunk of this office shown in Figs. 2 and 3. After the distant operator in office 200 has completed the operation of apparatus for the connection to the trunk, this ringing current is applied automatically or manually to conductors 240 and 241 and transmitted through the winding of alternating current relay 202 which is energized. The energization of relay 202 releases relay 205 which is normally energized from battery through its winding to ground on the contact of relay 202. The release of relay 205 establishes a circuit for operating the incoming trunk relay 302 over a circuit from battery through the winding of relay 302, contact 2 of relay 205, contact 7 of relay 220, contact 6 of relay 311 to ground. Relay 302 in operating establishes a locking circuit for itself through its contact 3, contact 7 of relay 220 to ground and contact 6 of relay 311. When ringing current is disengaged from the trunk conductors 240 and 241, relay 202 releases which reenergizes relay 205. A circuit is thus established for relay 213 from battery through its winding, contact 5 of relay 212, contact 2 of relay 205, contact 3 of relay 302, contact 7 of relay 220, contact 6 of relay 311 to ground. Relay 213 is locked through contact 4 of relay 301, contact 6 of relay 213 to its operating ground on contact 6 of relay 311. The operation of relay 213 now establishes a start circuit for a link which associates the incoming trunk and the operator at office 200 with the cordless operator whose telephone apparatus is shown in Fig. 9 of this disclosure. This link start circuit may be traced from ground through contact 3 of relay 213, contact 1 of relay 212, lead 343, winding of link start relay 610 to battery. The link connector and link control circuit is shown diagrammatically and only a brief description of associated elements is given. Reference is made to the patent application to King et al. Serial No. 295,010 filed September 15, 1939 for a complete disclosure of this link connector and link control circuit.

The energization of the link connector start relay establishes an obvious circuit for a relay such as relay 611 which is a multicontact relay for connecting a large number of leads from a plurality of link switches, trunks and position channels with the link control circuit 607. There is a plurality of selectable link control circuits 607 which plurality is small compared to the large number of switches 600 and 601. The link connector 606 finds an idle link control circuit before operating the multicontact relay 611 for connecting a number of position channels with the link control circuit and a group of trunks having the calling trunk therein with the link control circuit. The switch 600 is one representative primary link switch of a plurality of horizontal levels and verticals constituting primary link cross-bar switches. Switch 601 is one representative secondary link switch of which there are a large plurality in vertical and horizontal levels connected to channels in a plurality of cordless toll positions. The function of the link control circuit is to test a plurality of channels entering a number of cordless toll positions to obtain an idle channel and the services of the toll operator in the cordless position to which this channel is connected. In view of the fact that each channel is connected to a different switch, such as 601, the test of the channel determines the secondary switch to be used. This secondary switch is connected to

a particular vertical of a primary switch such as 600 and the horizontal level of this primary switch is connected to the calling incoming trunk. The hold magnets for these primary and secondary switches are in multiple as shown.

An idle channel in a position having an operator in attendance has battery on lead 730 and ground on lead 731. Ground is placed on lead 731 by the operation of relay 701 actuated when relay 715 is actuated. Relay 715 is only actuated when an operator is serving the cordless position. The circuit for relay 715 may, thus, be traced from battery through its winding, contact 1 of relay 702 to ground through jack 904 which has its contact closed when the telephone operator's headset plug 906 is inserted therein. Relay 701 has as many contacts thereon as there are channels in the position and its operation makes all channels idle which are not in use as will be seen from the description of the channel apparatus. The testing apparatus of the link control circuit is such that when battery is found connected to lead 730 and ground is found connected to lead 731 a relay, such as 614, is energized. This relay is not directly energized as shown, but is energized by delicate testing apparatus in this control circuit responsive to a test of the position channels. Other apparatus is included in the control circuit, as fully described in the aforementioned patent application to King, et al. which determines the primary switch, such as 600, which is connected to the calling trunk and the secondary switch, such as 601, which is connected to the idle channel found by the control circuit. When this has been determined, the primary select magnet 602 is energized from ground through its winding, contact of multicontact, relay 11 to battery on the contact of a control circuit relay. The select magnet 603 of the secondary switch, connected to the idle channel, is also operated from ground through its winding, contact of relay 611 to battery on a contact of a control circuit relay. The closure of the contact of select magnet 602 establishes a circuit for control circuit relay 613 and the closure of the contact on select magnet 603 establishes a circuit for relay 612. The circuit for relay 612, it will be noted, extends through the contact of relay 614 operated by the testing apparatus of the link control circuit. The operation of relays 612 and 613 establishes a circuit for the hold magnets of the primary and secondary switches. This circuit may be traced from ground through the contacts of relays 613 and 612, contact of the multicontact relay 611, winding of hold magnet 604 to battery and the winding of hold magnet 605 to battery which closes the cross-points of the primary and secondary switches 600 and 601. This connects the incoming trunk, Figs. 2 and 2, with the channel and toll position apparatus shown in Figs. 7, 8 and 9.

Position channel

Relay 711 is immediately operated from battery through its winding, contact 3 of switch 601 to the ground on the contact of relay 613 used for operating the hold magnets. The operation of relay 711 removes battery from the lead 730 and ground is associated therewith. Ground is disassociated from lead 731 and this lead remains open. Relay 710 is also operated from battery through its winding, contact 2 of relay 703, conductor 625, contacts 7 of switches 601 and 600, lead 337, contact 2 of relay 212

to ground on contact 2 of relay 213. The operation of relay 711 establishes obvious circuits for lighting the busy lamp 707 and the guard lamp 706. Relay 710 establishes an obvious circuit for lighting guard lamp 709. The operation of both relays 710 and 711 establishes a circuit for energizing the channel relay which, in this instance, has been shown as relay 702. There are as many relays, such as 702, as there are channels in a cordless position circuit. These relays are in a chain circuit to prevent seizure of more than one channel at a time as shown in the aforementioned patent application to King et al. The circuit for relay 702 may be traced from battery through its winding, contact 1 of relay 710, contact 3 of relay 711, contact 2 of relay 702, contact 1 of relay 715 to ground. Relay 702 in operating establishes a locking circuit for itself from battery through its winding, contact 1 of relay 710, contact 3 of the relay 711 to ground through contact 2 of relay 702. This relay also opens the operating circuit for relay 715 extending through its contact 1 and establishes a circuit for relay 713. The circuit for relay 713 may be traced from battery through its winding, contact 1 of relay 702 to ground on the contact of the operator's jack 904. The release of relay 715 opens the circuit for relay 701 to cause its release so that all channels of the position are made busy during the period required by the operator in serving the call entering her position. The operation of relay 713 establishes a circuit for operating relay 703 from ground through contact 4 of relay 712, contact 6 of relay 713, winding of relay 703 to battery and alters the guard lamp 709 from a steady to a flashing condition by the connection of ground from interrupter 708 through the lamp filament. This flashing signal indicates to the position operator that an incoming trunk has been connected to an idle channel of the position and is a preparatory signal in advance of a tone signal given to the operator a fraction of a second later. Relay 713 establishes a holding ground circuit through its contact 3 and contact 4 of relay 711 for the hold magnets 604 and 605 and for locking relay 711. The switches 600 and 601 are, therefore, no longer dependent upon the link control circuit for maintaining their holding circuit. The operation of relay 703 closes circuit paths for the talking and signaling conductors from the link switch and incoming trunk to the cordless position apparatus, opens the locking circuit for relay 710 which restores to normal and closes an operating path for relay 704. The circuit from relay 704 is established from ground on the contact of a relay in the position control circuit not shown, through contact 9 of relay 703, winding of relay 704 to battery. This position control circuit may be the same as disclosed and described in detail in the aforementioned patent application to King et al. Serial No. 295,010 filed September 15, 1939.

Link release

The operation of relay 703 energizes relay 212 in the incoming trunk circuit for opening the link start circuit extending to relay 610 and for energizing other apparatus of the trunk circuit. This circuit may be traced from ground on a contact of a relay in the position sender, not shown, through contact 5 of relay 703, lead 620, contact 12 of switches 601 and 600, lead 342, contact 2 of relay 220, contact 3 and the winding of relay 212 to battery. Relay 212

establishes a locking circuit for itself to ground on contact 6 of relay 311 through a circuit including contact 5 of relay 213, contact 2 of relay 205, contact 3 of relay 302, and contact 7 of relay 220. The operation of relay 212 removes the start circuit ground from lead 343 which extended through its contact 1 and causes the release of relay 610 in the link connector circuit. The release of relay 610 causes the release of relays 611 and 613. Relays 612 and 614 were released when the position channel was made busy. This link connector apparatus and the link control apparatus are now released and may serve other calls entering the telephone office. As previously stated, a ground is supplied from the position circuit for maintaining the hold magnets 604 and 605 operated and, therefore, the switch connection between the position channel and the trunk to the calling office 200 remains established.

Position circuit

A circuit is now established for energizing the splitting relay 301 for separating the inward and outward ends of the trunk circuit. This circuit may be traced from battery through the lower winding of relay 301, contact 4 of relay 212, lead 336, contact 6 of switches 600 and 601, lead 626, contact 8 of relay 703 to ground on the contact of a relay in the position control circuit or key 727 when actuated by the toll operator. A circuit is also established for relay 213, traced from battery through its winding, contact 4 of relay 301, contact 4 of relay 212 thence over lead 336 to ground connected to contact 8 of relay 703 over the circuit traced for operating the splitting relay 301. The forward end of the trunk is now connected with the cordless position circuit.

Position signals

The forward relay, such as 704, of the position channel is operated if no other forward relay in a sequence circuit of the channel is operated. The circuit for this relay is established when the backward relays 703 and 713 of the channel are operated. An arrangement of signals is provided which are operated by relay combinations in the position circuit under the control of apparatus in the incoming trunk circuit operated in response to incoming calls or recalls, such, for example, as the apparatus of the ring-down incoming intertoll trunk circuit, Figs. 2 and 3, or incoming intertoll trunks of other characters which have apparatus responsive to different signals transmitted over the toll lines or trunks. The operation of apparatus in the incoming trunk circuit under different conditions connects battery through different values of resistance over lead 337 to the position circuit. This lead 337 may be traced to the position circuit through contacts 7 of the link switches, Fig. 6, to lead 625, contact 2 of relay 703 and thence through the windings of marginal relays 814, 815 and 816 to ground. The number of these relays operated depends upon the value of resistance associated therewith responsive to calls of different character. For example, when a call is a new call for connection to an outgoing toll trunk, relay 212 is operated which associates resistance 230 in circuit with relays 814, 815 and 816. The value of resistance 230 is such that only relay 814 is operated. This establishes a circuit for relay 803 from battery through its winding, normal contact of relay 815, contact of relay 814

to ground. This causes the transmission of a distinctive tone to indicate that the call to be answered by the cordless operator is a new call. In this case the apparatus of the position control circuit will establish a circuit for relay 817. For a recall from the calling distant operator, the same circuit will be established with the exception that relay 828 in the position control circuit is operated and there will be no circuit for operating relay 817; therefore, on a recall, a circuit is established to light lamp 810 and a distinctive tone is transmitted to indicate this type of call. When a recall is made from the information operator's trunk disclosed in Fig. 5, circuits are established for relays 212, 317 and 312 of the incoming trunk circuit, Figs. 2 and 3. The operation of the above three relays connects resistances 322 and 230 in multiple and these multiple resistances are connected in series circuit with relays 814, 815 and 816. The value of resistance 322 in multiple with resistance 230 is such as to cause the operation of relays 814 and 815. The operation of both relays 814 and 815 establishes an obvious circuit for relay 802 which lights lamp 811 and associates a distinctive tone with the operator's headset. A different signal is given when the distant called party does not answer. In this case, incoming trunk relays 212 and 317 are operated which connects resistances 321 and 230 in series with relays 814, 815 and 816. The value of resistance 321 in multiple with resistance 230 is such as to cause the operation of all of the above relays. The operation of these three relays establishes an obvious circuit for both relays 802 and 803 which lights lamp 812 through their contacts and establishes a circuit for a distinctive tone.

The tone circuit, known as the order tone, for indicating to the operator that a particular connection has been established which is either a new call, a recall or that the connection desired has not been established. This tone circuit is established by the operation of relays shown in the left portion of Fig. 8 over the control relays 814, 815, 816, 802 and 803. The operation of either relay 802 or 803 indicates to the position operator that the incoming call is from a ring-down intertoll trunk and also establishes a characteristic circuit to the marker. With these relays released, circuits are established for indicating that the call is from a straightforward intertoll trunk. In the case where both relays are released three pulses of order tone are transmitted to both the distant operator and the cordless operator. When only one of the above relays is operated, the tone will be transmitted only to the cordless operator. One pulse of tone is transmitted when relay 802 is operated and two pulses of tone are transmitted when relay 803 is operated.

Position tone circuit

The order tone relay operating circuit is established from the position control circuit which associated ground with lead 829 through contact 4 of relay 804, lead 830, contact 4 of relay 820, contact 4 of relay 818, winding of relay 821 to battery. The operation of relay 821 is the first of a series of operations for energizing and deenergizing the tone circuit. This tone circuit may be traced from tone source 822 through various contacts of relays 813, 818, 819, 820 and 821 thence through the right winding of tone transformer 805 to ground. When either or both relays 802 and 803 are operated the tone is trans-

mitted by induction through tone transformer 805, contacts 1 and 5 of relay 804 to the talking conductors which in one case extend through contacts 1 and 4 of relay 901 and the windings of transformer 902 by induction only to the cordless operator's headset. When relays 802 and 803 are both released the tone is transmitted through contacts 1 and 5 of relay 803, contacts 1 and 6 of relay 802 thence to the contacts of relays 801 and 800, contacts 3 and 4 of relay 703, leads 630 and 631 over the trunk conductors to the distant operator in office 200 in addition to being transmitted to the cordless operator.

The sequence of operations of the tone relays is as follows: Relay 821 operates to ground 831 as previously traced. The operation of this relay establishes a circuit for relay 820 to the same ground through contact 4 of relay 821 and contact 4 of relay 819. The operation of relay 820 closes the tone circuit through its contact 3 from the tone source 822 and the tone coil 805. Relay 820 locks through its contact 4 and contact 4 of relay 819 which opens the operating circuit for relay 821 and the latter relay releases. A circuit is thus established for relay 819 through contact 5 of relay 820 and contact 3 of relay 821. The operation of relay 819 opens the tone circuit for ending the first impulse of tone. The circuit for relay 820 is opened by the operation of relay 819 causing its release. A circuit is now established for relay 818 through contact 1 of relay 819 and the latter relay releases. A circuit is thus established for relay 821 through contact 6 of relay 819 and contact 4 of relay 820. The circuit for relay 819 is thus opened causing its release. A second impulse of tone is started by again closing the tone circuit through contact 1 of relay 821, contact 1 of relay 820 normal, contact 1 of relay 818 which is operated, and through coil 805 to ground. A circuit is thus established for relay 820 which is the same as the circuit over which it was previously operated. A circuit is also established for relay 813 through contact 2 of relay 818, which is held locked, contact 2 of relay 820 and contact 1 of relay 819 to the original ground as traced. Relay 813 locks to this same ground. The operation of relay 820 opens the circuit for relay 821 causing its release and opens the tone circuit which ends the second pulse of tone. A circuit is now established for relay 819 which circuit is the same as previously established for this relay. This closes the tone circuit for a third impulse of tone and opens the circuit for relay 820. This is the last tone circuit established and may be traced from the tone source 822 through contact 1 of relay 821, contact 2 of relay 819, contact 3 of relay 813, winding of the tone coil 805 to ground. Relay 821 is now energized through contact 6 of relay 819, contact 4 of relay 820 over leads 830 and 829 to the original ground. The operation of relay 821 opens the tone circuit and terminates the third impulse of tone and also establishes a circuit from battery through the winding of relay 804, contact 1 of relay 813, contact 2 of relay 820, contact 2 of relay 821 to the original ground. Relay 804 in operating establishes a locking circuit for itself through its contact 4 to ground over lead 829. The operation of relay 804 separates leads 829 and 830 at its contact 4, thus releasing all of the relays which were held to this ground including 813, 818 and 821.

The foregoing describes the operation of the

tone circuit for transmitting three tones which is the maximum used in this circuit arrangement. As previously explained three tones are used when the toll call is incoming over a straightforward trunk and may indicate a new call over this trunk or a recall by the originating distant operator. A call from an originating operator over an incoming ring-down trunk actuates relay 803 either when this call is a new call or when it is a recall from the originating operator. A recall from the information operator operates relay 802 and when the called party does not answer both relay 802 and relay 803 are operated but relay 802 is the only one effecting the control of the tone circuit. Under the conditions of a new call or recall from the originating operator using an incoming ring-down inter-toll trunk the operation of relay 803 causes one pulse of tone to be transmitted only to the cordless operator. The talking circuit to the incoming trunk is opened to contacts 1 and 5 of relay 803 and thus this one pulse does not reach the incoming trunk. The operation of relay 803 establishes a circuit for relay 804 after one pulse of tone has been transmitted. This circuit may be traced from battery through the winding of relay 804, contact 2 of relay 802 which is normal, contact 2 of relay 803, operated, contact 1 of relay 819 which is operated at this time and thence to ground over leads 830 and 829 through contact 4 of relay 804. Relay 804 in operating separates leads 830 and 829 and locks through its contact 4 to lead 829. As previously stated the operation of relay 804 releases the tone actuating relays and ends the transmission of tone after one pulse. The operation of relay 802 on a recall from an information operator's desk causes the transmission of two pulses of tone to the cordless operator. These pulses do not reach the incoming and outgoing trunks. The operation of the tone circuit relays proceeds as previously described until relay 820 operates a second time. A circuit is thus established for relay 804 from battery through its windings, inside contact 2 of relay 802, contact 2 of relay 818, contact 2 of relay 820, contact 2 of relay 821 to ground over lead 829. Relay 804 opens the tone circuit as previously described and locks through its contact 4 to lead 829. The foregoing indicates the action in the cordless toll operator's position circuit both for a new call entering this position as previously described, and for a recall from the information operator's desk which occurs in a manner to be presently described.

Toll operator

The cordless toll operator challenges the calling operator in toll office 200 when she observes the flashing lamp 709 and hears the single pulse of tone. As previously stated, this description assumes that the distant toll operator in toll office 200 requests a connection to the information operator and consequently the cordless toll operator manipulates the key-set in her position for controlling the apparatus of the sender 415 and the marker 416 which operates the cross-bar switches of Fig. 4 for connecting the incoming intertoll trunk, Figs. 2 and 3, with an outgoing trunk, Fig. 5, extending to an information operator's position in an information switch-board office disclosed diagrammatically in the right portion of Fig. 5. Reference is made to the Patent 2,236,246 to King-McKim-Myers March 25, 1941 for a complete description of the cordless toll position equipment, position control cir-

cuit, position sender 415 and marker 416 for operating the apparatus of this office to complete the connection between the incoming intertoll trunk and the information operator's trunk.

As covered in the aforementioned patent application to King et al. the cordless toll operator sets a plurality of keys in her key-set for registering the code designation of the information operator's outgoing trunk in the position sender 415. The code designation from the sender 415 is transmitted to the marker 416 along with other information including the character of the calling incoming trunk which sets the registers in the marker for completing the connection. The apparatus of the marker is automatically operated for testing a plurality of trunks extending to the information operator's switchboard. Such trunks are represented in the marker on what are known as trunk block or trunk group relays which may be associated in groups with the testing apparatus of the marker. When an idle outgoing trunk to the information operator's switchboard is found, a ground is connected with a relay such as relay 503, shown in the information operator's trunk circuit, Fig. 5. A number indicating system is included in the marker in order that the location of switches, such as switch 404, connected to the information operator's trunk and switch 401, connected to the calling incoming trunk will be designated to the marker. This designation enables the marker to find an idle junction between switches 401 and 404 constituting switches 402 and 403 and their connecting conductors. The control relays 413 and 414 are operated for associating the marker with the switching apparatus associated with the switches 401, 402, 403 and 404. This idle junction having been found, the select magnets 405, 406, 407 and 408 are operated and the hold magnets 409, 410, 411 and 412 are operated to close the contacts of the switches involved for connecting the incoming trunk, Figs. 2 and 3, with the information operator's trunk, Fig. 5. When the contacts of the switches 401, 402, 403 and 404 have been closed a ground is extended from the incoming trunk for maintaining the hold magnets operated after the marker is released from this connecting apparatus. This ground may be traced through contact 4 of the incoming trunk relay 302 which is operated, contact 9 of relay 301 normal, thence through the switch contacts, through the windings of each of the hold magnets 409, 410, 411 and 412 to battery and also through the winding of the information trunk relay 503 to battery. The association of this ground with the sleeve circuit of the switches and the sleeve on the outgoing trunk energizes apparatus in a potentiometer circuit of the marker as one phase of the marker release circuit.

Trunk lines

The cordless toll operator energizes one of two relays in the intertoll trunk circuit, depending upon the destination of the telephone connection. When the telephone connection is made to what is known as a terminating station, relay 217 is operated through the actuation of key 722. In certain instances this circuit is established automatically by the position control and marker apparatus as fully described in the patent application to J. B. McKim Serial No. 312,468, filed Jan. 5, 1940.

The circuit for relay 217 may be traced from ground through resistance 724 of the potenti-

ometer associated with key 722, thence through contact 4 of relay 704, lead 622, contact 10 of switches 601 and 600, lead 340, contact 7 of relay 213, winding of relay 217 to battery. The operation of relay 217 does not establish circuits in the incoming trunk at this time and is used for signaling paths responsive to circuits established at the outgoing end of the trunk. When a connection is extended through a distant toll office for a via connection using a high efficiency toll trunk, key 721 is energized which establishes an operating circuit for relay 214 in the incoming intertoll circuit or this circuit may be automatically established by the marker and position circuit. This circuit may be traced from ground to the potentiometer associated with key 721, contact of key 721, contact 5 of relay 704, contact 11 of switches 601 and 600, lead 341, contact 1 of relay 213, winding of relay 214, to battery. A locking circuit is established for either relay 217 or 214 through contact 9 of relay 301, contact 4 of relay 302 to ground. As previously stated, a supplemental locking circuit is held closed from the position circuit if at any time relay 301 is operated. Under certain circumstances, key 723 may be operated which establishes circuits for both relays 214 and 217. The operation of relay 217 either automatically or manually by the actuation of key 721 or key 723 establishes a locking circuit for switches such as 600 and 601 associated with a particular channel in a cordless switchboard position. This circuit may be traced from ground on contact 1 of relay 214, over lead 333, contact 3 of switch 600, winding of hold magnet 604 to battery, winding of hold magnet 605 to battery and winding of channel relay 711 to battery. Thus, a holding circuit is established which maintains signaling paths between the incoming trunk and associated apparatus and the cordless toll operator position so that if at any time a signaling circuit is actuated from the calling or called parties the cordless toll operator is advised by the actuation of a signal and may immediately respond by associating the position apparatus with this channel. When relay 217 is energized no holding circuit is established for the switch hold magnets and the channel is, therefore, released when position relays 735 and 736 are either automatically operated by the release of apparatus in the sender and position control circuit or are manually operated by the actuation of key 714. Under present practices, it is only possible to obtain the services of the cordless operator by manually initiating a recall from the calling or the called office.

Information desk outgoing trunk

As previously stated, relay 503 in the information desk outgoing trunk was operated when this trunk was seized by the marker 416 and as soon as the cross-bar switches, Fig. 4, were operated and the hold magnets associated with these switches energized, ground is associated with the hold magnets of all of the switches, Fig. 4, and with relay 503, Fig. 3, from the incoming trunk circuit, Figs. 2 and 3. This ground is constantly maintained either from the incoming trunk circuit as traced or by a ground from the cordless position circuit when the splitting relay 301 is operated. When the splitting relay 301 is operated by ground from the position control circuit or key 727 another ground is also established through contact 5 of relay 713, lead 624,

contact 9 of switches 601 and 600, lead 339, and thence over the sleeve lead to the hold magnets 409, 410, 411 and 412 and trunk relay 503. The operation of the cross-bar switches, Fig. 4, also establishes a circuit for trunk relay 504. This circuit extends from battery through the winding of relay 504, contact 4 of relay 504, lead 522, winding of retardation coil 501, thence over the ring conductor 520 and the contacts of the cross-bar switches, Fig. 4, to conductor 350 of the incoming trunk circuit, through retardation coil 303, contact 8 of relay 302 which is operated, lead 338, contact 8 of the link cross-bar switches 600 and 601, lead 623, contact 6 of relay 704 which is operated, contact of relay 719, normal, and through the high resistance winding of relay 717 to ground. Relay 717 operates in the circuit traced but relay 504 does not operate due to the high resistance of the right winding of relay 717. An obvious circuit is established for relay 718 which locks to ground through a position sender relay contact which is not shown. The operation of relay 718 connects ground from its contact 2 through the low resistance left winding of relay 717, thence over the circuit traced above through the winding of information trunk relay 504 to battery. Relay 504 now operates and locks to ground on the contact of relay 503. Relay 504, in operating, removes battery from the ring conductor extending through the cross-points of the cross-bar switches and through both windings of relay 717. This causes the release of relay 717. With relay 717 released and relay 718 operated an obvious circuit is established for relay 719 which operates. The open lead 522 in the information operator's trunk circuit, Fig. 5, is now connected to the filament of the supervisory lamp 706 through contact 6 of relay 704, contact of relay 719 and contact 7 of relay 704 to a junction between resistance 732 and the filament of lamp 706. It will be remembered that during the period when the apparatus of the office including the position channel sender and marker are in operation for setting the switches of Fig. 4, a circuit is constantly established for lighting lamp 706 from battery through its filament to ground on contact 6 of relay 711. The circuit arrangement established by relay 719 is for supervision from the distant end to shunt lamp 706 whenever ground is associated with lead 522. A ground placed on lead 522 through a low resistance, such as the winding of retardation coil 501, will shunt the battery supply for lamp 706 and thus extinguish the lamp.

The operation of the information operator's trunk relay 504 establishes a lamp signal in the operator's position. The circuit for this lamp may be traced from battery through resistance 507, contact 3 of relay 504, contact of relay 509 to ground through the filament of lamp 508. The information operator answers this signal by operating key 510 which associates the operator's telephone circuit with the talking conductors of the trunk and operates relay 509. The operation of relay 509 extinguishes lamp 508. The association of the operator's telephone circuit with the tip and ring conductors energized relay 502. This circuit may be traced from ground through the upper winding of relay 502, thence over the tip conductor of the trunk, upper contact of key 510, windings of coil 513, lower contact of key 510, ring conductor of the trunk, contact 1 of relay 504, lower winding of relay 502 to battery. The operation of relay 502 connects

ground through its contact, contact 2 of relay 505 normal, contact 2 of relay 504, winding of relay 505 to battery which operates relay 505. Relay 505 locks to ground through its contact 1 and contact 2 of relay 504 and thus remains operated until relay 503 is released since the relay 504 is locked to ground on the contact of relay 503. The information operator is now connected through her telephone set, shown in the right portion of Fig. 5, with the toll operator at the distant toll office 200, and a ground is connected to lead 522 for signaling the cordless operator that such connection has been completed. This ground may be traced from the contact of relay 502 through contact 2 of relay 505, contact 4 of relay 504, lead 522, thence through the winding of retardation coil 501 and over the ring conductor 520 to extinguish lamp 706 in the cordless operator's position over a circuit as previously traced. At this time the cordless operator may disconnect the cordless position apparatus and link apparatus from the connection by the operation of key 714 which operates relay 735 to open the locking circuit for trunk circuit relay 213 which releases. The release of relay 213 opens the locking circuit for splitting relay 301 which releases. The operation of relay 735 causes the operation of the slow operate relay 736 which releases relay 713 and the remaining position and channel apparatus. The position channel associated with the link switches 600 and 601 and the switches 600 and 601 are now released. In this case, the only connection remaining is between the information operator and the distant toll operator. Under other traffic conditions, the cordless operator may lock the channel extending to this cordless position and maintain a connection between the cordless position over this channel and the incoming trunk, Figs. 2 and 3. In this case, the link switches 600 and 601 remain operated and relay 711 in the cordless position channel remains operated. The position apparatus is, however, disassociated from this locked channel by the operation of key 714 and, consequently, the cordless operator may handle other calls until such time as a signal is received requiring attention to this particular channel. The channel apparatus is released with the exception of relay 711. The release of relay 704 connects the shunt path for lamp 706 directly through its contact 6 to the trunk line connection.

A circuit is established for operating the timing circuit 210 from interrupter 215 or 216 depending upon the relay 214 or 217 operated, and for operating the timing relay 208. This timing circuit is included in the incoming trunk circuit in order to signal the operator if the called party does not answer within a limited time and for establishing other signaling circuits as will be apparent. The circuit for relay 208 may be traced from 24-volt battery 325 through its winding, through relay contacts in the timing circuit 210, contact 3 of relay 201, contact 4 of relay 206, contact 2 of relay 313, contact 4 of relay 213 to ground on contact 3 of relay 214 or contact 3 of relay 217. It will be remembered that a ground was connected to lead 522 when the information operator actuated key 510. This ground extinguishes supervisory lamp 706 in the cordless operator's position unless the position apparatus has been previously disconnected. The connection of ground to lead 522 energized relay 313 which was not included in the foregoing description. Relay 313 is a differentially connected relay hav-

ing its windings normally connected together through a contact of relay 302. This relay does not energize in this local circuit which may be traced from ground through the left winding of relay 313, contact 5 of relay 302 to battery through the right winding of relay 313. When ground is connected to lead 522 extending through the winding of retardation coil 501 and over the ring conductor, a circuit is established through retardation coil 303, contact 8 of relay 302, contact 9 of relay 213, contact 10 of relay 301 to battery through the right winding of relay 313 which unbalances the current in this relay and causes its operation. The operation of relay 314 establishes a circuit for relay 318 from battery through its winding, contact 1 of relay 312, contact 4 of relay 313, contact 8 of relay 213 to ground through contact 2 of relay 214 or contact 4 of relay 217. The operation of relay 313 also causes the release of timing relay 208 by associating 48-volt battery 324 in circuit with the 24-volt battery 325. This circuit may be traced from 48-volt battery 324 through contact 3 of relay 316, contact 2 of relay 313, contact 4 of relay 206, contact 3 of relay 201, timing circuit 200, winding of relay 208 to 24-volt battery 325. The circuit for operating relay 208 extended from ground to the 24-volt battery and the reversal of current in the winding of relay 208 causes its immediate release. The release of relay 208 opens the circuit for the relays included in the timing circuit 210 which also release. When the relays of the timing circuit 210 have all released a circuit is reestablished for the timing circuit relay 208 which now operates from 24-volt battery 325 to the 48-volt battery 324 over the circuit as previously traced. The reestablishment of the timing circuit relays establishes a circuit for operating relay 316 which circuit may be traced from ground through contact 3 of relay 208, contact 4 of relay 201, contact 3 of relay 313, winding of relay 316 to battery. Relay 316 locks through its contact 2 to ground on contact 2 of relay 214 or contact 4 of relay 217. The operation of relay 316 again opens the circuit for timing relay 208 which releases and again releases the relays included in the timing circuit 210.

Automatic recall of cordless toll operator

The information operator responds to the signal given by lamp 508 and operates key 510 as previously described. This information operator then requests what information is desired and gives the telephone designation and number of the wanted party to the calling distant toll operator in telephone office 200. This information operator then disconnects by restoring key 510 to normal which releases relays 502 and 509. The release of relay 509 lights lamp 508 to signal the information operator that the trunk is still connected to the cross-bar switches and incoming trunk; Figs. 2, 3 and 4. This signal is extinguished when the switches are disconnected from the trunk to advise the information operator that the trunk is free. The release of relay 502 establishes a recall interrupter circuit by associating interrupter 506 with lead 522. The rotation of this interrupter intermittently associates an open circuit and a ground through contact 3 of relay 505, contact of relay 502, contact 2 of relay 505, contact 4 of relay 504, lead 522, winding of retardation coil 501, lead 520 and thence over the ring conductor through switches 404, 403, 402 and 401, retardation coil 303, con-

tact 8 of relay 302 which is operated, contact 9 of relay 213 which is released, contact 10 of relay 301 released, right winding of relay 313 to battery. When the information operator disconnected and relay 502 was released, the first open circuit from interrupter 506 causes the release of relay 313 by the action of its differential windings. The release of relay 313 reestablishes the operating circuit for timing relay 208 from battery through its winding, contact 3 of relay 201, contact 4 of relay 206, contact 2 of relay 313, contact 4 of relay 213 to ground on contact 3 of relay 214 or contact 3 of relay 217. The release of relay 313 also establishes a circuit to connect interrupter 315 with the timing relays which circuit may be traced from ground through interrupter 315, contact 1 of relay 316, contact 1 of relay 313, contact 3 of relay 206, contact 1 of relay 208 to timing circuit relays. A circuit for relay 312 is established from battery through its left winding, contact 2 of relay 318, contact 4 of relay 313, contact 8 of relay 213 to ground on contact 2 of relay 214, or contact 4 of relay 217. Relay 312 locks through its right winding to ground on contact 2 of relay 214 or contact 4 of relay 217. The rotation of interrupter 506 in the information operator's trunk circuit after a time interval associates ground with conductor 522 through relay contacts including contact 3 of relay 505, contact of relay 502, contact 2 of relay 505, contact 4 of relay 504 to conductor 522 which extends through the winding of retardation coil 501 to the ring conductor as previously traced and through the right winding of relay 313 to battery. Relay 313 is again unbalanced and operates. The operation of relay 313 opens the circuit for timing relay 208 causing this relay to again release. Since in this instance relay 316 is operated, a circuit for the timing relay will not be reestablished from 48-volt battery 324. This operation of relay 313 establishes a circuit for relay 317 which may be traced from battery through the winding of relay 317, contact 1 of relay 217, contact 1 of relay 318, contact 1 of relay 312, contact 4 of relay 313, contact 8 of relay 213, contact 2 of relay 214 to ground, or to ground through contact 4 of relay 217. Relay 317 locks to ground on contact 2 of relay 214 or contact 4 of relay 217 through contact 4 of relay 318. The operation of relay 317 opens the holding circuit for relay 212 which extended through contact 3 of relay 212, contact 1 of relay 317, contact 2 of relay 205, contact 3 of relay 302, contact 7 of relay 220 to ground on contact 6 of relay 311.

The responsive operations to the opening of the circuit for relay 212 depend upon which of relays 217 or 214 was operated when this call was set up by the cordless operator. Assuming that only relay 217 is operated, and that the link and channel were disconnected from the trunk, the release of relay 212 must energize apparatus for establishing circuits for obtaining the services of a link to again connect the incoming trunk circuit to a cordless toll operator's position. In this case the release of relay 212 reestablishes the operating circuit for relay 213 from battery through its winding, contact 5 of relay 212, contact 2 of relay 205, contact 3 of relay 302, contact 7 of relay 220 to ground on contact 6 of relay 311. The operation of relay 213 opens the locking circuit for relay 318 which extended through contact 8 of relay 213. Relay 318 releases and, in so doing, opens the locking circuits for relays 317, 312 and 316 which extended through contact 4 of relay 318. Relays 317 and 312 are slow to

release and establish new locking circuits through contact 4 of relay 213 to ground on contact 3 of relay 217. Therefore, at this time the only relays which are operated in the intertoll trunk circuit are relays 217, 302, 312 and 317 which remain operated, and relay 213 which was operated by the release of relay 212.

Link connection

The release of relay 212 and the reenergization of relay 213 establishes a start circuit to obtain the services of a link for reconnecting the calling toll operator in office 200 with the cordless toll operator of this telephone office without waiting for a new call from this operator. The link start circuit may be traced from ground through contact 1 of relay 214, contact 3 of relay 213, contact 1 of relay 212, lead 343, winding of link start relay 610 to battery. The energization of relay 610 establishes circuits for finding an idle link control circuit, such as 607, and operates a relay, such as 611, for connecting the control leads between the incoming trunk circuit and the control circuit. The operation of the link control circuit is the same as previously described for testing a plurality of channels entering the cordless toll positions and for energizing switches, such as 600 and 601, associated with an idle channel. The cordless operator's position and the channel in this position which is seized on this recall may be the same as for the original call or may be a different cordless position and a different channel than was taken for use when the toll operator 200 called for information, as previously described.

Signaling cordless toll operator

The operator's position circuit and channel apparatus is the same for all positions and thus only one is shown. The apparatus of the channel and the apparatus of the toll operator's position is energized for this automatic recall by the information operator's outgoing trunk in the same manner as previously described, including the operation of relays 710, 711, 713, 703 and 704 for making the channel busy and for associating the signaling circuits with the incoming trunk. The operation of relay 703 associates ground with conductor 620 extending through contacts 12 of switches 600 and 601, contact 2 of relay 220, winding of relay 212 to battery for reenergizing the latter relay in the incoming intertoll trunk circuit. The position signaling circuit is energized by battery through resistances 322 and 230 in multiple through contact 2 of relay 212, lead 337, contact 7 of switches 600 and 601, contact 2 of relay 703, windings of relays 814, 815 and 816 to ground. Relays 814 and 815 are operated which establishes a circuit for relay 802. A signaling path is completed for lighting a lamp in the toll operator's position and for establishing the tone circuit as previously described. The cordless toll operator immediately challenges the calling operator at the distant toll office 200 who now gives the code designation and number of the wanted party which is the code designation and number given to the distant toll operator in office 200 by the information operator. The cordless toll operator accordingly operates her key-set for setting the registers of a sender, such as 415, which in turn, operates the apparatus of a marker, such as 416. This marker now tests a plurality of outgoing trunks extending to an office according to the designation given by the toll operator 200. An idle trunk to the

wanted office is found and made busy by the marker which then energizes switches, such as shown in Fig. 4, for associating the calling incoming trunk, Figs. 2 and 3, with the outgoing trunk extending to the wanted office. The operation of the sender and marker for completing a connection of this character is as fully described in the aforementioned patent 2,236,246 to King et al., March 25, 1941.

In the case where the relay 214 was operated by the cordless toll operator for maintaining a channel locked between the position and the incoming intertoll trunk, Figs. 2 and 3, it is not necessary to again establish a link start circuit when the information operator disconnects from the information trunk shown in the left portion of Fig. 5. This link is locked by the association of ground through contact 1 of relay 214 with lead 333, contact 3 of switch 600, winding of hold magnet 604 to battery, winding of hold magnet 605 to battery and through contact 3 of switch 601, winding of relay 711 to battery. It will be remembered that trunk relays 312, 313 and 317 were energized when the information operator disconnected from the information trunk. The operation of relay 317 opens the holding circuit for relay 212 which releases. The release of relay 212 reoperates relay 213 which now establishes a circuit for the channel talking relay 710. The circuit for relay 710 may be traced from ground on contact 2 of relay 213, contact 2 of relay 212, lead 337, switches 600 and 601, contact 2 of relay 703, winding of talking relay 710 to battery. The apparatus of the channel and position circuit is operated as hereinbefore described. The operation of relays 312 and 317 associates resistances 322 and 230 in multiple with the signaling circuit in the cordless toll operator's position for energizing relays 814 and 815. This circuit is the same as previously traced from battery associated with the resistance 322 through contact 4 of relay 312, contact 2 of relay 317, contact 2 of relay 212, which places resistance 322 in multiple with resistance 230 and extends battery through this combined resistance value over lead 337 to ground through relays 814, 815 and 816. The operation of relays 814 and 815 establishes an energizing circuit for relay 802 which, as previously described, energizes the tone relays for giving a distinctive tone to the cordless toll operator. In addition to this, a signal is given to the operator by flashing lamp 706 when the interrupter 506 of the information operator's trunk is associated with the ring conductor. This flashing circuit is the same as previously described and, it is believed, need not be retraced. The foregoing signals are transmitted to the cordless toll operator immediately after the information operator has disconnected from the information trunk. The cordless toll operator challenges the toll operator in the distant toll office 200 shortly after the latter operator has received the information governing the code designation and number of the wanted party from the information desk operator.

Disconnection of switches

After an automatic recall by disconnection from the information office outgoing trunk the switches connecting the incoming trunk with this outgoing trunk are released by the operation of key 728 in the toll position which operates the splitting relay 301 to open the ground connected to the sleeve lead 352. This ground normally extends from contact 4 of relay 302 through con-

tact 9 of relay 301. When the switches of Fig. 4 are to be held the splitting relay is operated by a key such as 727 so that ground is extended through contact 5 of relay 713 thence over lead 624 to the incoming trunk circuit lead 352 and the hold magnets. The hold magnets 409, 410, 411 and 412 are released and relay 503 in the information operator's outgoing trunk is also released. This releases the apparatus of the outgoing trunk circuit since relay 504 was held operated to ground on relay 503 and relay 595 was locked through contact 2 of relay 504. After receiving the code designation and number of the wanted party, the cordless operator proceeds in a manner previously described for setting the position key key-set which operates the position sender 415 and the marker 416 for completing a connection to the designation office given by the calling toll operator in office 200.

It may be seen from the foregoing that a considerable saving is made in the holding time of toll lines by the adoption of the circuit according to the invention since with other traffic practices known in the art time is consumed by the originating toll operator in office 200 in recalling the cordless toll operator to give her the office designation transmitted by the information operator. This time is consumed in setting up apparatus in office 200 in a similar manner to that described for the cordless operator in this office. After this apparatus has been set up ringing current is transmitted as described for again operating the apparatus of the incoming trunk, such as shown in Figs. 2 and 3. After the apparatus of the incoming trunk is again energized the cordless operator is reached by the actuation of a link in a manner previously described. In the present arrangement, according to this invention, the cordless operator is immediately reassociated with the incoming intertoll trunk from the distant office 200. The toll connection to the wanted party is thus completed in a minimum time period and a saving is made in the holding time of expensive toll trunks.

What is claimed is:

1. In a toll telephone system, an office having a plurality of attending toll operators' positions therein, distant offices having operators therein, links, incoming trunk lines from said distant offices having link actuating means and signaling means, means in an incoming trunk responsive to a call initiated by an operator in a distant office for establishing a link actuating circuit, means in a link responsive to the establishing of said actuating circuit for connecting said calling incoming trunk to an idle attending operator's position, an information operator's switchboard, outgoing trunks to said information switchboard, outgoing trunks to telephone stations, means in said attending operator's position for controlling the connection of said incoming trunk to an outgoing trunk extending to an information operator's switchboard, means for disconnecting said attending operator's position from said calling incoming trunk, means for connecting the equipment of the information operator's switchboard with said outgoing trunk for transmitting information to said calling operator and for disconnecting the information equipment from said outgoing trunk, and means in said outgoing trunk responsive to said disconnection for reconnecting said calling incoming trunk and consequently the calling operator with an at-

tending toll operator's position for completing a desired telephone connection.

2. In a toll telephone system, an office having a plurality of attending toll operators' positions therein, distant offices having operators therein, means for automatically connecting an incoming trunk to one of said attending toll operators' positions responsive to an incoming call over said trunk, an information operator's switchboard, outgoing trunks to said information switchboard, means in said operator's position for controlling the connection of said incoming trunk to an outgoing trunk extending to an information operator's switchboard, means for disconnecting said toll position from said calling incoming trunk, means for connecting the equipment of the information switchboard with said outgoing trunk for transmitting information to the operator in said distant office covering a station designation and for disconnecting the information switchboard equipment from said outgoing trunk, and means in said information operator's outgoing trunk circuit responsive to said disconnection for automatically adjusting the apparatus of the calling incoming trunk circuit for reassociating said incoming trunk circuit with one of said operators' positions.

3. In an automatically operable telephone office, incoming trunks, operators' positions, links, means in an incoming trunk responsive to an incoming call over said trunk for operating an idle link, means in said link for automatically selecting an idle operator's position for connecting said incoming trunk to said position, an information operator's switchboard, outgoing trunks to said switchboard, a register control device, means in said selected idle operator's position for setting the registers in said control device, means in said control device responsive to said setting for automatically selecting an idle trunk to an information operator's switchboard, means for releasing said link for disconnecting said operator's position from said calling incoming trunk, means for connecting said switchboard to said idle outgoing trunk for transmitting information over said calling incoming trunk and for disconnecting said switchboard from said outgoing trunk, and means responsive to said disconnection for reactivating a link to connect said incoming trunk with an idle operator's position.

4. In a telephone office, incoming trunks from distant offices, operators' positions, means for automatically connecting an incoming trunk to one of said operators' positions responsive to an incoming call over this trunk, an information operator's switchboard, outgoing trunks to said information switchboard having pulsing devices, means in said operator's position for controlling the connection of said incoming trunk to one of said outgoing trunks, means for releasing said link for disconnecting said operator's position from said calling incoming trunk, means for connecting the information switchboard equipment with said outgoing trunk for transmitting information to the operator in said distant office covering a station designation and for disconnecting the information switchboard equipment from said outgoing trunk, equipment in said outgoing trunk circuit responsive to said disconnection for associating said pulsing device with the equipment of said incoming trunk circuit, and means in said incoming trunk circuit operably responsive to pulses from said device for

reconnecting the operator in the position with the calling distant office.

5. In a toll telephone system, an office having a plurality of attending toll operators' positions therein, distant offices having operators therein, links, incoming trunk lines from said distant offices having link actuating means and signaling means, means in an incoming trunk responsive to a call initiated by an operator in a distant office for establishing a link actuating circuit, means in said link responsive to the establishing of said circuit for connecting said calling incoming trunk to an idle attending operator's position, an information operator's switchboard, outgoing trunks to said switchboard having pulsing devices, means in said operator's position for controlling the connection of said calling incoming trunk to one of said outgoing trunks, means in said outgoing trunk for operating an information switchboard signal, means for connecting the information switchboard equipment with said outgoing trunk for transmitting information to the operator in said calling office covering a station designation and for disconnecting the information operator's switchboard equipment from said outgoing trunk, a relay in said outgoing trunk circuit operable in response to the connection of said information switchboard equipment for transmitting a signal to the attending toll operator's position and for operating a second relay which is locked in its operated position, said first relay being released responsive to the disconnection of the information switchboard equipment from said outgoing trunk, means for releasing said link for disconnecting said attending operator's position from said calling incoming trunk, a circuit established by the release of said first relay through the contacts of said second locked relay for connecting said pulsing device with the equipment of the incoming circuit, means in said incoming trunk circuit responsive to pulses from said pulsing device for adjusting said incoming trunk circuit equipment to reestablish said link actuating circuit for reconnecting said incoming trunk circuit and the calling office with an attending toll operator's position.

6. In a toll telephone system, an office having a plurality of attending toll operators' positions therein, distant offices having operators therein, links, incoming trunk lines from said distant offices having link starting means and signaling means, means in an incoming trunk responsive to a call initiated by an operator in a distant office for establishing a link actuation circuit, means in said link responsive to the establishing of said circuit for connecting said calling incoming trunk to an idle attending operator's position, an information operator's switchboard, outgoing trunks to said switchboard having pulsing devices, means in said operator's position for controlling the connection of said calling incoming trunk to one of said outgoing trunks, means in said outgoing trunk for operating an information switchboard signal, means for connecting the information switchboard equipment with said outgoing trunk for transmitting information to the operator in said calling office covering a station designation and for disconnecting the information operator's switchboard equipment from said outgoing trunk, a relay in said outgoing trunk circuit operable in response to the connection of said information switchboard equipment for transmitting a signal to the attending toll operator's position and for operating a second relay which is locked in its

operated position, said first relay being released responsive to the disconnection of the information switchboard equipment from said outgoing trunk, means for releasing said link for disconnecting said attending operator's position from said calling incoming trunk, a circuit established by the release of said first relay through the contacts of said second locked relay for connecting said pulsing device with the equipment of the incoming circuit, means in said incoming trunk circuit responsive to pulses from said pulsing device including a plurality of relays for adjusting said incoming trunk equipment to reestablish said link actuating circuit for reconnecting said incoming trunk circuit and the calling office with an attending toll operator's position and for adjusting said incoming trunk circuit equipment for transmitting signals to said attending operator's position for indicating the character of call incoming to said position.

7. In a toll telephone system, an office having a plurality of attending toll operators' positions therein, distant offices having operators therein, links, incoming trunk lines from said distant offices having link starting means and signaling means, means in an incoming trunk responsive to a call initiated by an operator in a distant office for establishing a link actuating circuit, means in said link responsive to the establishing of said circuit for connecting said calling incoming trunk to an idle attending operator's position, an information operator's switchboard, outgoing trunks to said switchboard having pulsing devices, means in said operator's position for controlling the connection of said calling incoming trunk to one of said outgoing trunks, means in said outgoing trunk for operating an information switchboard signal, means for connecting the information switchboard equipment with said outgoing trunk for transmitting information to the operator in said calling office covering a station designation and for disconnecting the information operator's switchboard equipment from said outgoing trunk, a relay in said outgoing trunk circuit operable in response to the connection of said information switchboard equipment for transmitting a signal to the attending toll operator's position and for operating a second relay which is locked in its operated position, said first relay being released responsive to the disconnection of the information switchboard equipment from said outgoing trunk, means for releasing said link for disconnecting said attending operator's position from said calling incoming trunk, a circuit established by the release of said first relay through the contacts of said second locked relay for connecting said pulsing device with the equipment of the incoming trunk circuit, means in said incoming trunk circuit including a relay which releases and operates responsive to impulses from said pulsing device for successively releasing certain trunk circuit relays and operating other trunk circuit relays for reestablishing such link actuating circuit to reconnect said incoming trunk circuit and the calling office with an idle attending operator's position and for establishing a signal circuit in said attending operator's position for indicating the character of call incoming to said position.

8. In a telephone system, a telephone office, incoming trunks, outgoing trunks, switches for interconnecting said incoming and said outgoing trunks, a plurality of call completing operator's positions, means responsive to an incoming call for selecting any idle one of said positions for connecting the calling incoming trunk therewith,

a second operator's position, means in said completing operator's position for operating said switches to connect said incoming trunk with an idle outgoing trunk extending to said second operator's position, means for disconnecting said completing operator's position from the incoming trunk, means for disconnecting said outgoing

5 trunk from said second operator's position and means in said outgoing trunk responsive to said latter disconnection for causing the selection of any idle one of said completing operator's positions and associating said calling incoming trunk therewith.

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