

Oct. 4, 1949.

R. C. MATHES

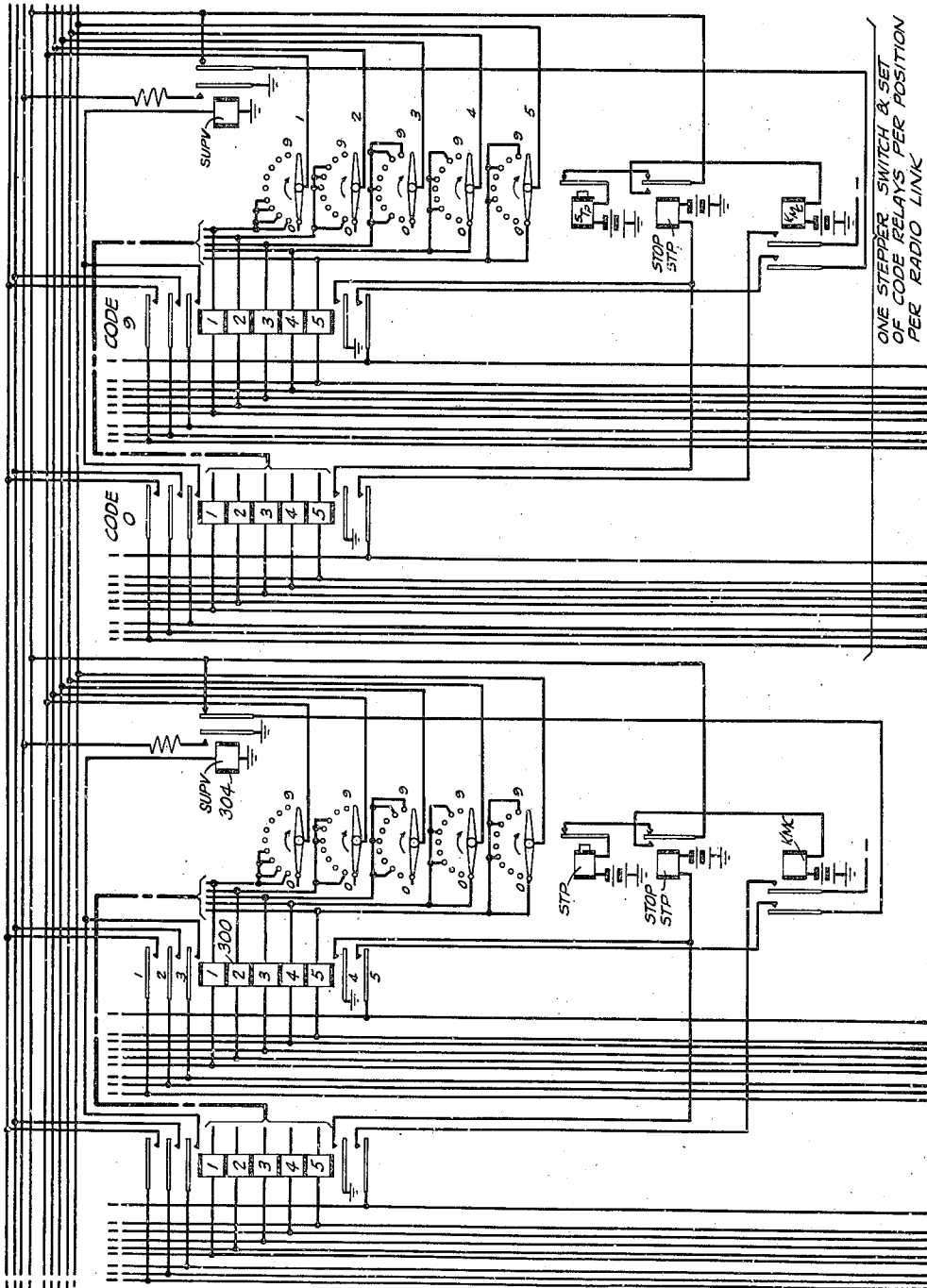
2,483,732

SIGNALING CIRCUIT

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8 Sheets-Sheet 2

FIG. 3



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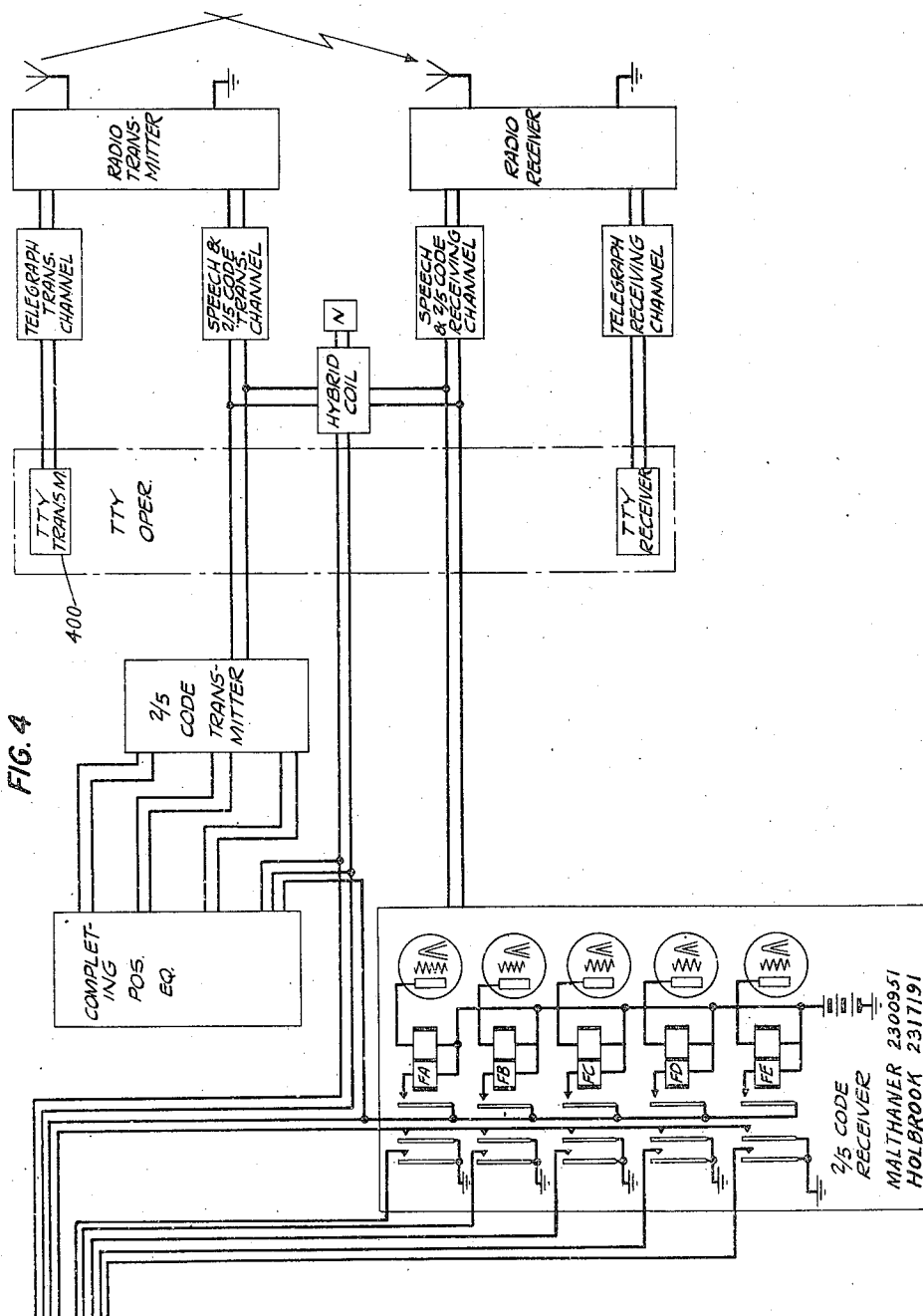
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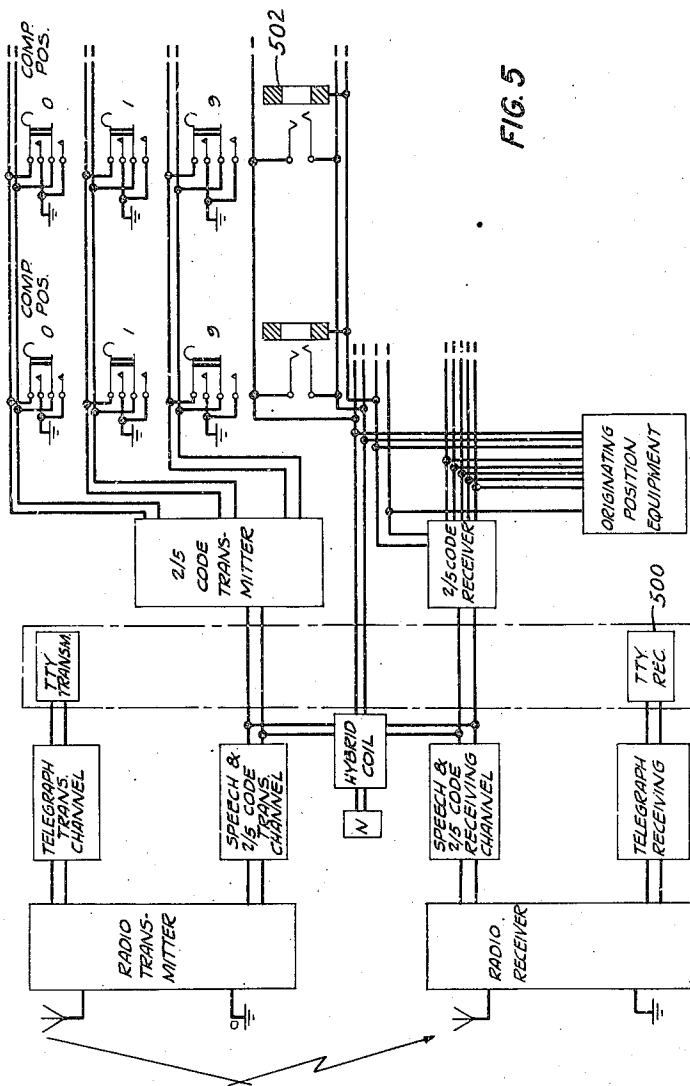
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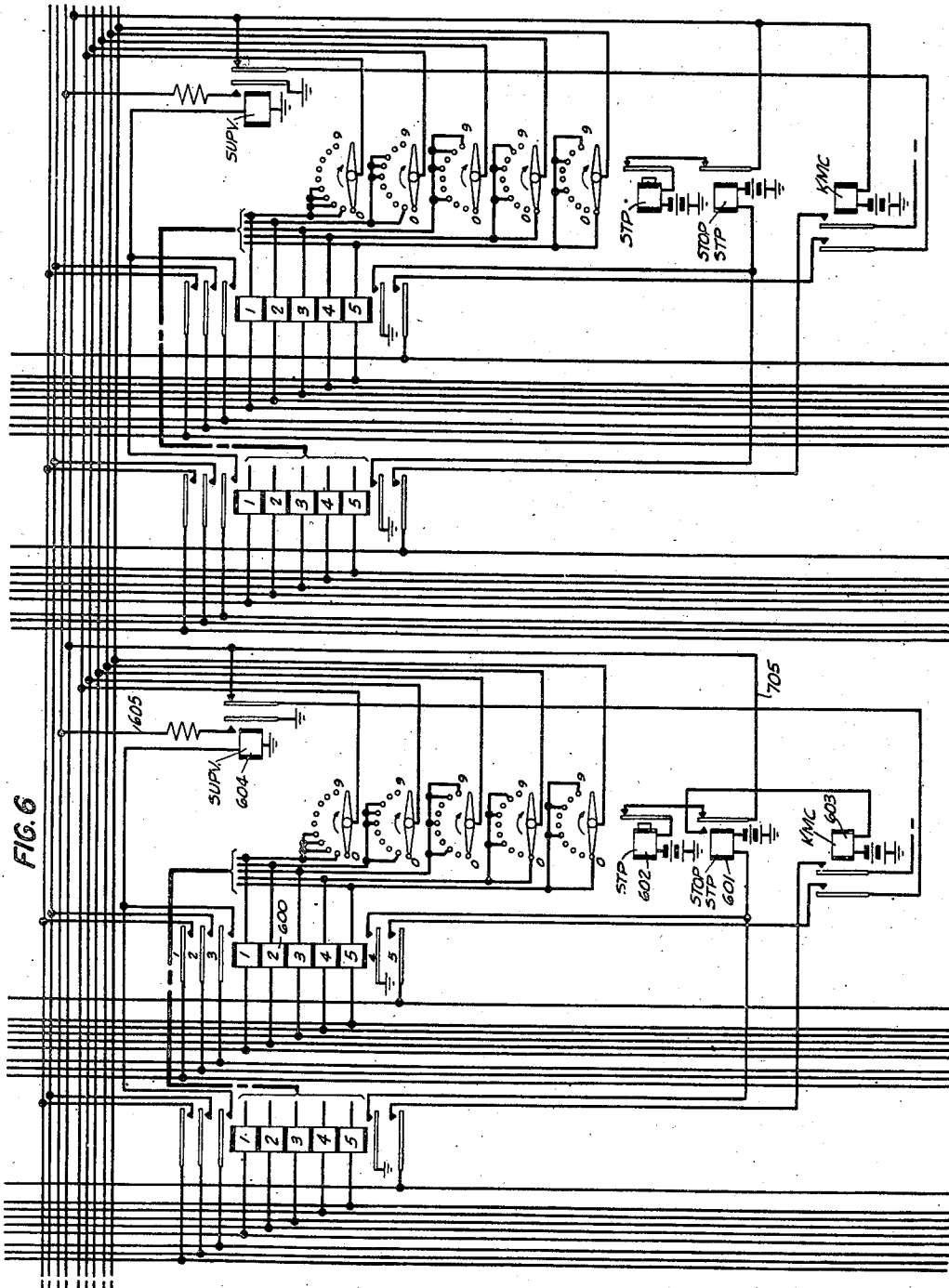
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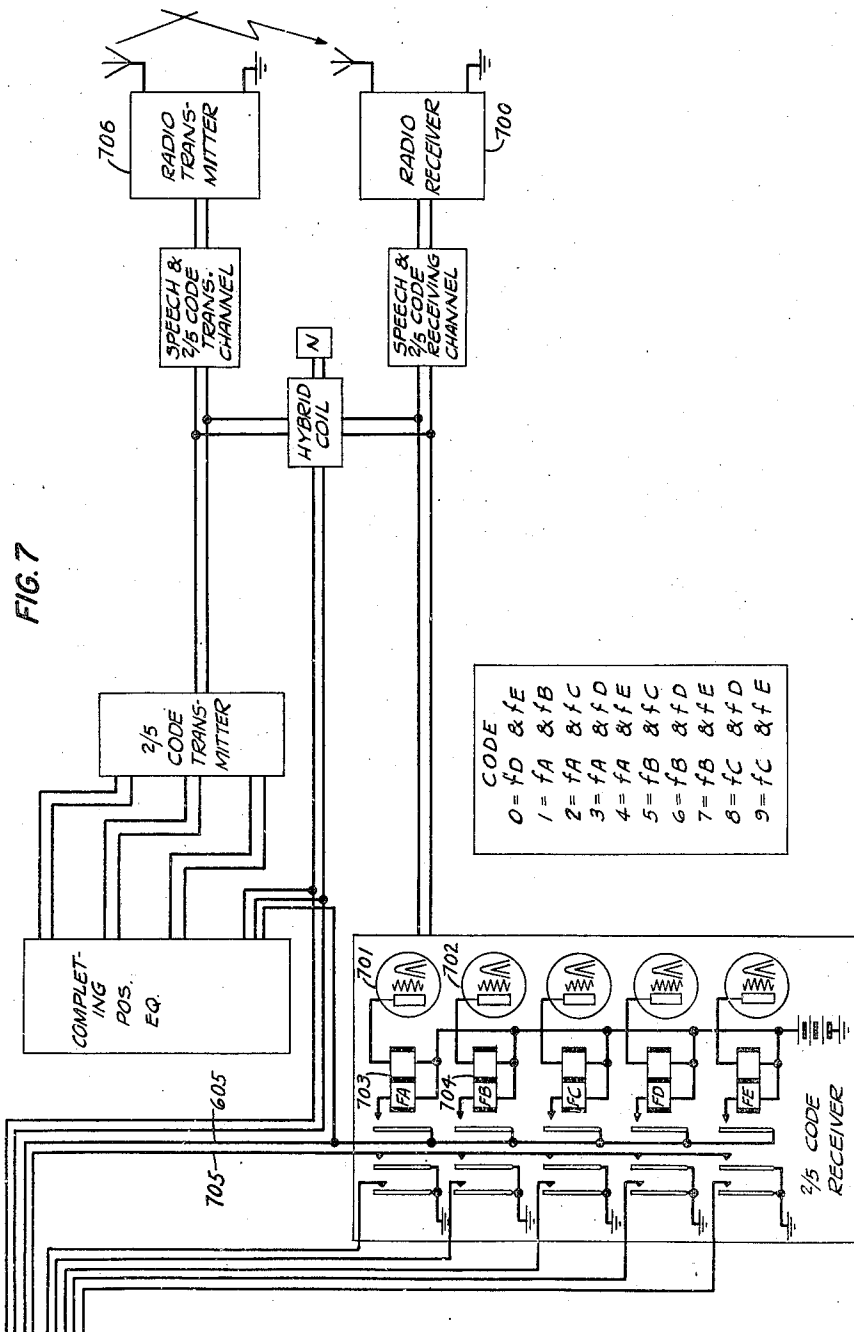
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8 Sheets-Sheet 6



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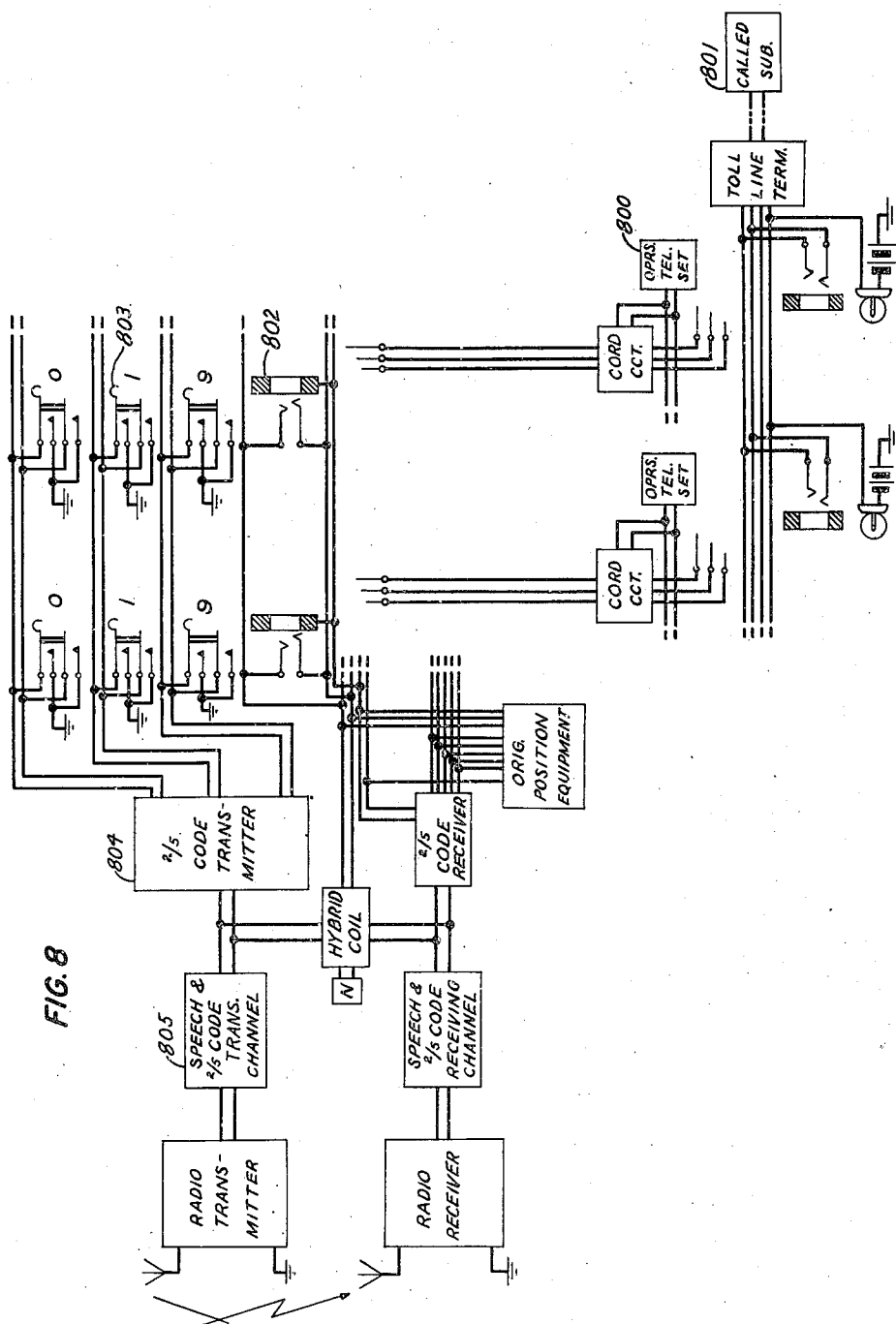
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8 Sheets-Sheet 7



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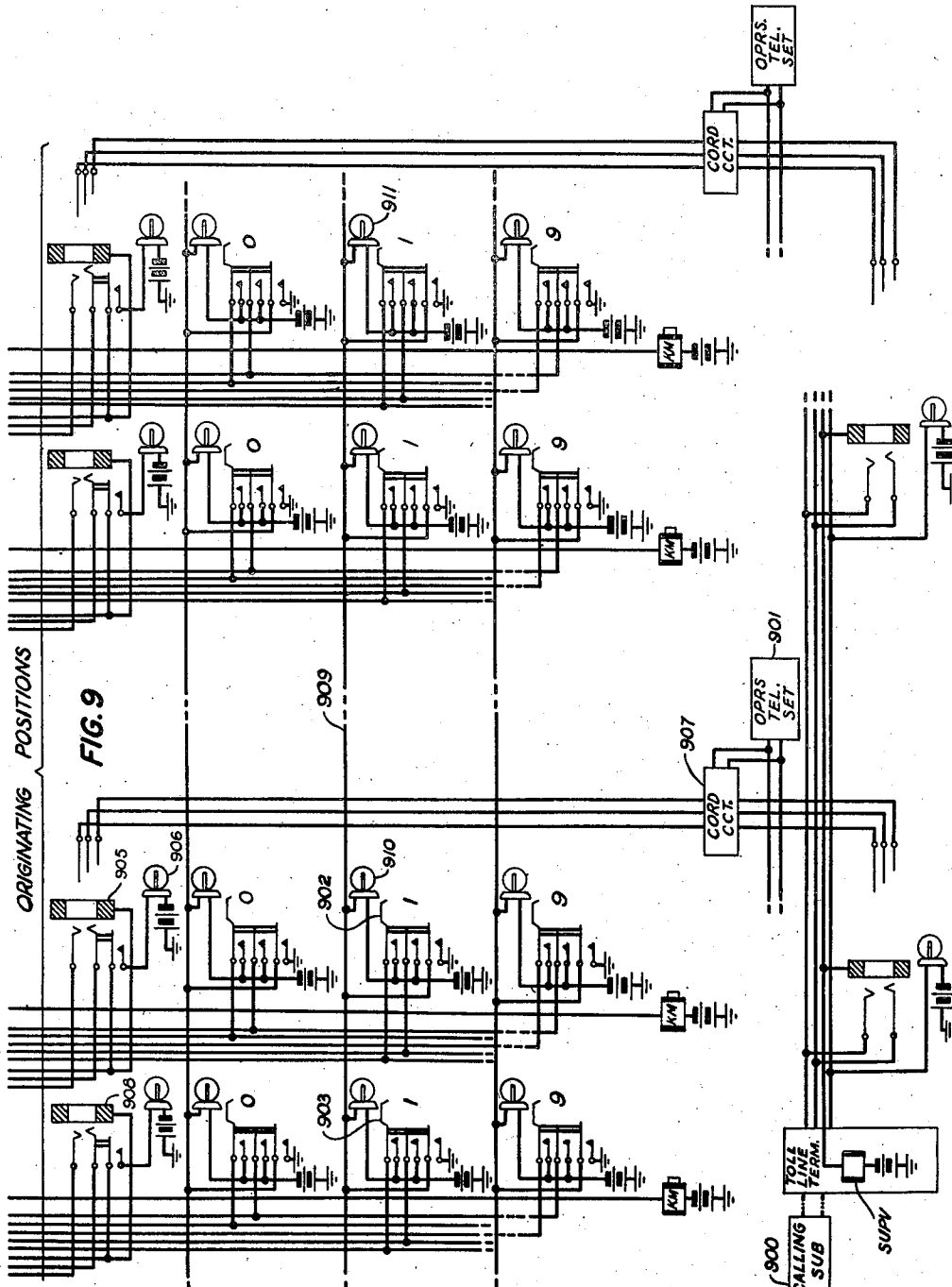
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UNITED STATES PATENT OFFICE

2,483,732

SIGNALING CIRCUIT

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3 Claims. (Cl. 179—41)

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This invention relates to communication systems and particularly to a method of operation whereby expensive circuits are more effectively employed.

The invention relates particularly, though not exclusively to such long distance circuits as transatlantic radio telephone channels. A system known as the interpolated telephone and telegraph system has been developed in which all intervals in the use of such a system during which voice currents are not being transmitted are employed for telegraph communication, even of intervals as small as a fraction of a second, so that such a circuit is substantially used simultaneously as both a telephone and a telegraph communication channel. In accordance with the present invention all information which must be passed from terminal to terminal which does not constitute subscriber use is passed by telegraph. Accordingly, when an operator at one end wishes to establish a call to a subscriber at the other end the details including the name and probable location of the wanted subscriber are passed to a completing operator at the distant end by telegraph. Included in these details will be a code designation which will identify the originating operator at the near end together with information indicating the urgency of the call, such as the information as to whether the calling subscriber is presently waiting on the line for the establishment of the connection. The completing operator will thereupon establish the connection to the called subscriber and then pick out an idle telephone channel, or if none is available will perform an operation which will result in the automatic selection of the first one of such channels to become idle. This will result in the transmission over the selected idle channel of a signal which has been agreed upon and which will result at the originating end in notifying the particular originating operation that a channel is available and that the wanted subscriber is awaiting the completion of the connection from the calling subscriber.

The coded signal which is sent back over the selected telephone channel may be in the form of a selected plurality of currents of voice frequency. Over long mutable links where static may affect the transmission, it is of advantage

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to employ frequency modulation to transmit these signals.

The selected plurality of currents of voice frequency may be on a two-out-of-five basis such, for instance, as described in Patent 2,300,951 to Malthaner or 2,317,191 to Holbrook by using a two-out-of-five code. Ten communication channel appearances may be used by each operator. If the system is larger and more facilities have to be provided then a similar system using three-out-of-seven may be employed to give a capacity of thirty-five appearances.

A feature of the invention is a means whereby an (originating) operator may characteristically mark a communication channel appearance normally free from connection to any one of a plurality of communication channels combined with means responsive to a corresponding characteristic signal transmitted by a (completing or distant) operator over one of said communication channels for interconnecting said marked appearance and said transmission channels.

Another feature of the invention consists in the use of a plurality of communication channel appearances before each of a plurality of operators and a plurality of communication channels with a selectively operated means per channel appearance. Each channel appearance before an operator will have associated with it a number of marking devices such as keys whereby an originating operator may condition the said channel appearance to respond to a corresponding signal transmitted over any one of said communication channels to operate the said selective means corresponding to the marked channel appearance and the communication channel employed.

The drawings consist of eight sheets having nine figures as follows:

Fig. 1 is an abbreviated schematic circuit diagram showing the organization of the communication system forming the subject-matter of the present invention;

Fig. 2 is a block diagram showing how Figs. 3 to 9, inclusive, may be arranged to form a complete circuit diagram;

Fig. 3 shows the switching means by which an incoming call from the completing operator may be automatically routed to the originating operator's position;

Fig. 4 shows the originating operator's position

equipment used on a telephone channel basis;

Fig. 5 shows a similar arrangement at the completing operator's position;

Fig. 6 is similar to Fig. 3;

Fig. 7 is similar to Fig. 4 except that the telecommunication channel is equipped for telephone traffic only;

Fig. 8 is the same as Fig. 5 with the exception that the telecommunication channel in this case is equipped only for telephone use and in addition facilities by which the completing operator may extend a connection to a called subscriber are shown; and

Fig. 9 shows the equipment at the originating operator's position including facilities by which a called subscriber may extend connection to such operator's position.

The telecommunication system shown in Fig. 1 includes a plurality of radio channels. Two of these channels are shown, the upper one consisting of such a system as that shown in the Patent No. 2,207,720, granted to Cole and Melhose. The system of the present invention may use a plurality of radio channels, at least one of which will be an interpolated telephone and telegraph channel by which telegraph messages may be transmitted over the channel in either direction during the silent periods in a telecommunication conversation. The system may also include other radio channels equipped only for telephone communication.

In the working of this invention a calling subscriber 1 may wish to have a connection established to a called subscriber 2 at a distant point. The calling subscriber 1, for instance, may be in New York and the called subscriber 2 may be in London. The calling subscriber has a connection established by conventional means to an operator at an originating position here indicated by the dotted line rectangle 3 who will take the particulars of the call to be set up and pass such particulars along to an operator of a printing telegraph transmitter 4 by means of which the particulars of the call will be transmitted to the printing telegraph receiver 5 at the distant end and give them to the completing operator situated at the operator's position 6. Among the particulars of the call will be a number or other means of identifying the call. The originating operator then operates a key 7 corresponding to this identifying number. When the completing operator establishes a connection to the called subscriber 2, she then makes connection over the channel 8 so as to reach via the radio transmitter 9 and the distant receiver 10 the two-out-of-five code receiver 11. The completing position operator then operates her key 12 corresponding to the identifying number given her by the printing telegraph message whereupon the two-out-of-five code transmitter 13 transmits over the radio channel a combination of two different frequencies which operates the code receiver 11. The combination of the operation of this two-out-of-five code receiver 11 and the key 7 will cause a stepping switch 14 to operate until a relay 15 becomes interconnected in the circuit between the key 7 and the code receiver 11 whereupon the relay 15 operates to interconnect the channel 8 at the completing operator's position and the channel 16 at the originating operator's position and to light the lamp 17 thereat. The originating operator may then connect the line from the calling subscriber through her cord circuit 18 to the channel 16 if the calling subscriber is awaiting the call or if the delay for this has been too great

the originating operator will then recall the calling subscriber 1 and establish the wanted connection.

In this manner the telephone channels are held reserved only for their main use and the information necessary to be passed from operator to operator is passed over the associated telegraph channels without subtracting from the actual use of the telephone channels.

This operation may be seen in somewhat more detail by looking at the complete circuit diagram shown in Figs. 3 to 9, inclusive. In this case a calling subscriber is represented by the rectangle 900. This calling subscriber will get in touch with the operator here represented by the operator's telephone set 901 through conventional means. This originating operator will take the particulars of the call to be established from the calling subscriber and will pass the information to an operator at the printing telegraph transmitter 400. From here the information is passed over a radio channel to a printing telegraph receiver 500 at the distant end. The information received at this point is passed to an operator, let us say, that one represented by the rectangle 800 and this operator will thereupon establish through conventional means a connection to the called subscriber 801. When this connection has been established the operator 800 will select the first idle radio channel to the originating end. Channels at her disposal are represented here by the jack 802 and the jack 502. Let us say, that the channel represented by the jack 802 is idle and that the operator 800, therefore, selects this channel.

The originating operator in passing the information to the printing telegraph operator represented by the rectangle 400 includes as part of the information for the call a particular number by which the call may be identified. Let us say, in this case, that the operator identifies this call by the index number 1. She may then operate the No. 1 key 902 or the No. 1 key 903. Again, let us say, that she operates the No. 1 key 902. This places battery on the 1 and 2 windings of the five-winding relay 600.

At the same time the operation of the key 902 will ground the conductor 909 so as to operate all of the signal lamps connected thereto such as the signal lamp 910 and the signal lamp 911 whereby other operators will know that this particular index number has been reserved by some other operator and she will, therefore, not use it in establishing another call.

The originating operator, Fig. 9, has at her disposal a plurality of trunk appearance jacks such as 905 and 908. These jacks are not permanently associated with any particular radio link but may be automatically associated with any one of such links. Thus, the jack 905 has multiple connections associated with the relays 600 and 300 with the radio links between Figs. 7 and 8 and between Figs. 4 and 5, respectively. The number of jacks at the originating operator's position is a matter of choice but may be related to the number of radio links or the number of expected connections. Thus, each jack such as the jack 905 has associated with it a plurality of keys such as the key 902 and these are represented here as being ten in number, one for each of the digits 0 to 9, inclusive. In this case there would be ten jacks such as the jack 905 so that ten waiting connections may be established by the operator. Thus, when the originating operator in our description has passed the information by ticket to the tele-

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graph operator she will designate 1 as the number to be used in completing this particular call. She thereupon inserts a plug in the jack 905 and depresses the key 902. She may alternatively insert a plug in the jack 908 and depress the key 903 or any one of the other jacks and any one of the other No. 1 keys. We will assume in the present case that she inserts a plug in the jack 905 and depresses the key 902.

The operation of the key 902 places battery on the 1 and 2 windings of the relay 600 for a purpose which will presently appear.

The terminating operator having made connection through the jack 802, will then operate her No. 1 key 803 which causes the code transmitter 804 to transmit over the speech and code transmitting channel 805, a combination of two frequencies which coming in over the radio receiver 700 will operate the two tubes 701 and 802 causing the relays 703 and 704 to operate. Either of these relays will place a ground on conductor 705 which will extend through the back contact and armature of the magnet 601 and the interrupter contacts of the stepping magnet 602 to cause the eight arms of the stepping switch shown schematically above to rotate. The various windings of the relay 600 are each connected to the contact banks of the various wipers of this switch in accordance with the code indicated on Fig. 7. Thus, by way of example, the code 1 consists of frequencies which will operate the FA relay 703 and the FB relay 704. If the designations A, B, C, D and E are given spaces on these switches corresponding to the first, second, third, fourth and fifth windings of the relays such as the relay 600, then when the wipers of the switch operated by the stepping magnet 602 reach their No. 1 contacts, grounds will be connected therethrough from the FA and FB relays, the No. 1 contacts of the first and second wipers leading from the top, the No. 1 and No. 2 windings of the relay 600 to the battery connection established on the corresponding wires by the No. 1 key 902. While the switch is in this position, no other winding of the relay 600 will be connected in circuit. Thus, in each separate position of the switch some two windings will be connected to corresponding wires leading to the code receiver relays. When the arms have reached the point where a connection is established between the battery on the two conductors leading through the coils 1 and 2 of the relay 600 to the front contacts and armatures of the relays 703 and 704, the relay 600 will operate. It should be noted that this relay is marginal in nature and will respond only when two windings have thus been included in circuit.

As the switch operated by the stepping magnet 602 comes to rest on the contacts which include the relay 600 in an operative circuit the talking conductors to this jack will be extended through to the talking conductors leading to the radio transmitter 706 and the radio receiver 700. At the same time a supervisory connection will be set up from the lamp 906 through the auxiliary contacts of the jack 905, the armature 3 and front contact of the relay 600 to the supervisory relay 604. This will cause the lamp 906 to light showing the originating operator that her telegraphed call is or has been completed and at the same time will cause the supervisory relay 604 to operate to ground the conductor 605 to lock the relays 703 and 704. It will be understood that the period of transmission of the coded fre-

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quencies by the key 803 is long enough for the stepping switch of Fig. 6 to operate to establish this connection. The originating operator now interconnects the calling subscriber through the radio channel to her cord circuit 907 so that the conversation may proceed.

It should be noted that when the relay 600 is operated a ground will be established over its armature 4 and front contact to the relay 601 which opens the circuit of the stepping magnet 602 so as to leave the switch in its selected position.

When the conversation has ended, the originating operator will take the cord circuit from the jack 905 and this will cause the lamp 906 to be extinguished and the supervisory relay 604 to be released. When the relay 600 operated, ground from its armature 4 and front contact in operating the relay 601 had extended the ground on conductor 705 to the relay 603 and now this ground is extended through the back contact and armature of the relay 604, the front contact and armature 5 of the relay 600 to the key release magnet 904 so that this causes the locking key 902 to release. This opens the circuit of the relay 600 and the supervisory relay 604 removes the locking ground from the conductor 605 to release the code receiver shown in Fig. 7.

What is claimed is:

1. In a communication system, a plurality of communication channels, one or more of said channels being arranged to operate as an interpolated telephone and telegraph system wherein telegraph signals are interpolated in telephone conversations thereover, a plurality of operators' positions at each end of said channels at each of which said channels appear, means for preparing a particular operator's position at one end for response to a given signal transmitted over the telephone facilities of said interpolated telephone and telegraph system from the other end, means including the telegraph facilities of said interpolated telephone and telegraph system for passing information including the nature of said given signal to an operator at the said other end and means under control of said operator at the said other end for selecting an idle one of said channels and for transmitting thereover said given signal.
2. In a communication system, a plurality of originating operators' positions, a plurality of distant incoming operators' positions, a plurality of communication channels between said originating and said incoming operators' positions, a plurality of communication channel terminations at said originating operators' positions, means at each said position for preempting one of said terminations and rendering said preempted termination responsive to a particular signal received over any one of said communication channels from any one of said distant incoming operators' positions, telegraph means available to said originating operators for informing said distant incoming operators of the details of a connection to be established including the nature of said particular signal to be used for establishing a connection to a said preempted termination and means at said distant incoming operators' positions for seizing an idle one of said communication channels and for transmitting said designated particular signal thereover.

3. The method of establishing telephone connections over communication channels, consisting of seizing a channel termination and render-

ing it responsive to a given signal, recording information regarding the details of a connection to be established including the nature of said given signal, telegraphing such recorded information to the distant end of said channels, selecting an idle one of said channels at the distant end thereof and transmitting said designated given signal back over said selected idle channel, whereby said seized channel termination is connected to said selected idle channel.

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