

March 29, 1938.

R. E. HERSEY

2,112,366

TELEPHONE CONTROL CIRCUIT

Filed Dec. 5, 1936

4 Sheets-Sheet 1

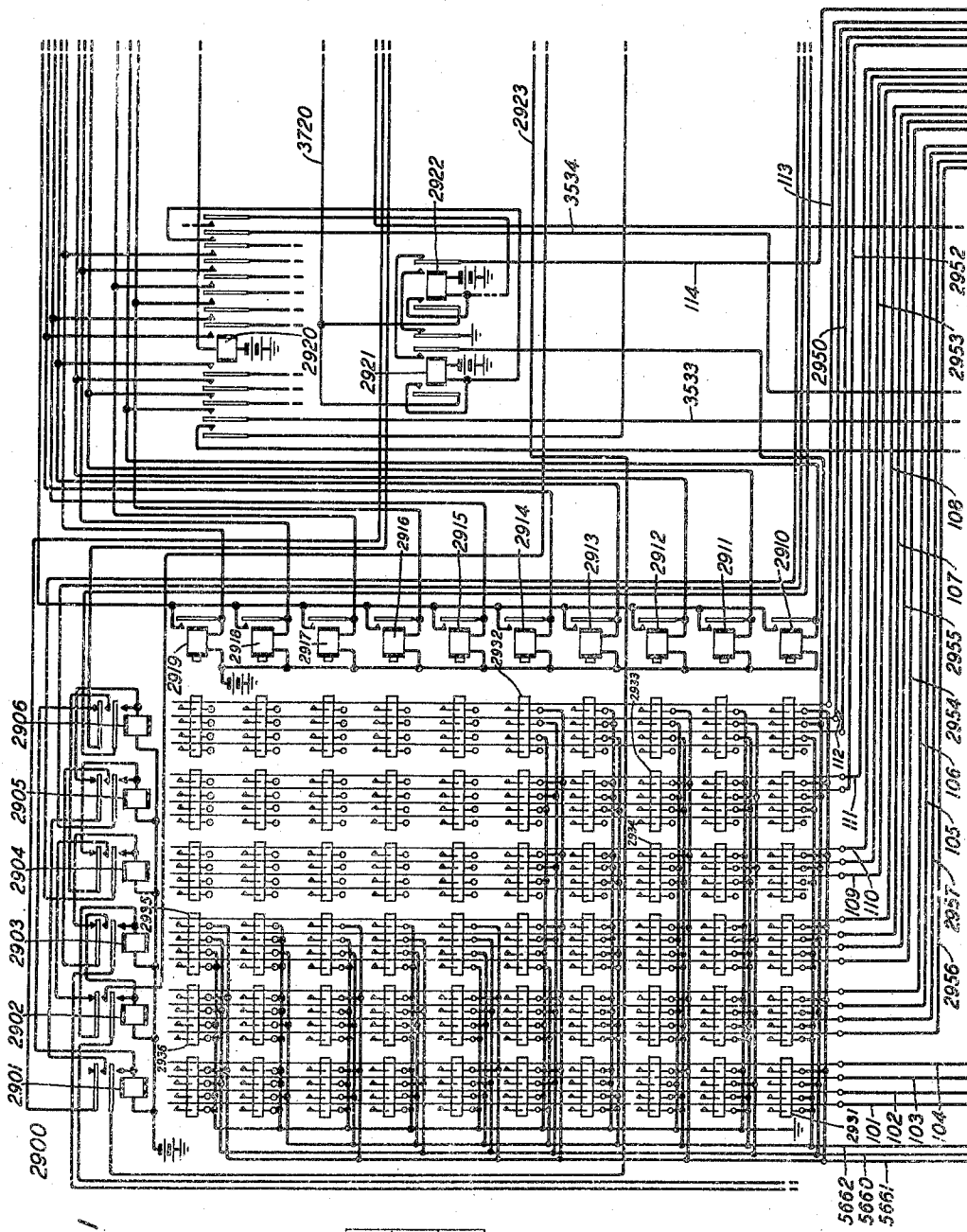


FIG. 1

FIG. 5

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

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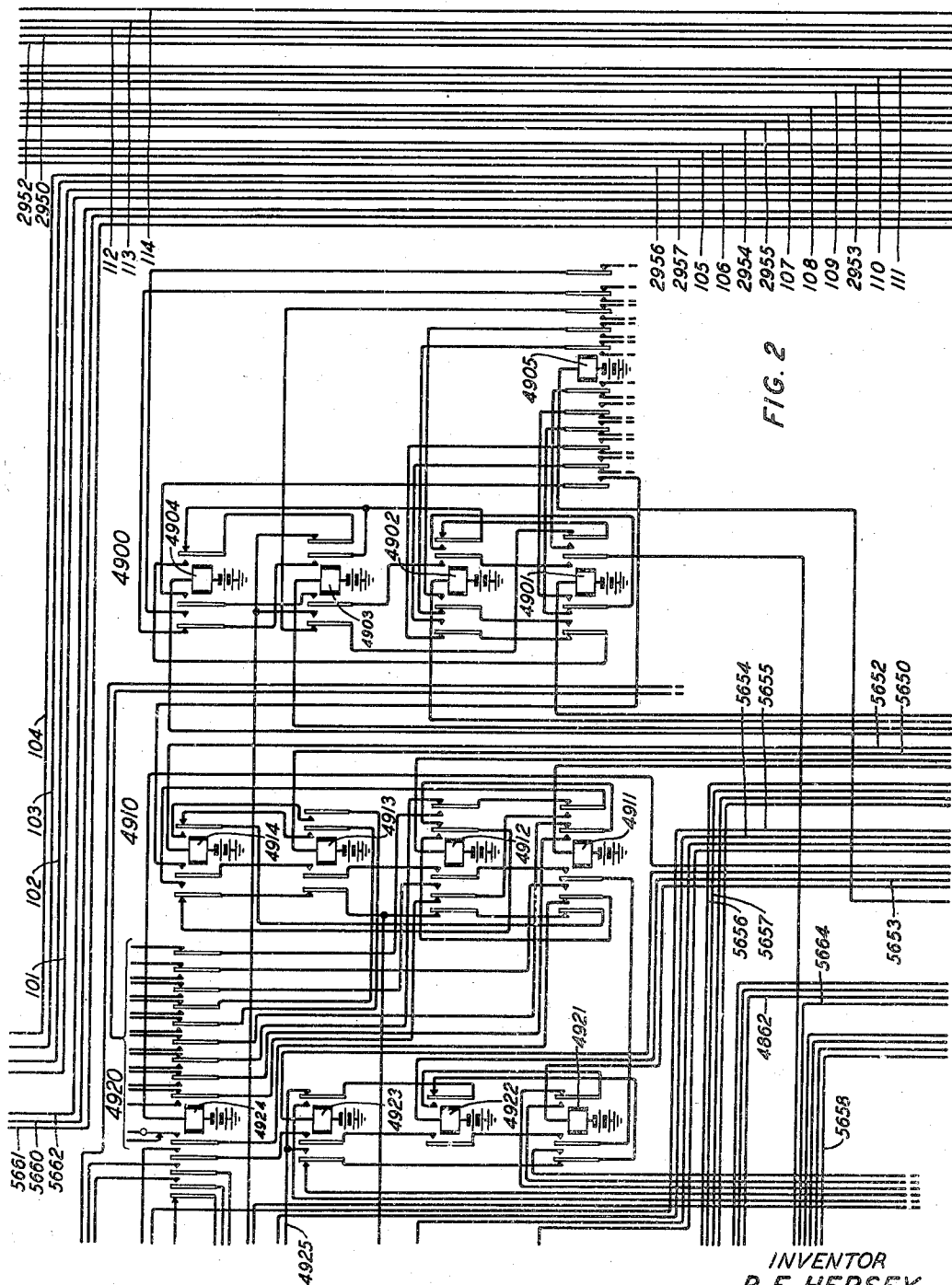


FIG. 2

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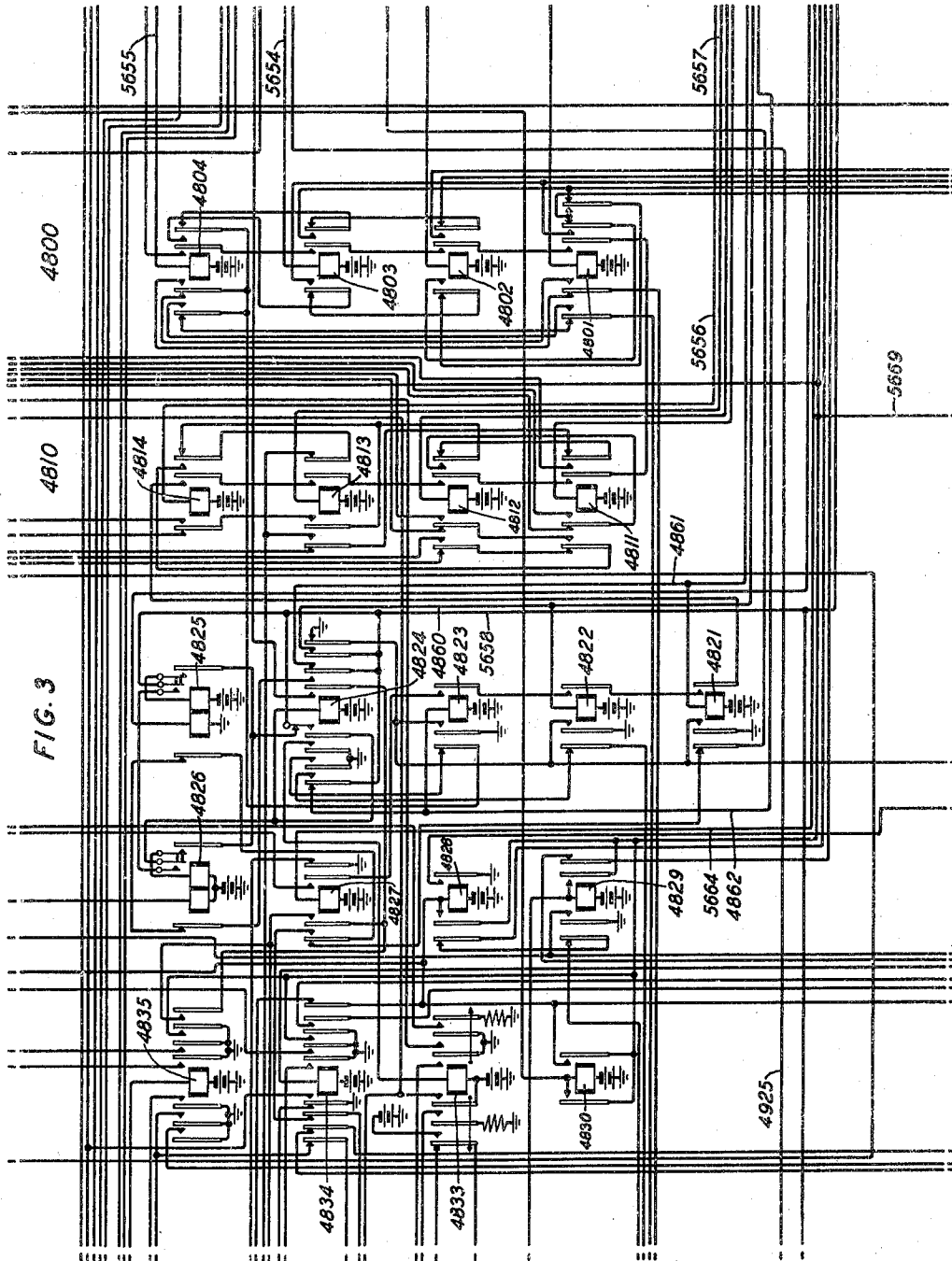
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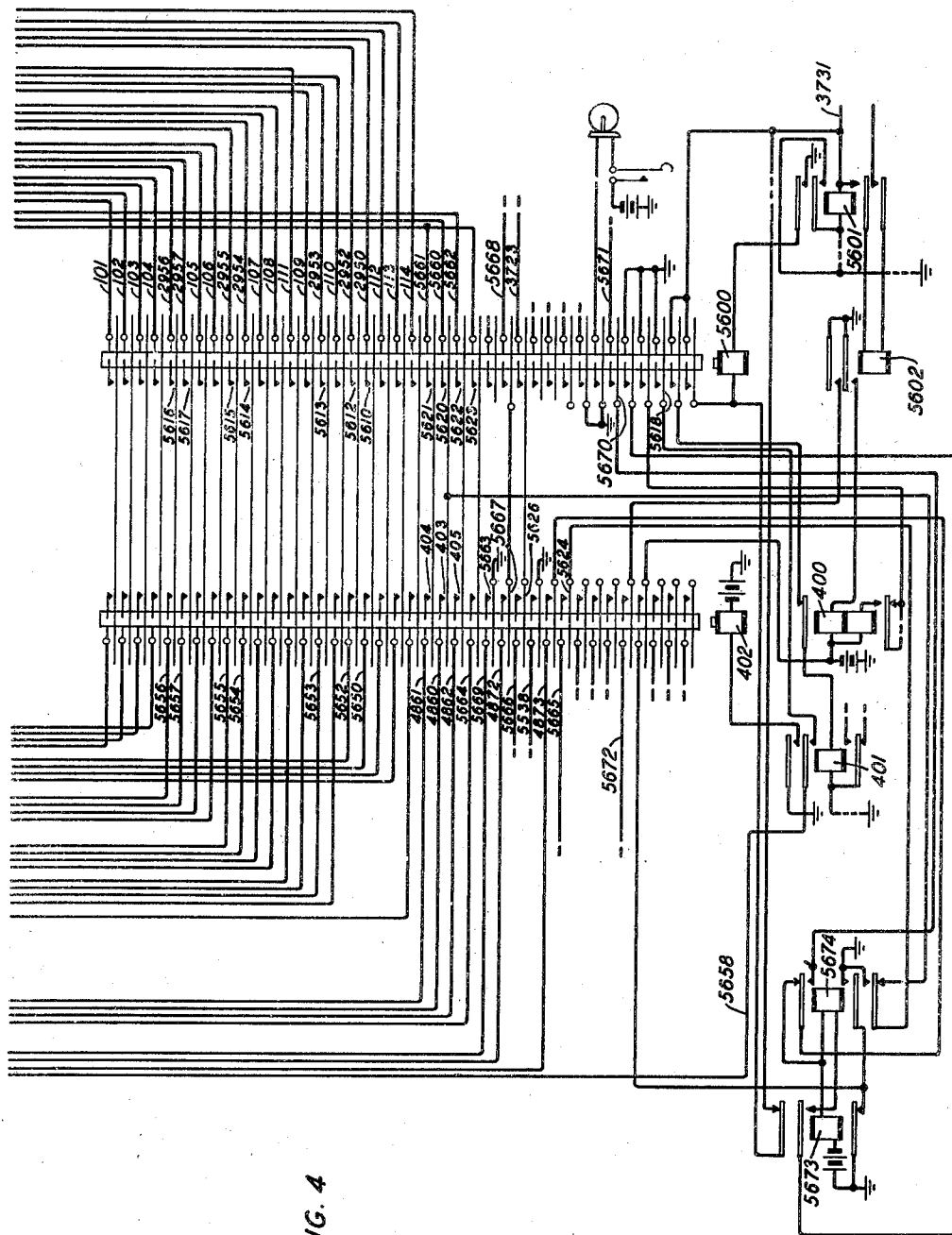


FIG. 4

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2,112,366

TELEPHONE CONTROL CIRCUIT

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Application December 5, 1936, Serial No. 114,373

6 Claims. (Cl. 179—18)

This invention relates to telephone systems and has for its object to improve the accuracy with which such systems function.

In a cross-bar telephone system and in a panel telephone system where decoders are employed, registrations are transferred from the sender to the decoder or marker by means of a plurality of circuits which include the contacts of a connecting switch and are therefore open to such faults as failure to close properly or false ground due to cross connections. It has been customary to test the registration circuits by transmitting ground from the marker to the unoperated contacts of the sender register relays by operating all of the marker register relays and completing a chain circuit which brings about the removal of the checking ground.

When the sender employs a cross-bar switch for storing the incoming registration, the unused contacts cannot be multiplied together in the manner employed for relay registers. Therefore, additional precautions are necessary and a plurality of checking circuits are employed. In accordance with the present invention these checking circuits are also tested for faults by being connected to battery through relays at the marker end. When the connection between the sender and the marker is established, registration transfer circuits are closed by the sender register. At the same time ground is supplied to the checking circuits operating the checking circuit relays as well as all of the non-operated relays in the marker registers. The chain circuit includes contacts of the checking circuit relays as well as contacts of the register relays. Completion of the chain circuit causes the removal of ground from the checking circuits to release the non-registering relays and the checking circuit relays, and the back contacts of the checking circuit relays are used for advancing the operation of the marker. An open circuit on any of the registering or checking conductors will prevent the completion of the chain circuit, while a false ground which would hold one or more of the register relays operated, also holds the checking circuit relays operated and prevents the establishment of the connection from advancing. In addition, the chain circuit itself is tested for faults.

The invention will be more clearly understood from a consideration of the following description in connection with the drawings in which:

Fig. 1 shows the cross-bar register of the sender;

Figs. 2 and 3 show the relay registers of the marker; and

Fig. 4 shows the marker connector.

Fig. 5 shows the manner in which Figs. 1 to 4 should be arranged.

Figs. 1, 2 and 3 are substantial copies of Figs. 29, 48 and 49 of the drawing of the patent of W. W. Carpenter, No. 2,089,921, granted Aug. 10, 1937, to which reference is made for a complete showing of the sender and marker and a description of their operation. In general, the same reference characters have been employed as in the Carpenter patent, but where additional reference numbers have been used they are less than 1000. The marker connector shown in Fig. 4 is a somewhat more detailed showing of the marker connector appearing in Fig. 56 of the Carpenter patent.

When a call is to be completed at a cross-bar office, a terminating sender is seized by a terminating sender link and connected over the incoming trunk to the originating sender. The frame on which the incoming trunk is located is first recorded in the sender and then the sender transmits a plurality of series of reverte pulses to satisfy the originating sender and to establish a record in the terminating sender of the wanted line designation.

The registering device of the present disclosure is a cross-bar type switch having ten select magnets 2910 to 2919 and seven hold magnets 2901 to 2906. In recording the frame designation relay 2920 is operated, connecting the select magnets to the set of ten conductors 3533, etc. representing the units digit of the frame designation and connecting relays 2921 and 2922 to conductors 3534, etc. representing the tens digit of the frame designation. Assuming, as in the above-identified Carpenter patent, that the frame involved is frame No. 0, conductors 3533 and 3534 will be grounded from the sender link, operating magnet 2910 and relay 2921. Magnet 2910 in operating prepares all of the cross-points in the zero row and extends its operating ground to a relay which initiates the further functioning of the sender and causes the closing of a circuit for hold magnet 2901. Magnet 2901 closes the cross-point 2931 and locks over conductor 2923. Relay 2921 locks over conductor 3120. With magnet 2901 locked relay 2920 is released thereby also releasing the select magnet 2910.

The terminating sender now transmits a plurality of sets of reverte pulses to satisfy the originating sender, simulating incoming brush selection, incoming group selection, final brush,

final tens and final units selections. These sets of reverive impulses are counted by a set of counting relays and at the termination of each selection one of the select magnets 2910 to 2919 is operated to prepare the proper level in the register. As in the case of frame registration, the operated select magnet extends its operating ground to a relay which brings about the operation of the hold magnet to lock the registration in place. Hold magnet 2906 is operated following incoming brush selection, magnet 2905 after incoming group selection, magnet 2904 after final brush selection and magnets 2903 and 2902 after final tens and final units selections, respectively. Each of these magnets locks independently to ground supplied by an off-normal relay.

Following the assumptions made in the Carpenter patent, it will be assumed that the No. 4 cross-point 2932 is closed in response to incoming brush selection, cross-point 2933 for incoming group selection, cross-point 2934 to record the final brush selection and cross-points 2935 and 2936 to record the final tens and final units selections, respectively.

Following the operation of the hold magnet 2902, a reverse battery signal is transmitted to dismiss the originating sender and battery is connected to conductor 3731 to cause the connection of an idle marker with the sender. Conductor 3731 extends to the winding of relay 5601 and thence over a chain circuit characteristic of an idle connector to ground. Relay 5601 locks over its inner upper contact to ground and closes a circuit for multicontact relay 5600 which may be traced from ground at the outer upper front contact of relay 5601, winding of relay 5600, upper back contact of relay 5673 to battery over conductor 3731. Relay 5600 closes a plurality of contacts connecting the sender with the cross-wires of the connector and locks over its innermost contact to conductor 3731 independent of relay 5673. Relay 5600 also extends the start battery over the back contact of relay 400 to the winding of relay 401 and ground. Relay 401 closes an obvious circuit for multicontact relay 402 and connects ground to conductor 5658 from armature 5618 of relay 5600.

With relays 5600 and 402 operated, a set of twenty leads is closed, connecting the sender register 2900 to the registers 4900, 4910, 4920, 4800 and 4810 of the marker. In addition, a circuit is closed to relays 2921 and 2922 to determine the tens designation of the frame and three check leads as well as certain other leads which are not of interest in the present connection.

Assuming that cross-points 2931 to 2936 were closed in registering the selections, direct ground will be connected over none of the contacts of cross-point 2931; over the left contact of cross-point 2932 to conductor 2950, over the middle contact of cross-point 2933 to conductor 2952; over the middle contact of cross-point 2934 to conductor 2953; over the inner left contact of cross-point 2935 to conductor 2955, and over the outer left contact of that cross-point to conductor 2954; over the outer left contact of cross-point 2936 to conductor 2956, and over the inner left contact of the same cross-point to conductor 2957. Conductors 2950 and 2952 to 2957 are extended over contacts 5610 and 5612 to 5617 of relay 5600 and the corresponding contacts of relay 402 to conductors 5650 and 5652 to 5657, respectively, operating thereover register relays 4913 and 4914 of thousands register 4910, relay

4922 of hundreds register 4920, relays 4804 and 4803 of the tens register 4800 and relays 4813 and 4814 of the units register 4810. None of the relays of frame register 4900 are operated by direct ground from the frame vertical of the sender register nor is relay 4905 operated by direct ground from relay 2922 which might occur for other frame registrations.

At the same time that these direct circuits are closed, a circuit is closed from ground over armature 5618 of relay 5600, inner upper front contact of relay 401, conductor 5658, middle right back contact of relay 4824, conductor 4860, to the winding of relay 4822 and battery and in parallel therewith over contact 403 of relay 402, contact 5620 of relay 5600, conductor 5660 and over the inner right contacts of cross-points 2931, 2936, 2935 and 2932 to conductors 103, 105, 107 and 112 and thence to the windings of relays 4902, 4812, 4802 and 4912 respectively. A branch of this circuit extends from conductor 5660 over the right front contact of relay 2921 and the right back contact of relay 2922 to conductor 114 to the winding of relay 4905, while a second branch of this circuit extends from contact 403 of relay 402, lower back contact of relay 5674, contact 5624 of relay 402, to conductor 5665 and the winding of the second trial relay which is not shown in the present disclosure.

A second circuit extends from conductor 5658 over the inner right back contact of relay 4824, conductor 4861 to the winding of relay 4821 and battery and in parallel therewith over contact 404 of relay 402, contact 5621 of relay 5600, conductor 5661 over the outer right contacts of cross-points 2931, 2936, 2935, 2934, 2933 and 2932 to conductors 104, 106, 108, 110, 111 and 113 and thereover to the windings of relays 4901, 4811, 4801, 4921, 4924 and 4911 respectively. A branch of this circuit extends over contact 5623 of relay 5600 and the corresponding contact of relay 402, conductor 5664 to the winding of re-order relay 4827 and battery.

A third circuit extends from conductor 5658 over the outer left back contact of relay 4824, conductor 4862 through the winding of relay 4823 and in parallel therewith over contact 405 of relay 402, contact 5622 of relay 5600, conductor 5662, to the two left contacts of cross-point 2931 and the left contact of cross-point 2934 and thence over conductors 101, 102 and 109 to the windings of relays 4904, 4903 and 4923, respectively.

It will be apparent from the foregoing that, immediately following the connection of the sender and the marker all of the relays of registers 4900, 4910, 4920, 4800 and 4810 are operated together with frame tens relay 4905, re-order relay 4827 and a second trial relay which is not shown, together with relays 4821, 4822 and 4823.

A circuit is thereupon closed from battery through the left winding of relay 4826, over a contact of the second trial relay back over the right front contacts of relays 4827, 4823, 4822, 4821, inner right front contacts of relays 4814, 4813, 4812, 4811, 4801, 4802, 4803, 4804, second left front contact of relay 4924, inner left front contacts of relays 4923, 4922, 4921, 4911, 4912, 4913, 4914, outer left front contact of relay 4905, inner left front contacts of relays 4904 and 4903, inner right front contacts of relays 4902 and 4901 to ground through the left winding of relay 4825. Assuming that this chain circuit is closed, relays 4826 and 4825 operate, locking through their right

windings and outer contacts over the left normal contacts of relay 4824 to grounded conductor 5658. At their inner contacts, which close an instant later, they complete a circuit from battery through the winding of relay 4824, inner contacts of relays 4826 and 4825 to grounded conductor 5658. Relay 4824 closes a locking circuit for itself over its inner left alternate contact to conductor 5658, thereafter opening its normal contact and the locking circuit for relays 4826 and 4825.

With relay 4824 operated the checking ground is disconnected from conductors 4860, 4861 and 4862 and, provided no false grounds or cross-connections exist, relays 4821, 4822 and 4823 are released together with the register relays operated over these checking conductors. Relay 4821 upon releasing provides the ground which, under the control of the thousands register 4910 and relay 4924, selects the proper line choice. Relay 4823 when released connects ground to the tens register 4800 for selecting the proper "block" of twenty lines, while relay 4822 provides the ground which, after checking the normal condition of certain special call relays, extends over conductor 4925 to the hundreds register 4920 to select the proper group of 100 lines.

A consideration of the above description and the drawings will disclose that a physical break in any one of the registering circuits, in any one of the checking leads or in the ground over conductor 5658 or a break due to a defective contact at the register or the marker connector will result in the failure of the chain circuit to close. A false ground on any one of the registering circuits which might cause a register relay to operate falsely will extend back to the corresponding one of the relays 4821 to 4823 holding that relay operated and preventing the progress of the connection. Similarly, a false permanent ground on any one of the checking leads will hold the corresponding relay operated.

In addition, a physical break in the chain circuit as well as the failure of one of the relays to operate will prevent the operation of relays 4826 and 4825, while a false ground or false battery connected to the circuit will cause the operation of one relay and prevent the operation of the other relay, again blocking the progress of the call. Furthermore, if relay 4824 fails to operate or relays 4826 and 4825 both fail to release together with relay 4827, the circuit for operating the line choice connector is opened and the call cannot proceed. This arrangement, therefore, provides a very complete check of all possible difficulties which may occur in the transfer of the registration from the sender to the marker.

What is claimed is:

1. In a telephone system, a primary register, a secondary register, means for connecting said registers, a plurality of circuits extending through said connecting means between said primary register and said secondary register, means under the control of said primary register for closing certain of said circuits to position said secondary register correspondingly, additional circuits, means for extending said additional circuits in parallel to those of said first plurality of circuits not closed by said primary register, a relay connected to each of said additional circuits, and means to indicate when all of said circuits are complete comprising a chain circuit closed by said secondary register and said additional relays.

2. In a telephone system, a primary register, a secondary register, means for connecting said registers, a plurality of circuits extending through

said connecting means between said primary register and said secondary register, means under the control of said primary register for closing certain of said circuits to position said secondary register correspondingly, additional circuits, means for extending said additional circuits in parallel to those of said first plurality of circuits not closed by said primary register, a relay connected to each of said additional circuits, means to indicate when all of said circuits are complete comprising a chain circuit closed by said secondary register and said additional relays, and means controlled by said relays to indicate the absence of faults on said additional circuits.

3. In a telephone system, a primary register, a secondary register, a plurality of circuits extending between said primary register and said secondary register and terminating in relays at said secondary register, additional circuits, said additional circuits connected to relays associated with said secondary register, means for preparing said plurality of circuits and said additional circuits, said primary register completing certain of said circuits and connecting said additional circuits to the remainder of said plurality of circuits, means responsive to said preparing means for completing said additional circuits and means to indicate absence of fault in said plurality of circuits comprising a chain circuit closed by said secondary register and the relays connected to said additional circuits, means responsive to the completion of said chain circuit for opening said additional circuits and means to indicate the absence of fault on said additional circuits comprising means operated by the release of said additional circuit relays.

4. In a telephone system, a primary register, a secondary register, means for connecting said registers, a plurality of circuits extending through said connecting means between said primary register and said secondary register, means under the control of said primary register for closing certain of said circuits to position said secondary register correspondingly, additional circuits, means for extending said additional circuits in parallel to those of said first plurality of circuits not closed by said primary register, a relay connected to each of said additional circuits, means to indicate when all of said circuits are complete comprising a chain circuit closed by said secondary register and said additional relays, and means to indicate absence of faults on said chain circuit comprising a relay connected to each end of said chain circuit and means controlled by said chain circuit relays for opening said chain circuit.

5. In a telephone system, a primary register, a secondary register, means for connecting said registers, a plurality of circuits extending between said primary register and said secondary register, means under the control of said primary register for closing certain of said circuits to position said secondary register correspondingly, additional circuits, means for extending said additional circuits in parallel to those of said first plurality of circuits not closed by said primary register, a relay connected to each of said additional circuits, means to indicate when all of said circuits are complete comprising a chain circuit closed by said secondary register and said additional relays, means controlled by said relays to indicate the absence of faults on said additional circuits, and means to indicate absence of faults on said chain circuit comprising a relay connected to each end of said chain circuit and means con-

trolled by said chain circuit relays for opening said chain circuit.

6. In a telephone system, a primary register, a secondary register, a plurality of circuits extending between said primary register and said secondary register and terminating in relays at said secondary register, additional circuits, said additional circuits connected to relays associated with said secondary register, means for preparing said plurality of circuits and said additional circuits, said primary register completing certain of said circuits and connecting said additional circuits to the remainder of said plurality of circuits, means responsive to said preparing means for complet-

ing said additional circuits and means to indicate absence of fault in said plurality of circuits comprising a chain circuit closed by said secondary register and the relays connected to said additional circuits, means to indicate absence of faults on said chain circuit comprising a pair of relays connected one to each end of said chain circuit, means responsive to the operation of said chain circuit relays for opening said additional circuits, and means to indicate the absence of fault on said additional circuits comprising means operated by the release of said additional circuit relays.

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