

Nov. 19, 1940.

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2,222,099

TELEPHONE SYSTEM

Filed Dec. 21, 1939

3 Sheets-Sheet 1

Fig.1.

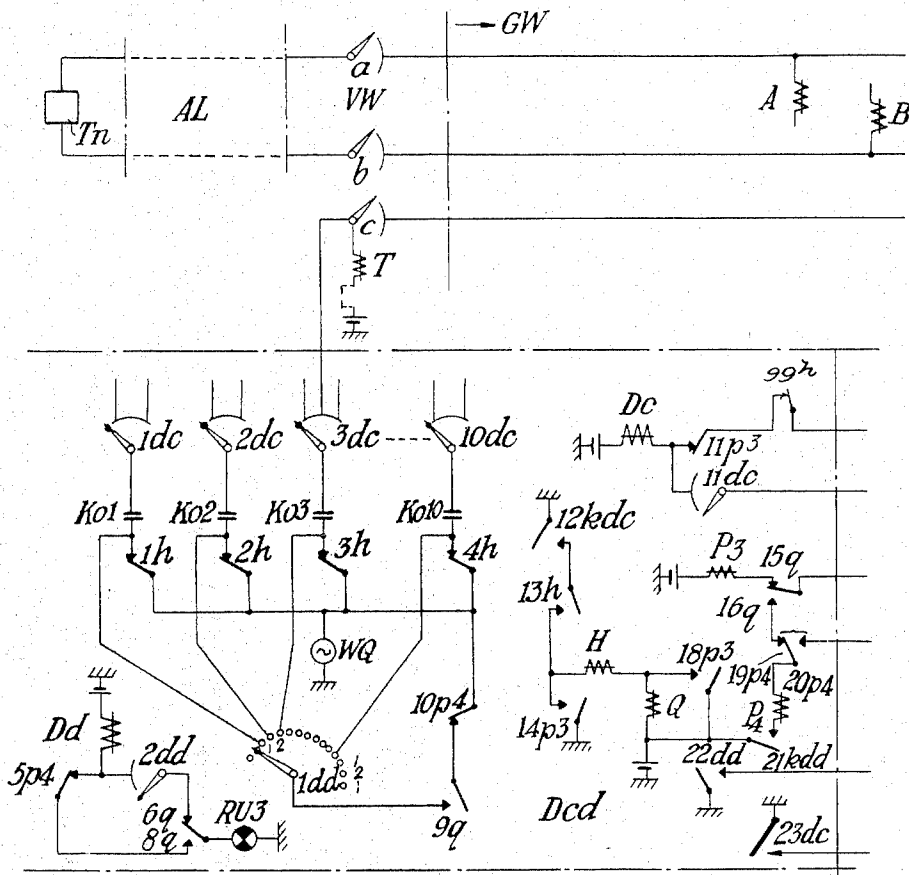
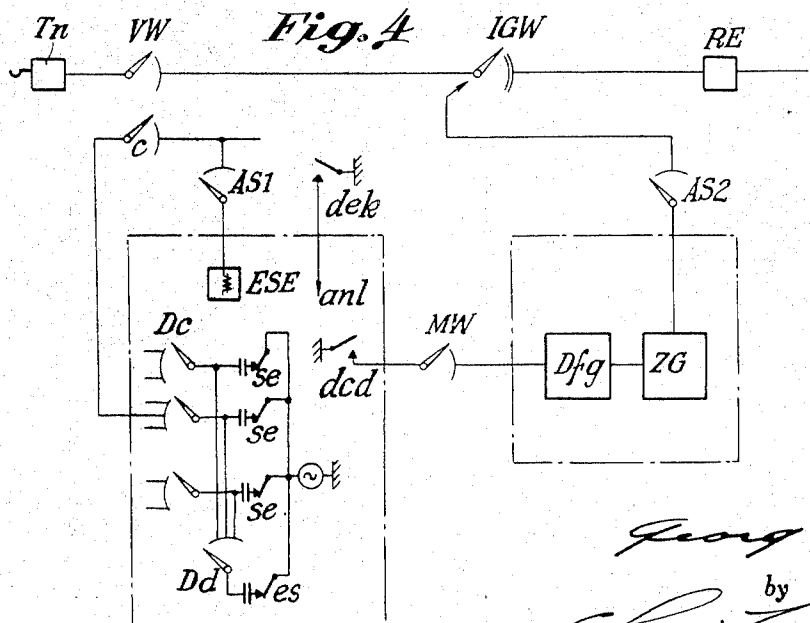


Fig. 4



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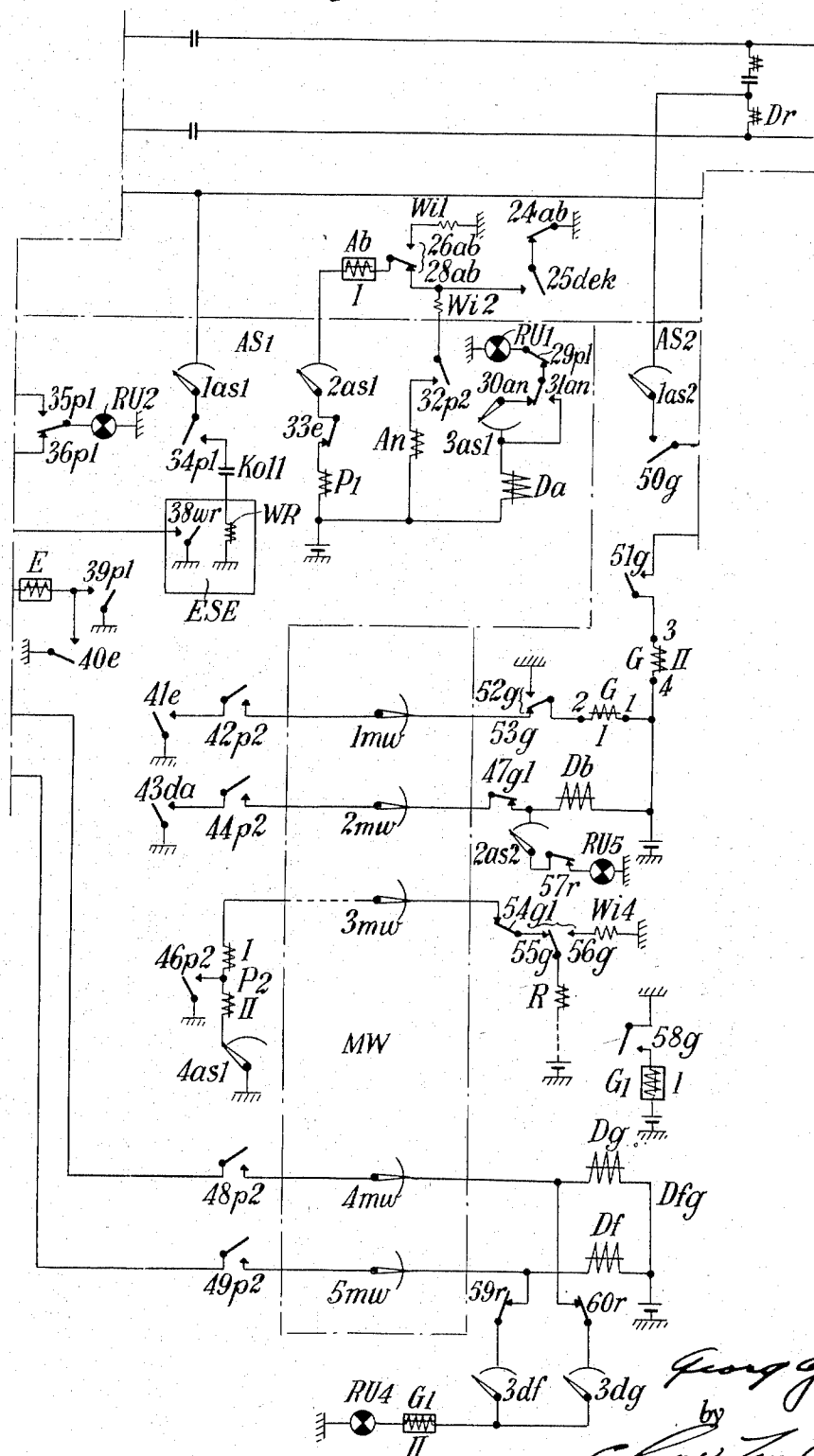
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TELEPHONE SYSTEM.

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3 Sheets-Sheet 2

Fig.2.



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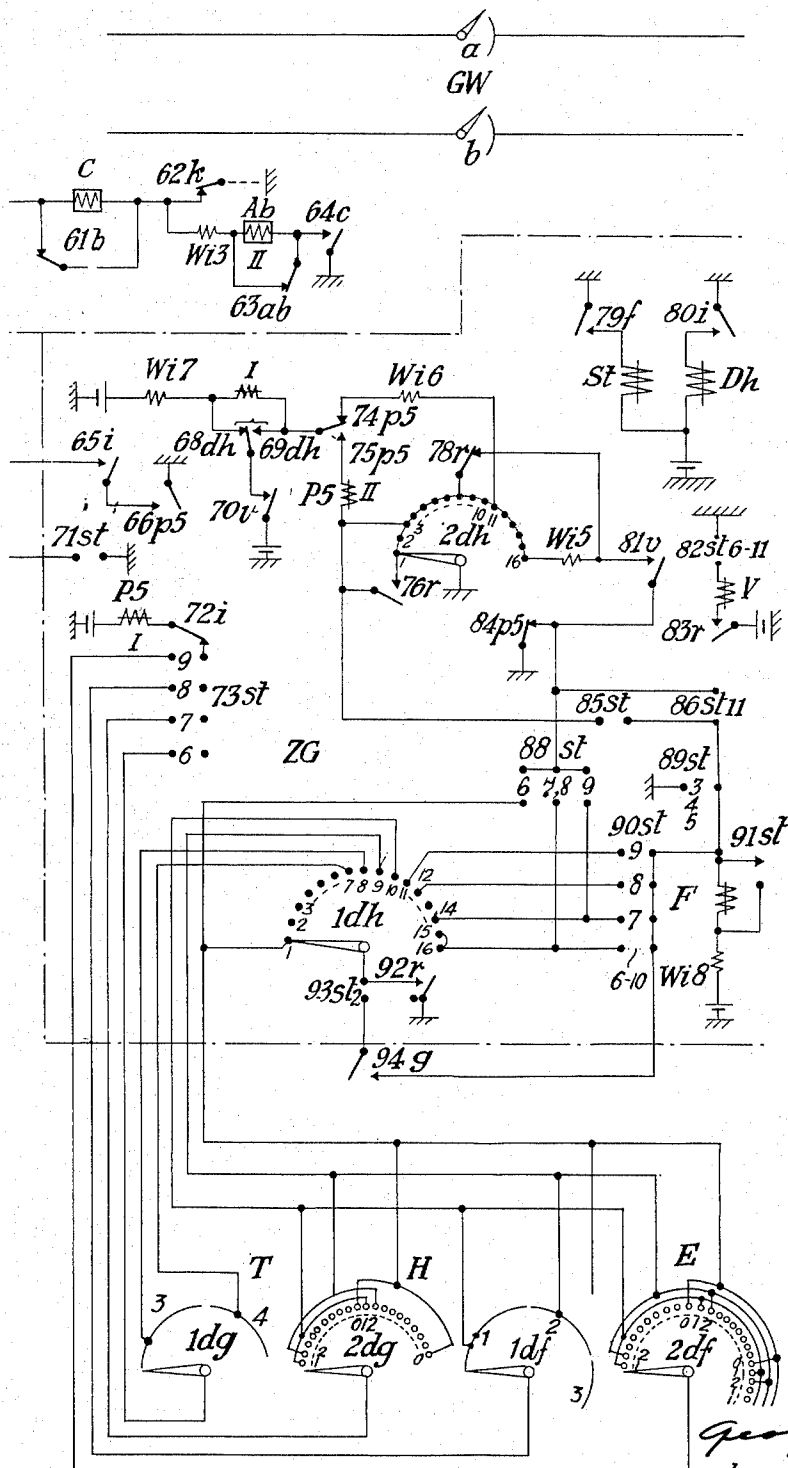
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TELEPHONE SYSTEM

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3 Sheets-Sheet 3

Fig. 3.



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TELEPHONE SYSTEM

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Application December 21, 1939, Serial No. 310,281
In Germany November 7, 1938

11 Claims. (Cl. 179—27)

The present invention relates to a circuit arrangement in distant communication installations, more particularly in telephone installations, for ascertaining calling subscribers by means of a testing device which is started when the subscriber's station is to be identified and hunts for his line.

With known arrangements of this type the testing device is definitely associated with an impulse sender, so that the testing device must be connected with the connection path through the impulse sender, until the transmission of the trains of impulses corresponding to the call number to be ascertained is finished.

The testing device for ascertaining the calling subscriber station is, however, relatively complicated and expensive, as it must be provided with different signal characteristics for each subscriber. In order to improve the economic operation of the installation and to limit as much as possible the number of testing devices required, it is imperative that the testing devices should be exploited as much as possible.

The present invention discloses a method for using the testing devices only as long as is absolutely necessary for ascertaining the calling subscriber and putting them into readiness for further calling number determinations immediately after this operation. This is achieved by transmitting, simultaneously with the setting of the testing device, impulses marking the calling number to be ascertained to a storage device which preparatorily connects to the testing device a storage device at the disposal of a plurality of testing devices and are prepared for receiving impulses.

The drawings illustrate, by way of example, an embodiment of the invention. All the devices and circuit arrangements which are not absolutely necessary for the understanding of the invention have been omitted.

Figs. 1, 2 and 3, when taken together, show the skeleton circuits of a subscriber's switch VW and a group selector GW and also the detailed circuits of the equipment for determining, storing, and transmitting the calling subscriber's telephone number to a recorder.

Fig. 4 is a schematic layout of the equipment employed in the system.

At first, a short summary description of the arrangement shown is given, with particular reference to the diagram of Fig. 4.

After lifting the receiver a subscriber T_n is connected by the preselector VW with a free first group selector IGW. The subscriber there-

upon sets up the desired connection, in a well known manner, by sending out trains of numerical impulses. The connection stages following the first group selector are not shown. Associated with the first group selector is the recording mechanism RE the object of which is to record automatically all the data necessary for fee-determination. The recording of the number called, of the duration of the connection, of the date etc. is effected in known manner. The amount to be charged is likewise recorded in known manner by means of metering impulses. The recording device is therefore preferably arranged in the neighbourhood of a time-zone-set.

The main object of the present application, namely, the automatic recording of the number of the calling subscriber, is achieved by a testing mechanism Dc/D_d hunting for the calling subscriber's line, the signals for the calling line being simultaneously transmitted to a storage device D_g over a preselecting secondary line switch MW. Thereafter trains of impulses corresponding to the number of the calling line are transmitted to the recording device RE by means of a numerical sender ZG.

The moment for ascertaining the calling line can be chosen according to requirements. It may frequently be desirable to effect registration of the number of the calling subscriber only if a conversation has taken place. Should this be desired the start signal for the testing mechanism is given by the relay connected on the reply of the desired subscriber.

In the present example the ascertaining of the calling number is effected during the setting up of the connection after the setting of the first group selector, it being, of course, supposed that the recording mechanism RE is immediately associated with the first group selector and is ready to receive when it is set.

The making out of a ticket and, therefore, the ascertaining of the number of the caller will normally only be necessary, if certain connections, for example toll connections, are set up. The contact dek shown in Fig. 1 is a bank contact of the first group selector which is closed only when the group selector is set in accordance with a high-valued connection. By this contact the start signal for the testing mechanism Dc/D_d is given. First the finder switch AS₁ is stepped forward from its normal position step-by-step until it has found the impulsing group-selector. Synchronously with this finder switch the finder switch AS₂ associated with the numerical sender ZG is stepped forward, so that both finder

switches are set on the same group selector. Thereupon the first part of the testing mechanism, the testing switch Dc, is started up. The contacts of this switch are connected in a special manner with the subscriber junction lines, that is to say the wipers c of the subscriber's preselectors are connected with the contacts of testing switch Dc corresponding to the associated call numbers. As the identifying operations require only a very short length of time, the testing mechanism can be associated with a large group of subscribers, say, for example, a group of 2000 subscribers. The testing switch Dc must therefore provide 2000 different positions. To this end a large group selector with a plurality of wipers or a plurality of selectors, for example two 100-sectional motor selectors with 10 wipers each may be used.

When the wiper c of the calling subscriber has been found by one of the wipers of testing switch Dc, an alternating current test circuit is completed extending over one of the contacts se, one of the wipers of the switch Dc, the wiper c of the preselector of the calling subscriber and the wiper of the finder switch AS1 to a signalling device EST. In the signalling device a switching means is controlled by the alternating current so as to cause the selector Dc to stop. By the position of the wipers of the testing switch Dc the two last digits of the calling number are marked, provided that 100-point selectors are used. Simultaneously with the setting of the testing switch Dc the two last digits of the calling number are transmitted to the storage device Dfg over the contact dcd and the preselecting secondary line switch MW.

After the stopping of the testing switch Dc the second part of the testing mechanism, the testing switch Dd, is started and hunts for the wiper of the testing switch Dc, over which the calling station has been reached, likewise completing an alternating current test circuit, which extends over contact es, the wiper of the switch mechanism Dd, a wiper of selector Dc, the wiper c of the preselector of the calling subscriber and the finder switch AS1 to the signalling device EST. Also the stepping forward of the switch mechanism Dd is transmitted at the contact dcd over the preselecting secondary line switch MW to the storage device Dfg. The number of steps which the selector Dd must take from its 9-position in order to reach the contact to which the wiper of the selector Dc which marks the calling subscriber is connected, constitutes the criterion for the next higher digits that is to say for the hundreds or, respectively, the hundreds and thousands digits.

When the storage device Dfg has received the marking signal for the number of the calling subscriber, the testing device with the selectors Dc and Dd and the finder switch AS1 are released and are set ready for further call number determinations. The numerical sender ZG thereupon sends out under the control of the storage device Dfg three or four trains of impulses over the finder switch AS2 and the first group selector IGW to the recording device RE where the individual digits of the calling number of the subscriber are recorded. Immediately after the transmission of the markings for the calling number the finder switch AS2, the storage device and the numerical sender are released for further use.

There will now be explained in detail, with reference to Figs. 1, 2 and 3 of the drawings,

the circuit arrangement for the determination and transmission of the calling number.

The preselecting secondary line switch MW of which only the wipers 1mw to 5mw are shown has been pre-set on a free storage device Dfg. When a free storage device has been connected by the line switch MW, the following circuit is established: earth, wiper 4as1 in normal position, windings II and I of relay P2, wiper 3mw, contacts 54g1, 55g, winding of relay R, contacts, 10 not shown, battery, earth. In this circuit the relay P2 operates and, by closing its contact 46p2, short-circuits its high-resistance winding II and, by closing contact 32p2 prepares the starting circuit for the finder switch AS1. In the circuit 15 stated also the relay R in the storage device Dfg operates and temporarily controls the numerical sender ZG connected with the storage device as the control switch of the numerical sender is moved from its initial position 1 into the position 2. The closing of contact 76r completes the following circuit for the control switch stepping relay F: earth, wiper 2dh, contact 76r, control switch contact 85st, closed in the control switch position 1, winding of relay F, resistance W18, 25 battery, earth. By the closing of contact 76f the magnet St of the control switch receives an impulse, so that the control switch passes into the position 2. By the closing of contact 91st (contact of the magnet St of the control switch) 30 the relay F is short-circuited and caused to release.

When the subscriber Tn lifts the receiver in order to set up a connection, over the subscriber's line AL the preselector VW is caused to hunt for a free group selector. When this is found, the relays A and B in the group selector operate over the subscriber's line AL and the wipers a and b of the preselector VW. By the opening of contact 61b the short circuit of the winding of the seizing relay C is opened, relay C operates in the following circuit: earth, battery, contacts (not shown), winding of relay T, wiper c of the preselector, winding of relay C, off-normal contact 62k (closed in the home position of the group selector), contacts (not shown), earth. By the closing of contact 64c the locking circuit over resistance W13 and contact 63ab, is made independent of the off-normal contact 62k. The cut-off relay T in the preselector performs its well known operations, not shown here. If now the subscriber sets the group selector GW on a high-valued line by sending out a corresponding train of impulses the bank contact 25dek of the group selector is closed. For the start relay An 55 of the finder switch AS1 the following circuit is then completed: earth, contacts 24ab, 25dek, resistance W12, contact 32p2, winding of relay An, battery, earth. By closing the contact 31an the interrupter RU1 is connected to the magnet Da 60 of the finder switch AS1; earth, interrupter RU1, contacts 29p1, 31an, magnet Da, battery, earth. Under the control of the interrupter the wipers 1as1, 2as1, 3as1, 4as1 of the finder switch are stepped forward step-by-step, until the group selector has been found from which the starting impulse is sent out by the closing of the bank contact. Synchronously with the finder switch AS1, the finder switch AS2, of which only the wipers 1as2 and 2as2 are shown here, are set, by 70 means of the contact 43da of the magnet Da of the finder switch AS1. Each time the magnet Da is energised, the magnet Db of the finder switch AS2 receives an impulse in the following manner: earth, contacts 43da, 44p2, wiper 2mw, 75

contact 47g1, magnet Db, battery, earth. Both finder switches are stopped when the following circuit is completed over the wiper 2as1: earth, contacts 24ab, 25dek, 28ab, winding I of relay Ab, wiper 2as1, contact 33e, winding of relay P1, battery, earth. In this circuit the relay Ab of the group selector and the relay P1 of the finder switch AS1 operate. The relay P1 opens the contact 29p1, whereby the interrupter RU1 is disconnected from the magnet Da. The relay Ab in the group selector opens the contact 28ab and closes the contact 26ab (make-before-break contact), so that a locking circuit for the relays Ab and P1 is closed over resistance W11. It further opens the contact 24ab whereby the starting earth in the group selector is removed. This condition is maintained throughout the connection, as the winding II of relay Ab, the short-circuit of which is removed at the contact 63ab, remains energised in the locking circuit throughout the connection.

After operation of relay P1 in the finder switch AS1 the interrupter RU2 is connected by contact 35p1 to the magnet Dc of the testing device Dcd. It receives impulses in the following way: earth, interrupter RU2, contacts 35p1, 99h, 11p3, magnet Dc, battery, earth. The testing switch Dc with the wipers 1dc-11dc is used for hunting the calling subscriber's station. The switch mechanism is here shown as a simple rotary switch. Preferably, a large-group-selector, for example a motor selector, or the like, might be used here. If, as previously stated, the testing device is associated with a group of 2000 subscribers, two motor selectors arranged for simultaneous stepping would be provided.

Under the action of the interrupter RU2 the wipers of the testing switch Dc are stepped forward, until the wiper c of the preselector of the calling station has been found by one of the wipers, which for this present example would be by the wiper 3dc. The following circuit is then completed: earth, source of alternating current WQ, contact 3h, condenser Ko3, wiper 3dc, wiper c of the preselector VW, wiper 1as1 of the finder switch, AS1, contact 34p1, condenser Ko11, alternating current relay WR in the signal receiving device ESE (shown diagrammatically only), earth. The alternating current relay WR operates and completes the following circuit by closing contact 38wr: earth, contacts 38wr, 15q, winding of relay P3, battery, earth. By the opening of contact 11p3 the magnet Dc is disconnected from interrupter RU2, whereby the wipers of the magnet Dc are stopped. By the closing of contact 14p3 and 18p3 the following circuit for the relay H is completed: earth, contact 14p3, winding of relay H, contact 18p3, battery, earth. The relay connects itself in the following circuit: earth, off-normal contact 12kdc (closed in the off-normal position of testing switch Dc), contact 13h, winding of relay H, contact 18p3, battery, earth. The relay H opens the contacts 1h to 4h over which alternating current had been applied to the condensers Ko1-Ko10 and at contact 99h opens another point in the circuit of magnet Dc. By cutting off of the source of alternating current the alternating current relay WR in the signalling device ESE is de-energised and restores. Relay P3 also restores when contact 38wr is opened and by the opening of contact 18p3 the winding of relay Q is freed of its short-circuit and is included in the above circuit for relay H. The relay Q therefore operates cutting off the relay P3 at the contact 15q and connecting prepara-

torily the winding of relay P4 at the contact 16q. By the closing of contact 8q the interrupter RU3 is connected to the magnet Dd: earth, interrupter RU3, contacts 8q, magnet Dd, battery, earth. Under the action of the interrupter RU3 the wipers 1dd and 2dd of the magnet Dd are stepped forward step-by-step, until over wiper 1dd the contact is reached to which the wiper of the testing switch Dc set to the calling subscriber's line is reached. The following circuit is then completed: earth, source of alternating current WQ, contacts 10p4, 9q, wiper 1dd upon contact 3, condenser Ko3, wiper 3dc, wiper c of the preselector, wiper 1as1, contact 34p1, condenser Ko11, alternating current relay WR in the signalling device ESE, earth. The alternating current relay WR in the signalling device operates again and completes the following circuit for the relay P4 over its contact 38wr: earth, contacts 38wr, 16q, 19p4, winding of relay P4, contact 21kdd (closed in the off-normal position of testing switch Dd), battery, earth. The relay P4 opens its contact 5p4 and thereby the stepping circuit for the magnet Dd, so that the latter is stopped. By the opening of contact 10p4 the source of alternating current WQ is cut off, whereby the alternating current relay WR in signalling device is de-energised. The relay P4, however, remains energised, as it completes for itself over contact 20p4 (make-before-break contact) the following locking circuit: earth, battery, contact 21kdd, winding of relay P4, contact 20p4, winding of relay E, contact 39p1, earth. In this circuit relay E also operates and locks itself over its contact 40e, independently of relay P1.

The impulses which the magnet Dc receives from the interrupter RU2 are transmitted by a contact 23dc of this magnet to the magnet Df of the storage device Dfg. In a similar manner the impulses which the magnet Dd receives from the relay interrupter RU3 are transmitted by the contact 22dd of the magnet Dd to the magnet Dg of the storage device Dfg. The storage device Dfg, therefore, simultaneously with the magnets Dc and Dd, receives impulses the number of which corresponds to the number of steps by which the wipers of the magnets Dc and Dd are stepped forward. The impulsing circuits for the magnets Dg and Df of the storage device Dfg extend as follows: earth, contacts 22dd, 48p2, wiper 4mw, magnet Dg, battery, earth, and earth, contacts 23dc, 49p2, wiper 5mw, magnet Df, battery, earth. In accordance with the impulses received the wipers 1dg, 2dg, 3dg of the magnet Dg and the wipers 1df and 3df of magnet Df are moved into definite positions. By the wipers of magnet Df, the two last digits, namely the units and the tens digits, and by the wipers 1dg and 2dg the two first digits, namely the hundreds and the thousands digits, of the call number are marked as will be explained in detail hereafter.

When the signals marking the subscriber's number are received by the storage device the purpose of the testing mechanism Dc/Dd has been fulfilled. There is, therefore, no objection to it being stepped-on into the home position in readiness for determining other call numbers. The release of the testing device is brought about by the relay E which was energised together with relay P4. By the closing of contact 41e the following circuit is completed: earth, contacts 41e, 42p2, wiper 1mw of the preselecting secondary line switch MW, contact 53g, winding I of relay G, battery, earth. The relay G closes its contact 52g (make-before-break contact) and thereby

completes a locking circuit for itself. By the closing of contact 56g (make-before-break contact) a holding circuit for the winding of relay R is completed over resistance Wi4. The relay G, furthermore, closes at the contact 58g a circuit for the winding I of relay G1. When contact 55g opens the circuit for the relay P2 is interrupted. The release of relay P2 causes, in known manner, the stepping-on of the preselecting secondary line switch MW, until it reaches the next free storage device Dfg.

Contact 33e opens and breaks the circuit for relay P1. By the closing of contact 36pl the relay interrupter RU2 is connected to the wiper 11dc and the magnet Dc, so that the magnet receives stepping impulses. The wipers of this magnet are stepped forward, until they reach their home position in which the wiper 11dc is disconnected from its segment. In the home position of testing switch Dc, the mechanical contact 12kdc is opened and thus the locking circuit for the relays H and Q is interrupted. By the closing of contact 6g the interrupter RU3 is connected to the wiper 2dd and the magnet Dd, so that the latter receives impulses. The wipers 1dd and 2dd are stepped-on to their normal positions. In the home position of testing switch Dd the contact 21kdd is opened and thus the locking circuit for the relays P4 and E is interrupted. The testing mechanism Dc/Dd is returned to its home position and is available for further use. Also, the finder switch AS1 associated with the testing mechanism is released, as the following homing circuit is completed when relay P1 restores: earth, interrupter RU1, contacts 29pl, 30an, wiper 3as1 on the segment, magnet Da, battery, earth. In the home position of the finder switch this circuit is connected at wiper 3as1.

After operation of the relay G in the storage device Dfg, the following circuit for the control-switch stepping-relay F is completed: earth, contact 92r, control-switch contact 93st closed in control-switch position 2, contact 94g, winding of relay F, resistance Wi8, battery, earth. By the closing of contact 79f the magnet St of the control switch receives an impulse so that it is stepped forward into its next or third position. At the contact 91st the relay F is short-circuited and the impulse for the control switch magnet is ended by the opening of contact 79f. In the control switch position 3 the following circuit is completed: earth, control switch contact 89st, closed in the control switch position 3, winding of relay F, resistance Wi8, battery, earth. The control switch is therefore stepped forward at once into its next or fourth position. The fourth and also the fifth positions of the control-switch are so-called transitory positions, so that the control-switch is stepped-on over contact 89st up to the position six. In the position six the contact 82st and the following circuit for relay V are closed: earth, control switch contact 82st, closed in the control switch position 6, winding of relay V, contact 83r, battery, earth. The control-switch contact 82st is closed in the positions 6-11 of the control switch and the relay V is energised in these control-switch positions. By the closing of contact 81v, the following circuit for the relay I is completed: earth, contacts 84p5, 81v, resistance Wi5, contact segment over which the wiper 2dh slides, resistance Wi6, contact 74p5, winding of relay I, resistance Wi7, battery, earth. By the closing of contact 80i the magnet Dh is connected and moves the wipers 1dh and 2dh to the next contact. The magnet Dh

actuates contact 69dh, so that the winding of relay I is short-circuited. The relay I restores and opens at the contact 80i the circuit for magnet Dh. The contact 69dh is therefore opened again and the relay I is again connected in the circuit referred to. The magnet Dh receives the next impulse. In this manner the wipers 1dh and 2dh are stepped-on step-by-step.

The switch positions of the wipers 1dg, 2dg and 1df, 2df of the storage device are wired with the contacts of the wiper 1dh in such manner that the contacts and contact segments of the storage device wipers which mark the numeral "1" are connected with the contact 10, the contacts and contact segments which mark the numeral "2" are connected with the contact 9, the contacts and contact segments which mark the numeral "3" are connected with the contact 8 of the contact bank of wiper 1dh, and so forth.

First the thousand-digit of the number of the calling subscriber which is marked by the wiper 1dg is recorded. It has been assumed that a testing device for 2000 subscribers is provided. For determining the thousand digit therefore only two possibilities arise, namely the marking that the calling subscriber is included in the one or to the other thousand. The contact bank of wiper 1dg accordingly presents only two different positions (contact segments). These positions are connected with the contacts of the numerical transmitter corresponding to the two thousand-groups with which the testing device is associated. According to the example the first segment of the contact bank of wiper 1dg is connected with the contact 8, the second contact segment with the contact 7 of the contact bank of wiper 1dh. When the wiper 1dg is set on the first segment the numeral "3" and when set on the second segment the numeral "4" is marked as the thousands-digit of the call number.

Assume that the wiper 1dg is set on the second segment. When the wiper 1dh, in the course of its forward movement, reaches the contact 7, the following circuit is completed after release of relay I: earth, battery, winding I of relay P5, contact 72i, control-switch contact 73st, closed in control switch position 6, wiper 1dg, second segment 4, wiper 1dh in position 7, contact 92p, earth. In this circuit relay P5 operates and completes the following locking circuit: earth, wiper 2dh on contact 8, winding II of relay P5, contact 75p5, winding of relay I, contacts 68dh, 70v, battery, earth and, also from contact 75p5 directly over contacts 69dh and 70v, battery, earth. The operations of the relay I, which now follow lead to the registration of the call number. For when the relay I is energised in further interrupting action of the relay I and of the magnet Dh an impulse is transmitted in the following manner to the recording device which is connected subsequent to the group selector: earth, contacts 66p5, 65i, 50g, wiper 1as2 of the finder switch AS2, choke Dr, wiper b of the group selector GW, lower talking conductor and the subsequent recording device, not shown. The impulses which the relay I receives are therefore transmitted to the recording device during the period during which relay P5 is energised. If four impulses are transmitted to the recording device at the contact 65i, the wipers 1dh and 2dh are moved on the 11th contact. The locking circuit for the relay P5, winding II is severed so that the relay restores. By the opening of contact 66p5 the impulse circuit to the recording device is

interrupted and subsequent operation of contact 65i is without effect on the recording device. When the wipers 1dh and 2dh reach the position 15, in the course of their advance movement, the following circuit for the control-switch stepping relay F is completed over the wiper 1dh: earth, contact 92r, wiper 1dh, contacts 15 and 16, control switch contact 90st, closed in control switch position 6, winding of relay F, resistance Wi8, battery, earth. As already described, the control switch is stepped from position 6 to position 7. In the position 7 the transmission of the hundreds-digit of the call number to the recording device takes place by means of the wiper 2dg of the storage device. In the contact bank of wiper 1dg the corresponding contacts that is to say the contacts "1," the contacts "2" etc. are connected with each other. The contacts "1" are connected with the contact 10 in the contact bank of the numerical sender wiper 1dh, the contacts "2" with the contacts 9, the contacts "3" with the contact 8 and so on.

As the relay V is also energised in the control switch position 7, the numerical sender rotates a second time immediately after the first one. Over the control switch contact 73st, closed in the control switch position 7, the wiper 2dg of the storage device is connected. Depending on the setting of this wiper a certain contact in the contact bank of the wiper 1dh of the numerical sender is connected with battery potential over control switch contact 73st, contact 72i, winding I of relay P5. If, for example, the wiper 2dg is set on a "2"-contact, then battery potential is applied to contact 9 of wiper 1dh. When the numerical sender reaches this contact in the course of its movement the following circuit for relay P5 is closed after wiper 1dh is stepped from contact 8 to contact 9 and after release of relay I: earth, contact 92r, wiper 1dh, contact 9, wiper 2dg on contact 2, control switch contact 73st, closed in control switch position 7, contact 72i, winding I of relay P5, battery, earth. The relay P5 is connected over winding II in a locking circuit as before, which circuit extends over wiper 2dh and is maintained, until this wiper leaves contact 10. Only after operation of relay P5 and the closing of contact 65p5 do the closings of contact 65i become effective on the recording device and impulses corresponding to the hundreds-digit of the subscriber's number are then transmitted to the subsequent recording device over the lower speaking conductor. When the wipers of the numerical sender are further stepped-on from contact 10 to contact 11, the locking circuit for relay P5 is interrupted and further operation of the contact 65i is without effect on the registration device since contact 66p5 is open. In position 14 of the numerical sender the following circuit for the control-switch stepping-relay F is closed over wiper 1dh: earth, contact 92r, wiper 1dh, position 14, control switch contact 90st, closed in position 7 of the control switch, winding of relay F, resistance Wi8, battery, earth. In a manner repeatedly described the control switch is stepped-on into the next position, namely position 8. Over the control switch contact 73st, closed in control switch position 8, the wiper 1df of the storage device is now connected. The wipers 1df and 2df slide over contact banks of 100 contacts each. The contacts of the wiper 1df are connected with each other in decades, that is to say 10 consecutive contacts are interconnected, whereas

in the contact bank swept by the wiper 2df the corresponding contacts, that is to say all the contacts "1," all the contacts "2" etc. are connected with each other. A contact corresponding to setting of the switch mechanism Df is marked over the wiper 1df in the contact bank of the wiper 1dh of the numerical sender. As the relay V remains further energised, the numerical sender, after having rotated a second time at once rotates for a third time. In the course of the movement of the numerical sender when the wiper 1dh reaches the contact which is connected with battery potential over the wiper 1df of the storage device the control switch contact 73st, closed in the control switch position 8, contact 72i and winding I of relay P5, the relay P5 operates as described, and the operation of contact 75i is effective for registration. In this manner impulses corresponding to the tens digit of the call number are transmitted over the lower talking conductor to the recording device. When the numerical sender is stepped from its position to the position 11, the locking circuit of relay P5 is interrupted again, so that impulse transmission to the recording device is terminated. In the position 12 of the numerical sender the following circuit for the control-switch stepping relay F is completed: earth, contact 92r, wiper 1dh, contact 12, control switch contact 90st, closed in the control switch position 8, winding of relay F, resistance Wi8, battery, earth. The control switch, therefore, is stepped-on into the position 9.

Over the control switch contact 73st, closed in the control switch position 9, the wiper 2df of the storage device is now connected and the transmission of impulses to the recording device takes place in the manner described, in order to mark the units digit of the calling number. When this operation is completed, the numerical sender is stepped from the position 10 to the position 11 and the following circuit for the control-switch stepping relay F is closed: earth, contact 92r, wiper 1dh, contact 11, control switch contact 90st, closed in the control switch position 9, winding of relay F, resistance Wi8, battery, earth. The control-switch therefore is stepped-on into position 10, from which position it is stepped forward, when the wiper 1dh reaches the contact 15: earth, contact 92r, wiper 1dh, contacts 15 and 16, control switch contact 90st, closed in the control-switch position 10, winding of relay F, resistance Wi8, battery, earth. The control switch therefore is stepped to the position 11.

In the position 11 the control-switch contact 71st is closed and the following circuit is completed for the winding II of relay G; earth, control-switch contact 71st, closed in the control switch position 11, contact 51g, winding II of relay G, battery, earth. The winding II of relay G is differentially connected to the winding I of relay G. The relay G therefore releases. By the opening of contact 52g the locking circuit for the winding I of relay G is interrupted. By the opening of contact 56g also the circuit for the relay R is broken. By the opening of contact 58g the circuit of the winding I of relay G1 is interrupted. The relay G1 does, however, not yet release, but holds itself until the storage device has reached its home position as the following circuits are completed: earth, interrupter RU4, winding II of relay G1, wiper 3df in operated position, contact 59r, magnet Df, battery, earth, and earth interrupter RU4,

winding II of relay G1, wiper 3dg, contact 60r, magnet Dg, battery, earth. Under the action of the interrupter RU4 the magnets Dg and Df receive impulses, until the wipers of these magnets reach their normal positions. Only then does the relay G1 release, closing its contact 54gl and permitting the storage device Dfg to be again seized by the preselecting secondary line switch MW and to be prepared for a reception of further calling number markings.

From its last position II the control-switch of the numerical sender is moved into its initial position, the control-switch stepping relay F being energised in the following circuit; earth, contact 84p5, control-switch contact 36st, closed in the position II of the control switch, winding of relay F, resistance W18, battery, earth. As in the meantime the relay R has restored the control switch remains in its position I. Only when the storage device shown is seized by a preselecting secondary line switch is the control switch of the numerical sender preparatorily moved from the position I to the position 2.

After release of relay R also the finder switch AS2 is switched into its normal position in the following circuit: earth, interrupter RU5, contact 57r, wiper 2as2 in its operated position, magnet Db, battery, earth. When the finder switch reaches the home position this circuit is interrupted by the wiper 2as2 which runs off the segment.

All the devices are now in their normal position.

I claim:

1. In a telephone system, subscribers' lines, an individual switch for each of said lines, switching apparatus accessible to each of said individual switches, a plurality of storage devices, a testing mechanism for determining calling lines, means for associating an idle one of said storage devices with said testing mechanism, means including one of said individual switches and said switching apparatus for extending a connection from a calling one of said lines, means operative in response to the extension of said connection for automatically associating said testing mechanism with said switching apparatus, means operative in response to the association of said testing mechanism with said switching apparatus for initiating the operation of said testing mechanism to thereby find said calling subscriber's line, and a test circuit for terminating the operation of said testing mechanism effective only when said calling line is found.

2. In a telephone system, subscribers' lines, an individual switch for each of said lines, switching apparatus accessible to each of said individual switches, a plurality of storage devices, a testing mechanism for determining calling lines, means for associating an idle one of said storage devices with said testing mechanism, means including one of said individual switches and said switching apparatus for extending a connection from a calling one of said lines, means operative in response to the extension of said connection for automatically associating said testing mechanism with said switching apparatus, means operative in response to the association of said testing mechanism with said switching apparatus for initiating the operation of said testing mechanism to thereby find said calling subscriber's line, and a test circuit for terminating the operation of said testing mechanism effective only when said calling line is found,

said testing circuit including elements of said calling subscriber's individual switch, said switching apparatus, said means for associating said testing mechanism with said switching apparatus, and said testing mechanism.

3. In a telephone system, subscribers' lines, non-numerical switches individual to each of said subscribers' lines, a numerical switch accessible to said non-numerical switches, means controllable by a calling subscriber on one of said lines for operating his individual non-numerical switch to thereby seize said numerical switch and to extend a connection to a called subscriber's line, a calling line identifying device for identifying said calling line, a storage device, means operative in response to the extension of said connection for associating said identifying device with said numerical switch, means synchronously operative under control of said last mentioned means for associating said storage device with said numerical switch, and means operative in response to the association of said devices with said numerical switch for operating said identifying device to thereby identify said calling line and to simultaneously operate said storage device to thereby store the identification of said calling subscriber's line.

4. In a telephone system, a group of lines, a progressively operable switch train for extending a connection to desired called lines, means under control of a calling subscriber on one of said lines in said group of lines for progressively operating said switch train, a calling subscriber's line identifying unit, a sender, means operative responsive to the operation of a particular one of said switches in said train for associating said identification unit with said one switch, means directly controlled by said last mentioned means for associating said sender with said one switch, means operative in response to the association of said identification unit with said one switch for progressively testing said group of lines to find said calling subscriber's line, a recording mechanism associated with said one switch, and means controlled by said identification unit operative in response to the finding of said calling line for controlling the operation of said sender to thereby transmit the telephone number of said calling subscriber's line via said one switch to said recorder to thereby record said calling subscriber's telephone number.

5. In a telephone system, a plurality of selectors, a plurality of subscribers' individual switches, a conductor extending from each of said selectors and terminating in the banks of said individual switches, means effective responsive to the initiation of a call by a subscriber for operating his associated individual switch to seize an idle one of said selectors, means in the said selector operative in response to seizure thereof for placing a potential on said conductor, a testing mechanism for testing said subscribers' individual switches, means controlled by said seized selector for associating said testing mechanism therewith and for initiating the operation of said testing mechanism to find said calling subscriber's individual switch, a test circuit including said calling subscriber's individual switch and said conductor, and means for transmitting an alternating current over said test circuit for terminating the operation of said testing mechanism.

6. In a telephone system, a plurality of selectors, a plurality of subscriber's individual switches, a conductor extending from each of said selectors and terminating in the banks of

said individual switches, means effective responsive to the initiation of a call by a subscriber for operating his associated individual switch to thereby seize an idle one of said selectors, means in the said selector operative in response to seizure thereof for placing a potential on said conductor, a testing mechanism for testing said subscriber's individual switches, means controlled by said seized selector for associating said testing mechanism therewith and for initiating the operation of said testing mechanism to identify said calling subscriber's individual switch, a test circuit including said calling subscriber's individual switch and said conductor, means for transmitting an alternating current over said test circuit for terminating the operation of said testing mechanism, and means controlled by said testing mechanism for transmitting the telephone number of the calling subscriber's individual switch to said selector.

7. In a telephone system, subscribers' lines, switching apparatus accessible to said lines, a plurality of storage devices, a testing mechanism for determining calling lines, a preselecting switch for normally associating an idle one of said storage devices with said testing mechanism, means for extending a connection from any one of said lines over said apparatus, means operative in response to the extension of said connection for controlling said testing device to thereby determine the calling subscriber's line involved in said connection, and means including said testing device for transmitting impulses to said associated storage device indicative of the telephone number of the calling subscriber's line involved in said connection.

8. In a telephone system, an exchange having a plurality of groups of lines extending thereto, a first identifying mechanism, a second identifying mechanism, said first mechanism operative to identify a line in said groups of lines having a calling condition thereon, said second mechanism operative to identify the particular group of said groups of lines containing the line having the calling condition thereon, means for initiating the operation of said first mechanism when a calling condition is present upon a line in said groups of lines, and means for initiating the operation of said second mechanism operative in response to the identification of said line having a calling condition thereon by said first mechanism.

9. In a telephone system, an exchange having a plurality of groups of lines terminating therein, switching apparatus in said exchange operative in response to a call on a line in said groups of lines for extending a connection from said calling line to a desired called line, a register, a first identifying mechanism operative in response to the extension of said connection for identifying said calling line in said groups of lines and for simultaneously transmitting certain digits indicative of a portion of the telephone number of said calling line to said register, and a second identifying mechanism operative in response to the identification of said calling line by said first mechanism for identifying the particular group of lines containing the said calling line and for simultaneously transmitting certain other digits indicative of another portion of the telephone number of said calling line to said register.

10. In a telephone system, a plurality of groups of lines, means for placing a calling condition on one of said lines, a register for registering the telephone number of a line having a calling condition thereon, a first identifying mechanism, means for initiating the operation of said first mechanism for identifying said line in said group of lines having a calling condition thereon and for simultaneously transmitting certain digits of the telephone number of said line to said register, and a second identifying mechanism operative in response to the identification of said line by said first mechanism for identifying the particular group of lines containing said line and for simultaneously transmitting certain other digits of the telephone number of said line to said register.

11. In a telephone system, subscribers' lines, switching apparatus accessible to said lines, a plurality of storage devices, a testing mechanism for determining calling lines, means for associating an idle one of said storage devices with said testing mechanism, means for extending a connection from any one of said lines over said apparatus, means operative in response to said connection for controlling said testing device to thereby determine the calling subscriber's line involved in said connection, and means including said testing device for transmitting impulses to said associated storage device indicative of the telephone number of the calling subscriber's line involved in said connection.

GEORG ZAPF.