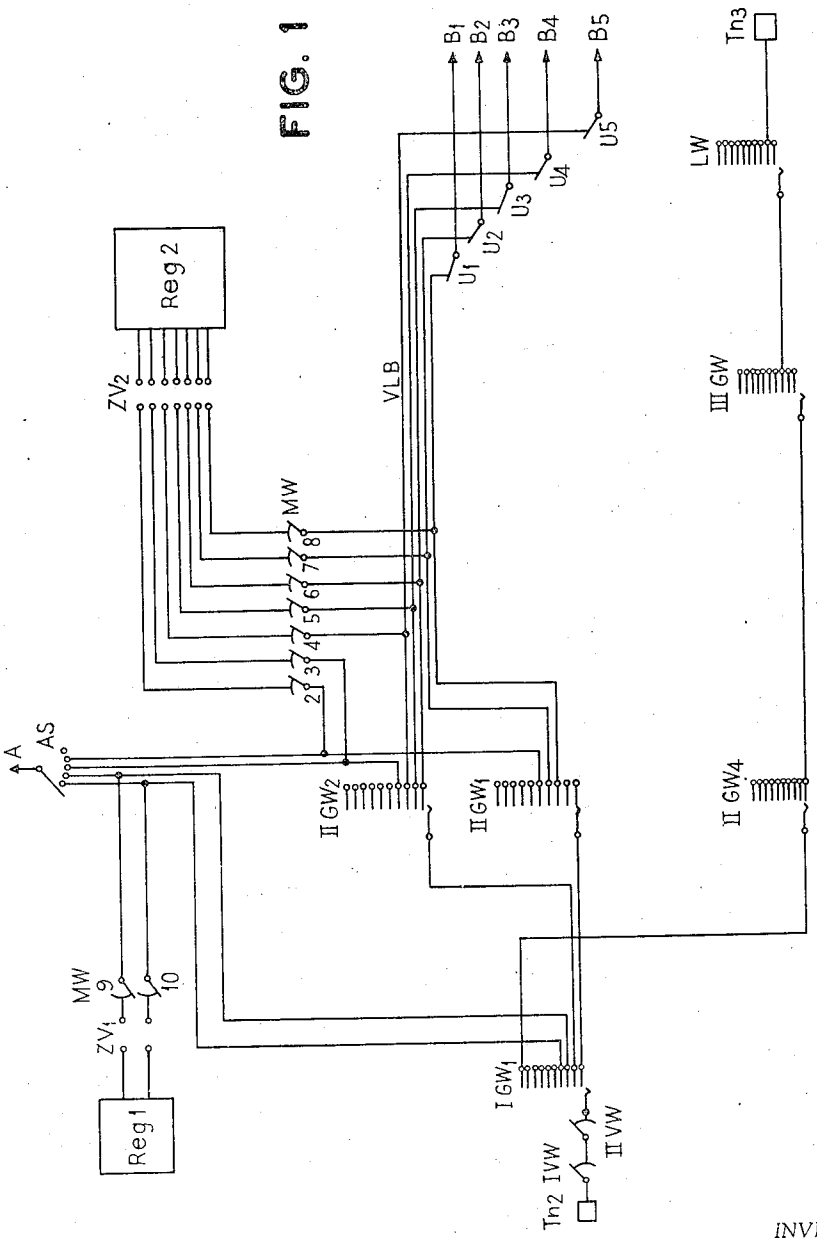
Aug. 13, 1940. R. PFANNSCHMIDT 2,211,159

AUTOMATIC TELEPHONE SYSTEM

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FIG. 1



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AUTOMATIC TELEPHONE SYSTEM

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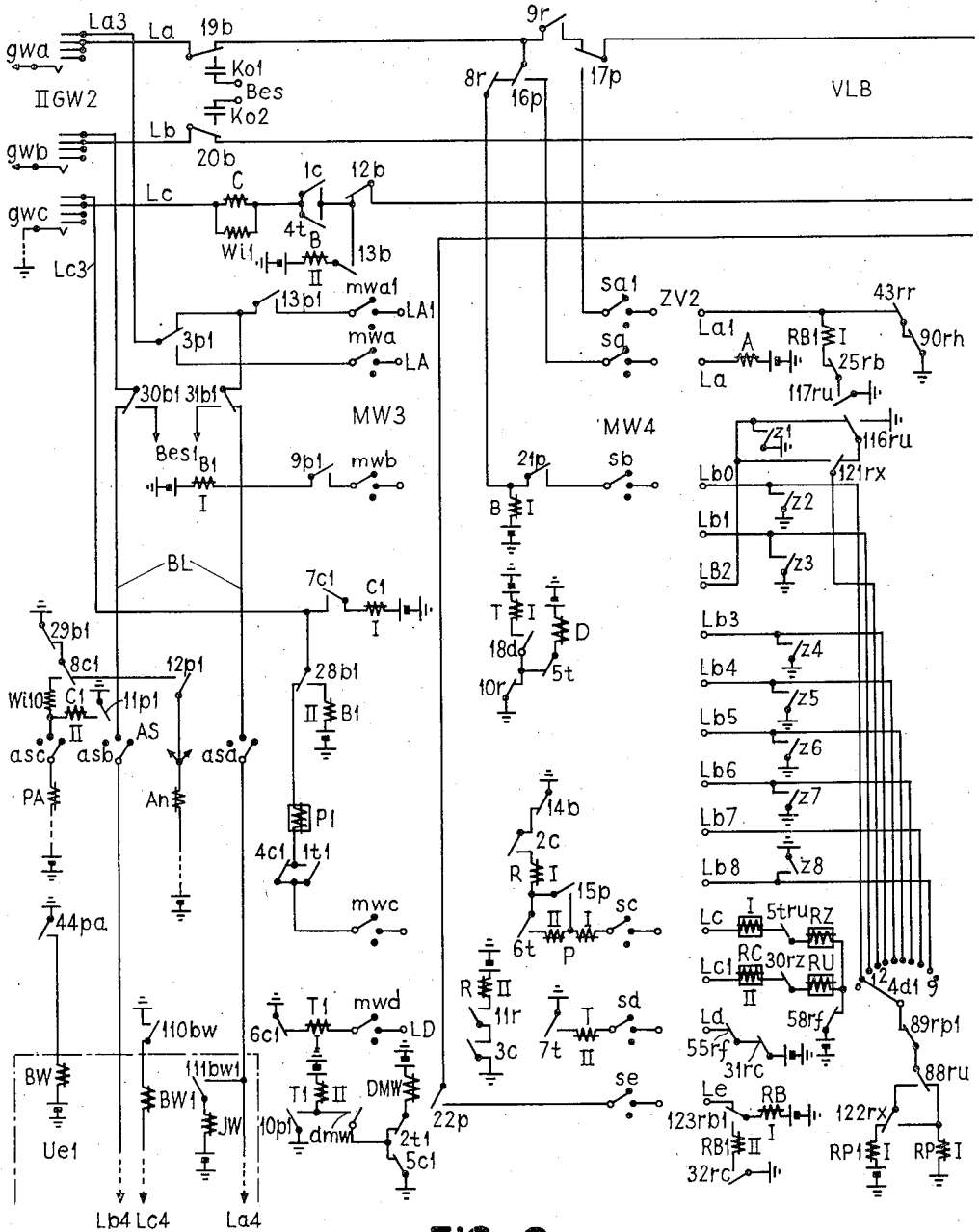


FIG. 2
PART 1

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AUTOMATIC TELEPHONE SYSTEM

Filed June 1, 1937 3 Sheets-Sheet 3

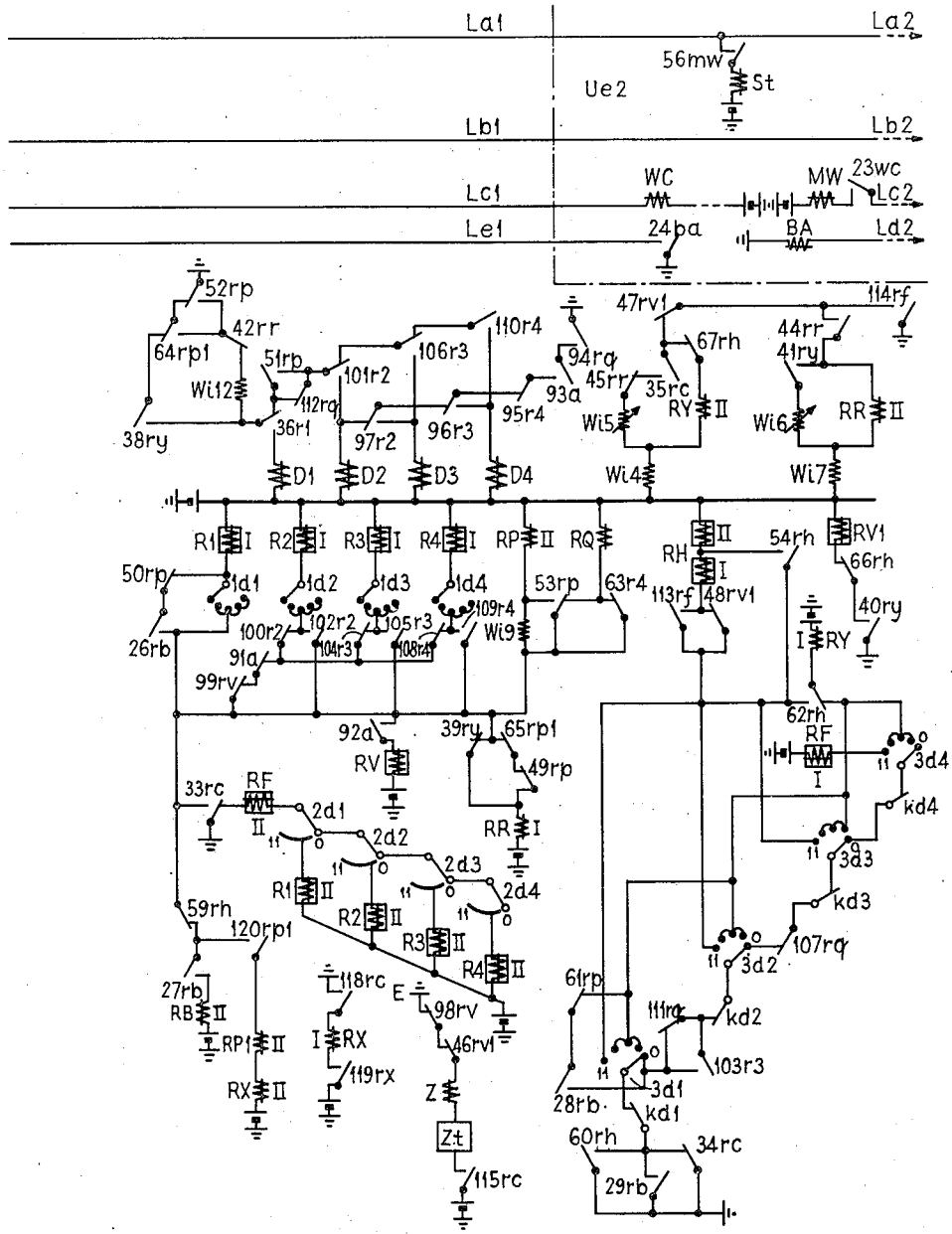


FIG. 2
PART 2

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UNITED STATES PATENT OFFICE

2,211,159

AUTOMATIC TELEPHONE SYSTEM

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Application June 1, 1937, Serial No. 145,724
In France June 30, 1936

14 Claims. (Cl. 179—18)

The present invention relates to a circuit arrangement for automatic telephone systems and especially to such systems in which a plurality of exchanges are provided and in which registers are used for the establishment of calls. The invention aims at simplifying the registers which are provided in such systems and to make them suitable for coping with the various conditions of operation which arise in such systems. For this purpose the registers are provided with a plurality of approaches, while switching means in the register determine the value and number of the additional impulse trains to be transmitted from the register or alternatively prevent any additional transmission of impulses in accordance with a characterizing condition arising at these approaches when a register is seized. A particularly convenient embodiment of the invention utilizes a single switch for fixing the value of the additional impulse trains and for determining whether there shall be any additional transmission of impulses.

A further characteristic of the invention consists in that in accordance with the seizing and characterizing of the approach to a register it is determined whether only a single impulse train or all the impulse trains are to be transmitted when a revertive impulse is sent out when the devices to be set by the register have been set in readiness. This arrangement enables the register to be used for establishing calls to exchanges operating in different fashions.

A further advantageous arrangement of the register consists in that the register can be seized by a preceding switch both by using a through testing lead and also by connection to a connecting line already seized by a preceding switch. In the first case the connection of a free outgoing line in the desired direction takes place at the preceding switch after the register has been seized.

Other devices characteristic of the invention which indicate the various applications to which the register may be put by suitable utilization of the approaches, may be deduced from the drawings and from the description.

Fig. 1 shows by way of an example a telephone system in which the register Reg 2 shown in detail in Fig. 2, parts 1 and 2, can be used with advantage. If the subscriber desires to call an exchange to which the line B5 leads the subscriber effects the setting of the group selector IGW1 on the level 2. Over this level access is gained to a free second group selector IIGW2. This group selector becomes set on level 3. A free line in the direction B5 is thereupon found. A free register, for example, the register Reg 2, is set in readiness over the secondary switch MW4. The register is guarded on the seizure of the line B5. The seizure of the register Reg 2 by way of the secondary switch MW4 determines that the register shall not only transmit impulse trains sent to it by the subscriber but that an additional impulse train shall also be transmitted. The value of the additional impulse train is determined by characterizing the particular approach to the register.

If the subscriber desires a connection in the direction B4, he sets the second group selector IIGW2 on level 2. This connects him to a free line in the direction B4 to which a free register is connected by way of the secondary switch MW5. On account of the special wiring between the secondary switch MW5 and the approach to the register, the register is caused not to transmit impulses but merely to re-transmit those sent in to the register by the subscriber. In this case, of course, translation of the individual impulse trains may take place.

If the group selector IIGW2 is set on the fourth level the group selector tests over a secondary switch MW3 which has been set previously on a free register (for example, Reg 2). A free call finder AS is then started up and connects the line A with the line seized by the group selector. Through the seizing of the register Reg 2 over the secondary switch MW3 the approaches to the register are characterized in such a way that the register transmits two additional impulse trains. The value of these impulse trains can correspond to the particular level on which the group selector IIGW2 has been set, since switches in the register hunt for the characterized approach and are thus able to effect the transmission of a corresponding number of impulses.

It is possible when transmitting two additional impulse trains for the value of the first impulse train to be transmitted to be in accordance with the setting of the group selector IGW1 and for the value of the second impulse train to be transmitted to be determined by the setting of the group selector IIGW2.

If the group selector IGW1 is set on levels 3 or 4 the register Reg 1 is connected up over this group selector and a line of the group of lines A is connected over a free call finder AS. Thus calls in the traffic direction A can be set up either by the aid of the register Reg 1 or by the aid of the register Reg 2.

Fig. 2, parts 1 and 2, shows the details of the

register indicated by the reference Reg 2 in Fig. 1. Two secondary switches are represented indicated by MW3 and MW4. These secondary switches have access to the register Reg 2 and are set in preparation on such a free register. The group selector IIGW2 shown in Fig. 2, part 1, has, as is indicated in Fig. 1, access to a number of different traffic directions. The traffic direction A is reached by setting the group selector IIGW2 on the fourth level. On setting the group selector on the level 3 access is gained to the traffic direction B5 as represented in Fig. 1. Secondary switches are associated with the outgoing lines from a level of a group selector and these seize the same approaches to the register. It is, however, also possible to connect the secondary switch which is connected to the last contact in a level of a group selector to the register in such a way as to obtain a different mode of operation of the register in this case. This may be necessary, for example, when traversing engaged groups of lines in that in this case a special additional impulse train may be transmitted.

When the group selector is set on level 3 a secondary switch is connected to the register, the wiper *sc* of which secondary switch is connected to the approach Lc and the wiper *sb* being connected to the approach Lb3. This characterization of the approaches means that the register is to receive and to transmit three of the impulse trains transmitted by the calling station and that in addition a further impulse train is to be transmitted whose value is determined by the approach (Lb3) characterized.

If the group selector IIGW2 is set on another level, for example on the level 2, one of the traffic directions B, for example B4 in Fig. 1, is connected up. The secondary switches MW5 connected to the lines in level 2 of the group selector are connected to the approach Lc by way of the contacts associated with wiper *sc* of the secondary switch, and by way of the contacts associated with wiper *sb* are connected to the approach Lb0. This reference indicates that the register is only to transmit the three impulse trains sent in from the calling station without any additional impulse having to be transmitted.

If the group selector IIGW2 is set on level 4 the register is connected up over the secondary switch MW3 whose wiper *mwc* has access to the approach Lc1 of the register. Wiper *mwb* of the secondary switch MW3 is connected to the approach Lb5. This characterizing of the approaches causes the register to transmit 5 impulse trains. Thus in addition to the three impulse trains transmitted by the call station two additional impulse trains are transmitted. The first of these impulse trains corresponds to the complementary number of the number 2 with respect to the number 11. The second digit which corresponds to the setting of the group selector IIGW2 is determined by the characterizing of the approach Lb5. The transmission of the additional impulse trains is effected by the aid of the switch D1. The value of these digits is computed by means of wiper 4d1. If, for this sort of characterization another approach, for example the approach Lb7, is characterized instead of the approach Lb5, the value of the second impulse train to be transmitted is adjusted in accordance with this approach.

A further specialty of the register shown consists in that in accordance with its seizure the register is in the position either to bring about the transmission of all the impulse trains when a "ready" signal is received from succeeding devices or alternatively to be able to receive a "ready" signal before the transmission of each individual impulse train. For determining this mode of operation the lead Le1 and wiper *se* of the seizing secondary switch are used.

A further property of the register consists in that when the group selector is set on level 3 the register is connected to line VLB which the group selector has tested as free while on the setting of the group selector IIGW2 on level 4 the group selector can test directly on a free register.

In the following description the establishment of a call by setting the group selector IIGW2 on level 3 will first be described. The register is in this case taken into use over the secondary switch MW4. The secondary switch MW4 is already set in preparation on a free register. This preliminary setting of the switch MW4 takes place as follows:

When the wipers of the secondary switch MW4 are standing on the approaches to an engaged register the following circuit is set up: earth, contacts 10*r* and 5*t*, rotary magnet D, battery and earth. The rotary magnet energizes and advances the wipers *sa*, *sa1*, *sb*, *sc*, *sd*, and *se* of the secondary switch. Contact 18*d* of the rotary magnet D is closed whereupon relay T energizes over winding I. Relay T breaks the circuit of the rotary magnet D at contact 5*t*. Magnet D releases and opens contact 18*d*. Relay T thereupon releases whereupon magnet D is again operated through the closing of contact 5*t*. This cycle of operation is repeated until wiper *sd* of the secondary switch rests on the contacts associated with a free register. The following circuit is set up: earth, contact 7*t*, winding II of relay T, wiper *sd*, contact Ld in the intermediate distributor ZV2, contacts 55*rf*, and 31*rc*, battery and earth. In this circuit relay T remains energized over its winding II. The energizing circuit for the rotary magnet D then remains open at contact 5*t*. Contact 6*t* is closed and prepares a circuit over which the register, which has been connected up in preparation, when taken into use is guarded against further seizure. Contact 4*t* is closed so that the line LC is characterized as being able to be seized by the wiper *gwc* of a hunting group selector IIGW2.

When the group selector IIGW2 has been set on level 3 and after hunting in this level finds the line VLB to be the first free line the following circuit is set up: earth, switching means which are not shown associated with wiper *gwc* of the group selector, lead Lc, relay C, contacts 4*t* and 12*b*, lead Lc1, relay WC in the repeater Ue2, switching means which are not shown, battery and earth. In this circuit in addition to the testing means in the group selector, relays C and WC also energize. Relay WC operates its contacts 23*wc* whereupon relay MW and the battery connected to this relay is connected to lead Lc2. This connection of battery can be used to set subsequent switching devices in readiness, whereupon relay MW then energizes and operates contact 56 MW. The application of battery to the lead Lc2 can also serve to cause succeeding devices to connect battery to the lead Ld2 so that contact 24*ba* is closed by the energizing of relay BA and applies earth to lead Le1. This application of earth to lead Le1 is used for influencing the register in a particular way as will be described later.

When on the seizure of the lead Lc, relay C energizes contacts 1*c*, 2*c*, and 3*c* are switched

over. Contact 1c shunts contact 4t. Contact 2c sets up the following circuit: earth, contacts 14b and 2c, winding I of relay R, contact 6t, windings II and I of relay P, wiper sc, contact Lc of the intermediate distributor ZV, winding I of relay RC, contact 57 ru, relay RZ, contact 58rf, battery and earth. Relays RP, RC, and RZ operate in this circuit. Contact 3c prepares a circuit for winding II of relay R. Relay P switches over contacts 16p and 17p and closes contacts 15p, 21p and 22p. The energizing of relay R opens contact 8r and closes contact 9r. Contact 10r is open so that the deenergizing of relay T and the closing of contact 5t do not result in the energization of the rotary magnet D. Contact 11r sets up a locking circuit for winding II of relay R. In the register relays RZ and RC are energized. Contact 30rz is opened by relay RZ thereby definitely preventing relay RU from energizing over another secondary switch. Contact 31rc is open so that relay T of the secondary switch MW4 releases. The contacts of relay T are thereby restored to normal which fact does not, however, influence the secondary switch MW4. Other secondary switches which were likewise set on the register which was taken into use are switched on when their T relays release through the closing of contacts corresponding to contact 5t. Contact 32rc is closed but does not promote any further switching operations. Contact 33rc prepares a locking circuit for winding II of relay RB. In addition it effects the energizing of relay RR in the following circuit: earth, contacts 33rc and 39ry, winding I of relay RR, battery and earth. Contact 34rc is opened, but this does not produce any switching operation. Contact 35rc connects resistance Wi5 in parallel with winding II of relay RY in preparation. The register is now seized in the normal way and guarded so that impulses outgoing from the calling station and transmitted over the lead La as earth impulses can be received by relay A. Transmission of impulses by the register only occurs when a "ready" signal is sent from the repeater Ue2 over the lead Le1 and wiper se to winding I of relay RB. Should two secondary switches which are preliminarily set on the same register be taken into use at exactly the same time so that the relay C energizes simultaneously in two connecting lines VLB, that subscriber whose P relay was energized formerly obtains access to the free register. If this should be the relay P of the other secondary switch and the corresponding winding I of relay R does not receive sufficient current through the closing of contact 15p to energize, the corresponding secondary switch is then advanced in that the relay T of this secondary switch deenergizes when the lead Ld is broken at contact 31rc. Another free register is then set in readiness under the control of relay T and, since the relay C of the connecting line in question has energized, is immediately guarded. If the subscriber should transmit impulses before a free register has been connected, which is improbable, relay B would be energized over lead La and its winding I by the first impulse. Relay B then holds up over its winding II by closing contact 13b. Contacts 19b and 20b are switched over so that the calling subscriber receives the busy signal "Bes." The guarding of a register which has been prepared for use is prevented in this case since the opened contact 14b prevents the guarding circuit from becoming effective. When the calling subscriber replaces his receiver the seized connecting line is also released through the opening of lead Lc.

When, after the register has been seized and guarded, relay RB energizes through the closing of contacts 24ba in the repeater Ue2, the contacts of this relay (RB) are operated. Contact 25rb is opened. Contact 26rb sets up the following circuit for winding I of relay R1: earth, battery, winding I of relay R1, contacts 50rp, 26rb, 33rc, and earth. Contact 27rb establishes a locking circuit for winding II of relay RB which runs from earth over contacts 33rc, 59rh and 27rb to winding II of relay RB. Contacts 28rb and 29rb establish the following circuit for winding I of relay RY: earth, contact 29rb, contact kd1 of the rotary magnet D1, wiper 3d1 of switch D1 in position 0, contacts 28rb, 61rp, 62rh, winding I of relay RY, battery and earth. Relays R1 and RY energize. The rotary magnet D1 is connected up in the following circuit over contact 36r1 on the energizing of relay R1, earth, contacts 52rp, 64rp1, 38ry, 36r1, rotary magnet D1, battery and earth. The magnet D1 is operated and actuates its contact kd1. It advances the wipers 1d1, 2d1, 3d1 and 4d1 a step further. Relay RR is held operated over contacts 65rp1 and 49rp on the opening of the contact 39ry. Contact 40ry energizes relay RV1 over contact 66rh. Relay RV is a slow relay and remains energized during the impulsive operation of contact 40ry. Contact 48rv1 disconnects relay RH. Contact 47rv1 is opened. Contact 46rv1 breaks the circuit for relay Z which in special circumstances cooperates with the time switch zt as will be described later. When contact kd1 is opened after the switch D1 has taken its first step, relay RY releases. Contact 38ry brings about the deenergizing of the magnet D1. Hereupon contact kd1 is again closed. Relay RY energizes again over winding I in a circuit over: earth, contact 29rb, contact kd1, wiper 3d1 in position 1, contact 62rh, winding I of relay RY, battery and earth. Relay R1 does not release during the stepping of wiper 1d1. When relay RY energizes again the rotary magnet D1 is energized once more over contact 38ry. Relay RY is denergized again on the opening of contact kd1, whereupon the magnet D1 is again deenergized. This play between the magnet D1 and relay RY continues until wiper 4d1 rests on contact 3 which is especially characterized over wiper sb. The following circuit is set up for winding I of relay RP: earth, winding of relay RP, contacts 88ru, 89rp1, wiper 4d1, contact 3 in the bank associated with wiper 4d1, lead Lb3, a contact in the contact bank associated with wiper sb of the switch MW4, wiper sb, contact 21p, winding I of relay B, battery and earth. In this circuit only relay RP energized over its winding I and operates its contacts. Contact 49rp breaks the energizing circuit of relay RR so that relay RR now follows the intermittent operation of contact 39ry. Contact 50rp is opened but relay R1 remains energized over wiper 1d1. Contact 51rp is closed in preparation. Contact 52rp is switched over so that the further advancing of switch D1 is now independent of contact 38ry but is dependent upon the operation of contact 42rr. Contact 53rp keeps relay RP up over winding II by short-circuiting resistance Wi9 which had previously prevented relay RP from energizing over winding II. When relay RY operates after the third step has been taken by switch D1, relay RR is caused to deenergize. Accordingly the first impulse is transmitted over

contact 43rr and the switch D1 is stepping on to position 4 over contact 42rr. This impulse passes from earth over contacts 90rh, 43rr, wiper sa1 of the secondary switch MW4, contacts 17p and 56MW, the control relay St, battery and earth. The relay St energizes and thus transmits the impulse sent out from the register in any known manner. When contact kd1 opens relay RY falls back. Contact 39ry is closed and thereupon relay RR energizes. Magnet D1 is deenergized through the opening of contact 42rr and the opening of contact 43rr terminates the transmission of the first impulse to be sent out. Contact kd1 is closed and relay RY energizes again whereupon relay RR releases on the energizing of magnet D1 and a second impulse is sent out over contact 43rr. When magnet D1 energizes, contact kd1 again deenergizes relay RY. During the impulse operation of winding I of relay RY winding II of relay RR is switched on by contact 41ry. This latter winding is disposed in parallel with the adjustable resistance Wi6. By adjusting the resistance Wi6 the damping of relay RR can be controlled. A similar kind of damping takes place in the case of winding II of relay RY which is controlled by contact 45rr. Through this damping of the relays RY and RR, the speed of operation of the switch and the length of the impulses and impulse pauses during the transmission of impulses can be adjusted to the requirements of the system.

When the switch D1 advances to position 11 in the manner just described, relay RY (winding I) is deenergized for a prolonged period since contact 11 at wiper 3d1 is not directly connected to winding I of relay RY. Relay RV1 releases on account of contact 40ry remaining open for a long time. On the release of contact 48rv1 relay RH is energized. The energizing circuit for RH runs: earth, battery, windings II and I of relay RH, contact 48rv1, contact 11 associated with wiper 3d1, contact kd1 and 29rb and earth. Relay RH operates its contacts and locks up at contact 54rh. At contact 90rh earth is disconnected from the pulsing circuit. Contact 62rh causes relay RY to be energized afresh, whereupon the latter brings about the release of relay RR (winding I). Magnet D1 accordingly receives an impulse so that the wipers of the switch D1 are advanced to the position 0. Relay RV1 does not energize on the last step of the switch since contact 66rh is open. The damping of winding II of relay RY is removed at contact 67rh. The transmission of an impulse when the switch D1 is stepped from position 11 to position 0 does not take place in spite of the closing of contact 43rr since contact 90rh is opened. Contact 59rh has been opened and has broken the locking circuit for winding II of relay RB. The contact 29rb is shunted by contact 60rh. Relay RH makes a delayed release when the switch D1 is restored to normal. Relay RP is maintained energized over its winding II. The transmission of the digits registered in the switches D2, D3 and D4 takes place after the transmission of the digit counted up by the switch D1 only if a fresh ready signal in the form of an impulse has been transmitted over contact 24ba to winding I or relay RB. The reception of incoming impulses can take place during the period of transmission by the switch D1. The incoming impulses influence relay A which is disposed in the approach La. Relay A on energizing operates contacts 91a, 92a, and 93a. The switch D2 which receives the first incoming impulse train is operated over the following circuit: earth contact 94rq of relay RQ, which was energized over contact 33rc when relay RC energized, contacts 93a, 95r4, 96r3, 97r2, rotary magnet D2, battery and earth. The magnet D2 energizes and steps on the wipers of the switch D2 one step. After relay A has released the magnet D2 is deenergized by the opening of contact 93a. During the incoming impulse trains relay RV is energized in that it is connected to earth intermittently over contact 92a. Relay RV operates its contacts and contact 98rv prevents relay Z from being energized by the time switching device ZT. Contact 99rv prevents the control relay R2 from being energized over wiper 1d2 during the incoming impulses. When the switch D2 has been set by an incoming impulse train, for example, by the transmission of the digit 6, the slow acting relay RV deenergizes on the prolonged release of relay A. The following circuit is then set up for winding I of the control relay R2: earth, battery, winding I of relay R2, wiper 1d2, in position 6, contacts 100r2, 91a, 99rv, 33rc, and earth. Relay R2 operates its contacts and at contact 97r2 connects the impulse circuit controlled by contact 93a to the rotary magnet D3. The magnet D2 is connected to the circuit for advancing the switch D2 at contact 101r2 and this stepping circuit becomes effective when impulses are to be transmitted from the register. Contact 100r2 is open but relay R2 does not release since contact 102r2 has established a locking circuit for this relay. The switch D2 is first set in motion on the release of relay RR and the consequent closing of contact 42rr. The release of relay RR is dependent upon the opening of contact 29ry, i. e., upon the energizing of relay RY. This relay however can only be energized if contact 103r3 is closed. This only takes place on the energizing of relay R3, that is, after an incoming impulse train has been received by the switch D3. When the calling subscriber sends out an impulse train for setting the switch D3 relay A is again impulsively energized. The rotary magnet D3 is influenced over contact 93a and steps its wipers. During the reception of these impulses relay RV is held energized over contact 92a. Contact 99rv prevents relay R3 from energizing during the impulsing. If the subscriber dials the digit 7 the wipers of the switch D3 are advanced to position 7. When the transmission of this impulse train is finished relay RV releases. The following circuit is then set up for winding I of relay R3: earth, contacts 33rc, 99rv, 91a, 104r3, contact 7 in the contact bank of switch 1d3, winding I of relay R3, battery and earth. Relay R3 operates its contacts and locks up over contact 105r3. The switch D3 is connected in preparation to the stepping circuit for the purpose of sending out impulses at contact 106r3. Contact 96r3 connects the switch D4 to the circuit controlled by contact 93a. Contact 103r3 is closed so that relay RY (winding I) can be energized for the purpose of initiating the transmission of the digit register in the switch D2, in the event of a revertive impulse having been received in the meantime, over the lead Le1 which indicates the readiness of the succeeding devices. When such a revertive impulse is received relay RB is energized over winding I. Relay RB operates its contacts and locks up over its winding II at contact 27rb. This locking circuit runs from earth over contacts 33rc, 59rh and 27rb, to winding II of relay RB. Relay RB by closing contact 29rb

causes relay RY (winding I) to energize in the following circuit: earth, battery, winding I of relay RY, contact 62*rh*, contact 6 in the bank associated with wiper 3*d*2, wiper 3*d*2, off normal contact *kd*2 of the magnet D2, contact 103*r*3, wiper 3*d*1, contacts *kd*1 and 29*rb* and earth. When relay RY energizes relay RR releases since contact 39*ry* is open. Through the release of contact 42*rr* the rotary magnet D2 is subjected to currents over earth, contacts 52*rp*, 42*rr*, 36*r*1, 51*rp*, 101*r*2, rotary magnet D2, battery and earth. On releasing relay RR also closes contact 45*rr* and by connecting up resistance W15 in parallel exerts a damping effect on winding II of relay RY. In a similar way contact 41*ry* damps winding II of relay RR. When the rotary magnet D2 energizes wipers 1*d*2, 2*d*2, and 3*d*2 are switched on from position 6 to position 7. The off-normal contact *kd*2 is open when magnet D2 energizes. Relay RY then releases. Relay RR energizes again thereby deenergizing the magnet D2. Through the release and subsequent reenergizing of relay RR contact 43*rr* is transitorily closed so that an impulse is transmitted over wiper *sa*1 and the line La1/La2. When magnet D2 releases relay RY is energized again through the closing of contact *kd*2. Relay RR then releases again thereby advancing the magnet D2 one step. During this advancement relay RV1 which is subjected to intermittent current over contact 40*ry* is energized. The stepping of the switch D2 takes place in the manner described until the wipers reach position 11. Five impulses are then transmitted. When the switch D2 reaches position 11 relay RY (winding I) is deenergized for a prolonged period since its energizing circuit is broken at wiper 3*d*2 in position 11. Relay RV1 then releases whereupon relay RH becomes energized through the closing of contact 48*rv*1. This circuit passes from earth and battery over winding II and I of relay RH and contact 48*rv*1 and contact 11 of wiper 3*d*1, wiper 3*d*1, contacts *kd*2 and 103*r*3, wiper 3*d*1, contacts *kd*1, 29*rb* and earth. Relay RH locks up at contact 54*rh* and also at contact 60*rh* shunts contact 29*rb*. Relay RB (winding II) releases as soon as contact 59*rh* opens. Contact 90*rh* is also open so that the release of relay RR when the switch D2 is advanced from position 11 to position 0 and the closing of contact 43*rr* does not cause an impulse to be transmitted. When contact 62*rh* is switched over relay RY (winding I) energizes over the same circuit over which winding II of relay RH is held energized. Relay RR is deenergized whereupon magnet D2 receives an impulse over contact 42*rr*. The damping of winding II of relay RY is removed by the opening of contact 67*rh*. Through the opening of contact *kd*2 relay RY releases again and relay RR energizes again. When the switch passes into position 0 relay R2 is deenergized. The switch D3 is accordingly connected to the stepping circuit at contact 101*r*3. Relay RH is released. The stepping of switch D3 for the purpose of transmitting the digit which it has registered only takes place after relay RQ has released and has closed contact 107*rq* so as to energize relay RY. The release of relay RQ is however dependent upon the opening of contact 63*r*4 and this does not occur until relay R4 has been energized after the reception of an impulse train by the switch D4. Furthermore the transmission only takes place after relay RB has been energized over winding I on the reception of a "ready impulse" over the lead Le1.

The setting of switch D4 by incoming impulses takes place in the same way as the setting of the switch D3, by the operation of contact 93*a*. The circuit controlled by this contact passes through earth over contacts 94*rq*, 93*a*, 95*r*4 and 96*r*3 to magnet D4. During the operation of the switch D4 relay RV is energized over contact 92*a*. If the switch D4 is set by 8 impulses then at the end of this impulse train it will occupy the position 8. When then relay RV releases the following circuit is set up for energizing relay R4 over winding I: earth, battery, winding I of relay R4, wiper 1*d*4, in position 8, contacts 108*r*4, 91*a*, 99*rv*, and 33*rc*, and earth. Relay R4 energizes and locks up at contact 109*r*4. At contact 110*r*4 it connects the switch D4 in preparation to the stepping circuit for the purpose of transmitting impulses. The opening of contact 95*r*4 prevents any further influencing of the switch by the impulse contact 93*a*. Relay RQ is deenergized by the opening of contact 63*r*4. Consequently the contacts of relay RQ are restored to normal so that if meanwhile relay RB has been energized over winding I and has locked up at contact 27*rb* the following circuit is set up over winding I of relay RY: earth, battery, winding I of relay RY, contact 62*rh*, contact 7 in the bank associated with wiper 3*d*3, wiper 3*d*3, contacts *kd*3, 107*rq*, wiper 3*d*2, contacts *kd*2 and 103*r*3, wiper 3*d*1, contacts *kd*1, 29*rb* and earth. At contact 39*ry* relay RY breaks the circuit of relay RR. This releases and causes the magnet D3 to be switched on over earth, contacts 52*rp* and 42*rr*, resistance W12, contacts 36*r*1, 112*rq*, 101*r*2, 106*r*3, rotary magnet D3, battery and earth. An impulse is simultaneously transmitted over contact 43*rr*. Relay RY is deenergized by the opening of contact *kd*3 and relay RR is once more energized. Relay RV1 is held energized during the impulsive operation of relay RY. The stepping of the switch to position 11 takes place in the manner already described in connection with the other switches. When it reaches position 11 four impulses have been transmitted. Relay RY is deenergized for a prolonged period and after the release of relay RV1 relay RH is energized over position 11 of wiper 3*d*3 on the closing of contact 48*rv*1. Relay RH by opening contact 59*rh* brings about the release of relay RB. At contact 90*rh* it prevents an impulse from being transmitted when the switch D3 is advanced from position 11 into position 0. Relay RY (winding I) is again energized over contact 62*rh* and relay RR releases whereupon the switch D3 passes on from position 11 to position 0. Relays RH and RY release. Relay RR energizes again. In position 0 the circuit for winding I of relay R3 is broken over wiper 1*d*3. Relay R3 releases so that the switch D4 is switched on over contact 106*r*3. Switch D4 is only started up when the "ready" impulse is sent back over contact 24*ba* to indicate that the device set by the transmission of the last four impulses has set free succeeding devices in readiness. When this has taken place relay RB energizes over winding I. Relay RB locks up over its winding II and contact 27*rb* and on closing contact 29*rb* this circuit passes from earth and battery over winding I of relay RY, contact 62*rh*, contact 8 in the bank associated with wiper 3*d*4, wiper 3*d*4, contact *kd*4, wiper 3*d*3, contacts *kd*3 and 107*rq*, wiper 3*d*2, contacts *kd*2 and 111*rq*, wiper 3*d*1, contacts *kd*1 and 29*rb* and earth. Relay RY deenergizes relay RR whereupon relay RR causes the magnet D4 to be switched on over

contacts 42rr in the following circuit: earth, contacts 52rp, 42rr, 36r1, 112rq, 101r2, 106r3, 110r4, magnet D4, battery and earth. The magnet D4 is advanced into position 1 in the same way as has been described in connection with switches D2 and D3. Three impulses are accordingly transmitted over contact 43rr and the lead La1.

When switch D4 advances its wipers into position 1 relay RY is deenergized for a prolonged period. Relay RV1 releases. The following circuit is set up: earth, battery, winding I of relay RF, position 1 of wiper 3d4, contact kd4 and from here over wipers 3d3, 3d2 and 3d1 to earth at contact 29rb. Relay RF energizes and operates its contacts. Contact 58rf breaks the circuit for relays RZ, RC, P and R. Relay P is the first of these relays to release and then only do the slow relays RZ and RC deenergize. Relay R remains energized over its winding II. At contact 114rf relay RY (winding II) is energized in the following circuit: earth, contacts 114rf, 47rv1 and 61rh, winding II of relay RY, resistance Wi4, battery and earth. Relay RY brings about the release of relay RR whereby an impulse is sent to the magnet D4 over contact 42rr and brings wipers of the switch D4 into position 0. For this position relay RF (winding I) also releases. No further impulse is transmitted over contact 43rr on the release of relay RR since relay P in the secondary switch MW4 has already released and has switched over contact 17p. The connection over the connecting line VLB is now switched through and after relays RC and RZ have deenergized the register is released. After relay RC has released relays which are still energized in the register deenergize so that the register is now at the disposal of other calls. Should the release periods of the slow relays RV1 and RC not be properly adjusted for any reason and relay RC releases too quickly the switch D4 is not advanced from position 1 to position 0 in the manner just described but when relay RY (winding II) energizes, a circuit is completed over earth, contacts 52rp, 64rp1, 38ry, 36d1, 112rq, 101r2, 106r3, and 110r4, magnet D4, battery and earth. Relay R4 in this case is maintained energized over wiper 2d4 and the normal contact 33rc until wiper 2d4 is set in the position 0.

As already described on each operation of the register switches relay Z is disconnected from the earth potential E either by contact 98rv or contact 46rv1. Relay Z serves as a supervisory relay in the register and is caused to operate if the register does not execute any switching operation within a certain time. The connection of battery to relay Z takes place at definite intervals and in stages, the connection being effected by the time switching device Zt as soon as the register has been seized by the energizing of relay RC. If relay Z is operated because one of the contacts 98rv and 46rv1 have not been operated within a prolonged interval of time after the seizure of the register, contacts z1 to z8 are closed. This results in relay B energizing over winding I. Relay B then connects its winding II to the lead Lc over contact 13b. Through the closing of contacts 19b and 20b the busy signal "Bes" is connected to the speaking leads whereby an indication is given to the subscriber to replace his receiver. Contact 14b is opened whereupon relays RC and RZ or RC and RU in the register release. Accordingly contact 33rc is brought to the rest position so that the following circuit is established for advancing the switches of the register into the rest position: earth, contact 33rc, winding II of relay RF, wiper 2d1 or 2d2 or 2d3 or 2d4 of the first of the switches D1 to D4 which is not in the rest position (for example wiper 2d2 of switch D2) winding II of relay R2, battery and earth. Relay RF operates its contacts and at contact 55rf guards the releasing register. The initiation of the stepping of switch D2 into the rest position is effected over earth, contacts 34rc, kd1, 3d1 and 111rq—Relay RQ has released through the opening of contacts 33rc—kd2, 3d2, 62rh, winding I of relay RY, battery and earth. Relay RY then causes the switch D2 to be stepped into position 1 over contact 38ry in the manner already described. While the switch D2 is being stepped to position 1 relay RV1 is operated over contact 40ry. In position 1 relay RH is operated over wiper 3d2. Over contact 62rh relay RH connects winding I of relay RY to contact 1 of wiper 3d2 whereupon the magnet D2 is advanced into the position 0. Relay II remains energized over the segment associated with wiper 2d2 until wiper 2d2 leaves position 1. In position 0 relay R2 (winding II) also releases so that after relays RY and RF have deenergized the register remains in its normal condition. The release of the register takes place in a similar manner if a number of its switches have been set and the complete setting of the register cannot take place for any reason. The register switches are then released in succession under the control of wipers 2d1 to 2d4. This mode of release takes place in the case of faults in the switches themselves or in the case of negligent dialling on the part of the calling station or if the revertive impulse over the lead Le1 does not materialize. The energizing of relay Z which initiates the release is only a transitory energization for after relay RC releases contact 115rc is opened.

If the register is taken into use over a secondary switch whose wiper sb is connected to the approach Lb0, no additional impulse train is transmitted. The switching operations only differ as regards the switch D1. As regards switches D2 to D4 the switching operations correspond to those already described. If on the establishment of such a connection the register is taken into use by a switch similar to the secondary switch MW4, relays RC and RZ energize when relay C in the connecting line VLB energizes. Relay RC energizes relay RQ and winding I of relay RR by closing contact 33rc. Relay RZ opens contact 30rz. In the manner already described contact 31rc effects the advancement of the secondary switches set on the same register which are not taken into use. On the closing of contact 21p relay RP (winding I) is energized over position 0 of wiper 4d1 and over wiper sb and the approach Lb0. Relay RP is thereby held energized over winding II on the closing of contact 53rp. Contact 52rp is switched over thereby preparing the stepping circuit for the register switches. Contact 61rp is opened so that when relay RB energizes and indicates the ready condition of the devices reached over the connecting line VLB, winding I of relay RY cannot energize. The energizing of relay R1 is prevented by the opening of contact 50rp. The opening of contact 49rp brings relay RR under the influence of contact 39ry. When relay RB energizes on account of the closing of contact 24ba and indicates the ready condition of the succeeding devices, an energizing circuit is prepared for winding I of relay RY over contact 29rb. This circuit is however only effective when incoming impulses have reached the

register; relay RB continues to hold up over contact 27*rb*. The incoming impulses are repeated to the register by the operation of relay A, over contact 93*a*. The first impulse train transmitted by the calling station passes over earth, contacts 94*rq*, 93*a*, 95*r*4, 96*r*3 and 97*r*2, to the rotary magnet D2. During the reception of these impulses relay RV is energized over contact 92*a*. When the first impulse train has been transmitted to the register relay RV releases, whereupon relay R2 energizes in the manner described above. Relay R2 then causes the rotary magnet D3 to be connected up over contact 97*r*2. When the second impulse train transmitted from the calling station has been received by magnet D3, relay R3 energizes after relay RV has released over earth, contacts 33*rc*, 99*rv*, 91*a*, 104*r*3 and 1*d*3, relay R3 and battery. Relay R3 then closes contact 103*r*3 whereupon the digit registered in the switch D2 is transmitted on account of the energizing of winding I of relay RY. The energizing circuit for the switch D2 passes from earth over contacts 29*rb*, *kd*1 and wiper 3*d*1 in position 0, contacts 103*r*3 and *kd*2, wiper 3*d*2 in the position to which it has been set, contact 62*rh*, winding I of relay Y, battery and earth. The manner in which the register operates is then the same as has already been described in connection with the establishment of the connection already discussed. The only difference resides in the disconnection of the switch D1 by the immediate energizing of relay RP which in the case of the connection first described only takes place after the switch D1 has counted out one digit.

The establishment of a call in which two additional impulse trains are transmitted by switch D1 from the register will now be described. Moreover in contradistinction to the embodiment already described only a single "ready" signal is given to the register on the commencement of the transmission. In order to adapt the register to operate in this way it is taken into use over a secondary switch which corresponds to the secondary switch MW3 shown in Fig. 2. In order to cause the register to transmit two additional impulse trains its connection takes place over the approach Lc1 which is connected to the wiper *mwc* of the secondary switch MW3. The wiper *mwb* of the second switch MW3 can be connected to any of the approaches Lb1 to Lb8. It will be assumed that it is connected to the approach Lb5. The wipers *mwa*1 and *mwa* are connected to the same contacts of the register to which the wipers *sa*1 and *sa* can be connected. Wiper *mwd* of the secondary switch MW3 is connected to the same contacts of the register to which wiper *sd* of the secondary switch MW4 can also be connected. A wiper corresponding to wiper *se* is not required in the case of the switch MW3. The switch MW3 is likewise adapted to be given a preliminary setting. When the wipers of the switch MW3 are set on a busy register the magnet DMW is energized in the following circuit: earth, contacts 5*c*1 and 2*t*1, rotary magnet DMW, battery and earth. The rotary magnet energizes and advances the wipers and energizes winding II and the relay T1 over contact *dmw*. Contact 2*t*1 is consequently opened and the rotary magnet is again deenergized. This stepping continues until a free register is reached. When this has occurred, winding I of relay T1 is held energized over wiper *mwd* so that contact 2*t*1 also remains open and the rotary magnet DMW can no longer energize. The following circuit is set up for winding I of relay T1: earth, contact 6*c*1, winding I of relay T1, wiper *mwd*, contact LD, contact L*d*, contacts 55*rf* and 31*rc*, battery and earth. Relay T1 has closed contact 1*t*1. When now the group selector IIGW2 is raised to the level 4 and by means of its test wiper *gwc* finds that the lead Lc3 is the first free lead, the following circuit is established: earth, testing device in the group selector IIGW2 which is not shown, wiper *gwc*, lead Lc3, contact 28*b*1, relay P1, contact 1*t*1, wiper *mwc*, lead Lc1, winding II of relay RC, contact 30*rz*, relay RU, contact 58*rf*, battery and earth. In this circuit the relays RU, RC, P1 and the testing device in the group selector IIGW2 energize. Contact 10*p*1 holds winding II of relay T1 energized. Contact 9*p*1 connects winding I of relay B1 to wiper *mwb* in preparation. Contacts 3*p*1 and 13*p*1 are operated. Through the switching over of contact 3*p*1 the lead La3 is connected to relay A of the register over wiper *mwa*. Relay A*n* is energized over contact 12*p*1 and starts up a free call finder AS. Contact 11*p*1 characterizes the lead BL in the call finder. The call finder is set in known manner whereupon the testing relay PA in the call finder energizes. Relay C1 (winding II) is now also energized and switches over contact 8*c*1. Relay AN releases provided that no other starting impulses are received. Contacts 4*c*1, 5*c*1, and 6*c*1 are opened. At contact 7*c*1, winding I of relay C is connected to lead Lc3. When the call finder AS has been set relay BW in the repeater Ue1 energizes. Relay BW operates contact 110*bw*, thereby connecting relay BW1 to lead Lc4. Relay BW1 energizes as soon as the succeeding devices are ready to receive impulses. It operates contact 11*bw*1 thereby connecting battery potential to lead La4 over relay JW. This connection of battery serves to energize relay RB1 (winding I) in the register. Relay JW does not energize in series with winding I of relay RB1. Relays RC and RU in the register are energized. Relay RU operates its contacts and by opening contact 57*ru* has disconnected winding I of relay RC so that false connections caused through the energizing of relay RZ over any other secondary switch are prevented. Contact 88*ru* was switched over and thereby relay RP1 which is connected to battery is connected to wiper 4*d*1. Contact 116*ru* connects earth to contact 2 of wiper 4*d*1. Contact 117*ru* connects earth over contact 25*rb* to winding I of relay RB1. Through the energizing of relay RC battery was disconnected at contact 31*rc* so that the T-relays of other secondary switches which were set on the register which has been taken into use have been deenergized and have initiated the advancing of the rotary magnets and their associated switches. These rotary magnets are operated until free registers are set in readiness through the energizing of the windings I of the corresponding T relays. The secondary switch MW3 which has been taken into use is not stepped forward in spite of the opening of contact 31*rc*, since a locking circuit has been set up for winding II of relay T1 over contact 10*p*1.

The energizing of relay RC in the register causes this register to be set in readiness in the manner which has already been described apropos of the preceding example, the energizing of relays RQ and RR (winding I) taking place through the switching over of contact 33*rc*.

Impulse trains sent out by the calling subscriber pass in to the register over the lead La3, contact 3*p*1, wiper *mwa* and the approach La to

the register of relay A. The impulses of the first impulse train are repeated to the rotary magnet D2 of switch D2 by contact 93*a*. While the first impulse train is being transmitted to the register relay RV is energized over contact 92*a*. When this releases at the end of the first impulse train the control relay R2 of the switch D2 is energized by the releasing of contact 99*rv*. Through the energizing of the control relay R2 the rotary magnet D3 of switch D3 is connected over contact 97*r*2 so that the next incoming impulse train is transmitted to the switch D3 over contact 93*a*. At the end of this impulse train relay R3 is energized when relay RV releases. This locks up over its own contact and at contact 96*r*3 connects the switch D4 at contact 93*a* for the purpose of receiving the last impulse train sent out by the calling station. After this has been received relay R4 energizes.

The register can commence to send out impulses while incoming impulses are still being received. The switch D1 is set in operation on the energizing of winding I of relay RB1 in that this causes relay RB to energize. The energizing of relay RB takes place when contact 123*rb*1 is closed. In this circuit winding II of relay RB1 and winding I of relay RB are maintained energized until the register is released. At contact 25*rb* relay RB disconnects earth at contact 117*ru* from the lead La1 and by closing contact 26*rb* causes the control relay R1 to be energized over its winding I in the following circuit: earth, contacts 33*rc* and 26*rb* and 50*rp*, winding I of the control relay R1 and battery. Relay R1 operates its contacts and at contact 36*r*1 prepares a stepping circuit for the magnet D1. This circuit is established when relay RY energizes. The energizing circuit for relay RY passes from earth over contacts 29*rb* and *kd*1, wiper 3*d*1 in position 0, contacts 28*rb*, 61*rp* and 62*rh*, winding I of relay RY, battery and earth. By closing contact 38*ry* relay RY energizes the magnet D1 over earth contacts 52*rp*, 64*rp*1, 38*ry*, and 36*r*1 and magnet D1. Relay RY (winding I) is deenergized by the opening of contact *kd*1. Contact 38*ry* is opened, whereupon magnet D1 releases. During this stepping of the switch D1, relay RV1 is impulsively operated over contact 40*ry* and thus remains operated during the stepping on account of its slow to release feature.

When wiper 4*d*1 of the switch D1 passes into position 2, the following circuit is set up: earth, contacts 116*ru*, and 121*rx*, contact 2 in the back associated with wiper 4*d*1, wiper 4*d*1, contacts 89*rp*1, 88*ru*, 122*rx*, winding I of relay RP1, battery and earth. In this circuit relay RP1 energizes. A locking circuit is established for this relay over its winding 2 through the closing of contact 120*rp*1 and in this circuit relay RX also energizes. The approach Lb2 is connected to contact 2 associated with wiper 4*d*1 at contact 121*rx* so that during the second operation of the switch D1 which will be described later this approach can also be assessed if it should be characterized. Contact 122*rx* prepares for the connection of relay RP to wiper 4*d*1. Contact 89*rp*1 is open. Relay RX also prepares a locking circuit for itself over contact 119*rx*. Through the switching over of contact 64*rp*1 and 65*rp*1 the switch D1 is controlled after relay RP1 has energized in dependence upon relay RR so that the steps which the switch D1 takes after relay RP1 has energized cause impulses to be sent out over the lead La1. This generation of impulses continues to take place until the switch D1 reached position 11 so that when it has reached position 11, nine impulses have been transmitted. This impulse transmission takes place in the same manner as was described in connection with the first embodiment in that relay RY (winding I) controls winding I of relay RR, this being effected by the aid of contact 39*ry* after contact 65*rp*1 has opened. When the switch D1 reaches position 11 relay RH energizes over contact 48*rv*1 after relay RV1 has released, the circuit being earth, contact 29*rb*, off-normal contact *kd*1, wiper 3*d*1, contact 11 associated with wiper 3*d*1, contact 48*rv*1, windings I and II of relay RH and battery. Relay RH operates its contacts and by opening contact 90*rh* prevents a further impulse from being transmitted over the line and the approach La1 when the switch D1 advances from position 11 to position 0. Through the switching over of contact 62*rh* winding I of relay RY is connected to contact 11 associated with wiper 3*d*1 whereupon this relay energizes. Relay RP1 is deenergized through contact 59*rh* opening because its locking circuit is then broken. Relay RB does not release since its winding I remains connected in series with winding II of relay RB1. Relay RX holds up over winding I. After contact 64*rp*1 has released the switch D1 is advanced to position 0 when contact 38*ry* closes. While the switch D1 is taking this step relay RR is energized because contact 65*rp*1 was closed. This prevents a further impulse from being transmitted over the lead La1 when relay RH releases when the switch D1 reaches position 0. Relay R1 does not release when the switch D1 reaches position 0 since contacts 26*rb* and 50*rp* are closed.

A further advancing of the switch D1 for the purpose of transmitting a second impulse train is now again dependent upon winding I of relay RY which operates the magnet D1 over its contact 38*ry*. The transmission of impulses in accordance with the particular approach Lb1 to Lb8 which has been characterized takes place with the aid of relay RP (winding I) which now is connected to wiper 4*d*1 over contacts 122*rx*, 88*ru*, and 89*rp*1. The first energization of relay RY for advancing the switch D1 from position 0 to position 1 takes place over earth, contacts 29*rb* and *kd*1, wiper 3*d*1, contacts 28*rb*, 61*rp*, and 62*rh*, winding I of relay RY and battery. The magnet D1 operates and opens the off-normal contact *kd*1, whereupon relay RY releases again. Relay RR (winding I) remains operated for the closed contacts 65*rp*1 and 49*rp*. The stepping of the wipers of switch D1 in the manner described in connection with the first embodiment continues until wiper 4*d*1 reaches that approach of the approaches Lb1 to Lb8 which has been characterized. If for example lead Lb5 has been characterized in that this contact has been connected to a contact associated with wiper *mwb* of the secondary switch MW3 on the seizure of the register the following circuit is established when wiper 4*d*1 is set on contact 5: earth, winding I of relay RP, contacts 122*rx*, 88*ru* and 89*rp*1, wiper 4*d*1 in position 5, contact Lb5, wiper *mwb*, contact 9*p*1, winding I, relay B1, battery and earth. In this circuit winding I of relay RP energizes. Winding I of relay B1 does not receive sufficient current so this relay does not energize. Through the operation of relay RP winding I of relay RR is made dependent upon the operation of contact 39*rx* by the opening of contact 49*rp*. The magnet D1 is controlled in the manner already described by the aid of contact 42*rr* since on the operation of relay RP contact 52*rp* has also been switched

over. Impulses are now transmitted over the lead La1 by contact 43rr. When wiper 3d1 passes into position 11, relay RH is energized. Relay RH by opening contact 90rh prevents an impulse being transmitted when the switch D1 is set in the normal position. Relay RP remains energized over contact 33rc after contact 53rp has closed until the register is released. When the switch D1 passes into position 0 relay R1 releases since its circuit is broken at wiper 1d1 and contact 50rp is held open. Relay RY now energizes over winding I since it can be assumed that the switches D2 and D3 have been set meanwhile by the calling station. Relay Y is energized over earth contact 29rb, off normal contact kd1, wiper 3d1, contact 103r3, of the energized control relay R3 of the switch D3, contact kd2, wiper 3d2 in any position, contact 62rh, winding I of relay RY, battery and earth. Relay RY then causes relay RR (winding I) to release by opening contact 39ry whereupon the switch D2 can receive impulses over contacts 52rp, 42rr, 36r1, 51rp and 101r2. The transmission of the impulse trains registered in the switches D2, D3 and D4 then sets in in the normal way as already described in connection with the first embodiment. When the last switch D4 is advanced into position 11 winding I of relay RF energizes. The opening of contact 58rf then brings about the deenergization of relays RU and RC in the register and of relay R1 in the secondary switch MW3. The deenergizing of relays RC and RU in the register cause the energized relays BP, RX, RB and RB1 in the register to release. Through the closing of contact 114rf relay RY receives current over its winding II. Magnet D4 is energized over earth contacts 52rp, 64rp1, 38ry, 36r1, 112rq, 101r2, 106r3, and 110r4 whereupon switch D4 also advances to position 0. Relay R4 which was held energized over earth, contact 33rc, IIRF, 2d1, 2d2, 2d3, 2d4 and R4II so that after the release of relay RF the register is at the disposal of other calls.

The release of relay P1 in the secondary switch MW3 does not cause the secondary switch MW3 to be advanced since relay C1 is held operated over its winding I and lead Lc3 during the time that the call is in progress over the line BL and so the contact 5c1 remains open. Only relay T1 in the secondary switch MW3 releases on account of the circuit for its winding II being opened at contact 10p1. If for any reason the register should now have been set within the prescribed time for time switching device Zt becomes operative so that relay Z is energized. Hereupon contacts Z1 to Z8 are closed. Earth is hereby connected to the seized approach of the register. In the case of seizure over the secondary switch MW3 energization of winding I of relay B1 is brought about. Relay B1 operates its contacts and over contact 30b1 and 31b1 connects the busy signal "Bes1" to the speaking leads thereby intimating to the calling subscriber that he should replace his receiver. Contact 28b1 connects winding II of B1 to lead Lc3 over which relay B1 holds upon until the release of the connection. Contact 29b1 opens a point in the locking circuit of the testing relay PA of the call finder. On account of the switching over of contact 28b1, relays P1, RC and RU are also deenergized. The release of the relay P1 causes relay PA in the call finder to deenergize thereby initiating the release of the call finder. The release of relay RC in the register permits the release of the register in the manner already described and the restoration of the constituent switches. The time switching device Zt is set out of action through the opening of contact 115rc.

If one of the switches D1 to D4 should not operate in the regular manner for any reason in that for example one of the wipers 1d1 to 1d4 or 3d1 to 3d4 should remain suspended between the contacts, the register is released in that when the time switching device Zt and relay Z become operative and relay RC has released in the manner already described, relay RF (winding II) energizes over the released contact 33rc. In this event the relay RY which controls the stopping of the register device receives current over its winding II through contact 114rf and by energizing the corresponding rotary magnets advances the wipers of the corresponding switches into the appropriate position whereupon the register releases in the normal way.

What is claimed is:

1. In an automatic telephone system, a register sender provided with a plurality of approaches, means in the register for receiving and retransmitting impulse trains and for transmitting additional impulses, means for seizing the register over one of the approaches and transmitting impulses thereto, an impulse controller in the register operating in accordance with the approach over which the register was seized for controlling the number of additional trains of impulses transmitted by the register or alternatively preventing any additional transmission of impulses.

2. In a transmission system, a plurality of lines, a register sender accessible over a plurality of paths, means in the sender for receiving and retransmitting series of impulses and for transmitting additional impulses, means controlled from any line for seizing the sender over any of said paths and for transmitting impulses thereto, said sender operated to transmit additional impulses dependent on the path over which it is seized and to then retransmit the received impulses.

3. An automatic circuit arrangement as claimed in claim 1, in which the impulse controller comprises switching means having a single bank of contacts.

4. An automatic circuit arrangement as claimed in claim 1, in which all functions of the impulse controller are effected in a single switch through one and the same wiper.

5. An automatic circuit arrangement as claimed in claim 1, in which operation of the impulse controller is controlled by means of different potentials depending upon the approach over which the register was seized.

6. In an automatic circuit arrangement, a register sender having a plurality of approaches, means for seizing the register sender over any one of the approaches and for transmitting trains of impulses thereto, means in the register sender for receiving said trains of impulses, means in the register sender for transmitting trains of impulses dependent upon the received trains of impulses and for transmitting additional impulses, said last means including a stepping switch having a normal position and a relay for controlling said switch, said relay having an auxiliary winding for damping the action thereof and at times for controlling the return of said switch to normal, and an impulse controller in the register sender for controlling in accordance with the approach over which the register sender was seized the number of trains of additional impulses trans-

mitted, or alternatively, for preventing transmission of any trains of additional impulses.

7. A transmission system as claimed in claim 2, including switching means in the sender operated when the sender is seized over a particular path for determining the value of a train of said additional impulses.

8. In an automatic circuit arrangement, a plurality of register senders each having a plurality of approaches, a plurality of lines each having means associated therewith for seizing a register over one of the approaches and transmitting impulse trains thereto, means in the register for receiving and registering said impulse trains and other means in the register for transmitting additional impulse trains, means for retransmitting registered impulse trains, and means responsive to seizure of the register over a particular approach thereof for rendering said other means inoperative and causing said transimtting means to become operative.

9. In an automatic telephone system, lines of different classes, control equipment, means for seizing said equipment over any one of said lines for the extension of a call and for transmitting thereinto trains of impulses comprising call directing digits, means in said equipment for registering said digits and for transmitting trains of impulses dependent upon the registered digits, and means in said equipment for determining the class of said one line and, in dependence upon its class, for transmitting one or more trains of impulses in addition to those trains of impulses transmitted in dependence upon said registered digits.

10. In a telephone system, a first exchange trunk lines of different classes outgoing from said exchange, means for seizing any one of the lines for a call to a distant exchange, controlling equipment in said first exchange common to said lines, means for associating said equipment with the seized trunk line responsive to the seizure thereof and marking said equipment according to the class of the seized line, an impulse generator in said equipment, and means in said equipment rendered effective by an impulse reverted thereto over the seized line from the distant exchange for determining from said marking the class of the seized line and for controlling said generator to transmit over said line a train of impulses dependent in number upon the class of said line.

11. In a telephone system, trunk lines divided into groups which are further divided into subgroups, means for seizing any one of said trunk lines, controlling equipment common to said lines, a plurality of paths over which said equipment may be seized, means responsive to the seizure of said one trunk line for seizing, said equipment over a particular path depending upon the group of which the seized line is one and marking said equipment according to the sub-group of which the seized line is one, and an impulse generator in said equipment controlled both by the path over which the equipment was seized and by the marking of said equipment to transmit impulses over said one trunk line, the path of seizure determining the number of trains of impulses, if any are to be transmitted, and the marking determining the number of impulses, if any, in one of the trains.

12. In a signalling system, a register, means for controlling said register to store a plurality of digits, a line, an impulse sender controlled by said register and at times responsive to the receipt of an impulse over said line to transmit over said line a plurality of trains of impulses dependent upon the stored digits, said sender at other times responsive to the receipt of an impulse over said line to transmit only one of said trains of impulses.

13. In a signalling system, a register, means for controlling said register to store a plurality of digits, a line, an impulse sender controlled by said register for transmitting in succession over said line a plurality of trains of impulses depending upon the stored digits, means in said sender required to be operated to initiate the transmission of each of said trains of impulses, said last means operated over said line to initiate the transmission of a train of impulses and normally restored after the initiation of the transmission of that train of impulses, thereby requiring its reoperation over said line to initiate transmission of each train of impulses, and means effective at times for holding said last means operated after its initial operation thereby causing all of said trains of impulses to be transmitted responsive to a single operation of said last means.

14. In control equipment accessible to lines of different classes, discriminating means operated by the seizure of the equipment over one of said lines and determining the class of the seizing line, registering means controlled over the line an outgoing line, means controlled by said registering means for transmitting in succession a plurality of trains of impulses over said outgoing line, and means operated over said outgoing line before said impulses are transmitted thereover, said last means at times operated but once to permit all of said trains of impulses to be transmitted and at other times operated once to permit each train of impulses to be transmitted, depending upon the class of the seizing line as determined by said discriminating means.

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