Nov. 7, 1950 D. P. LONG 2,529,471

MARKING ARRANGEMENT FOR FINAL SELECTOR SWITCHES

Filed April 25, 1946 2 Sheets-Sheet 1

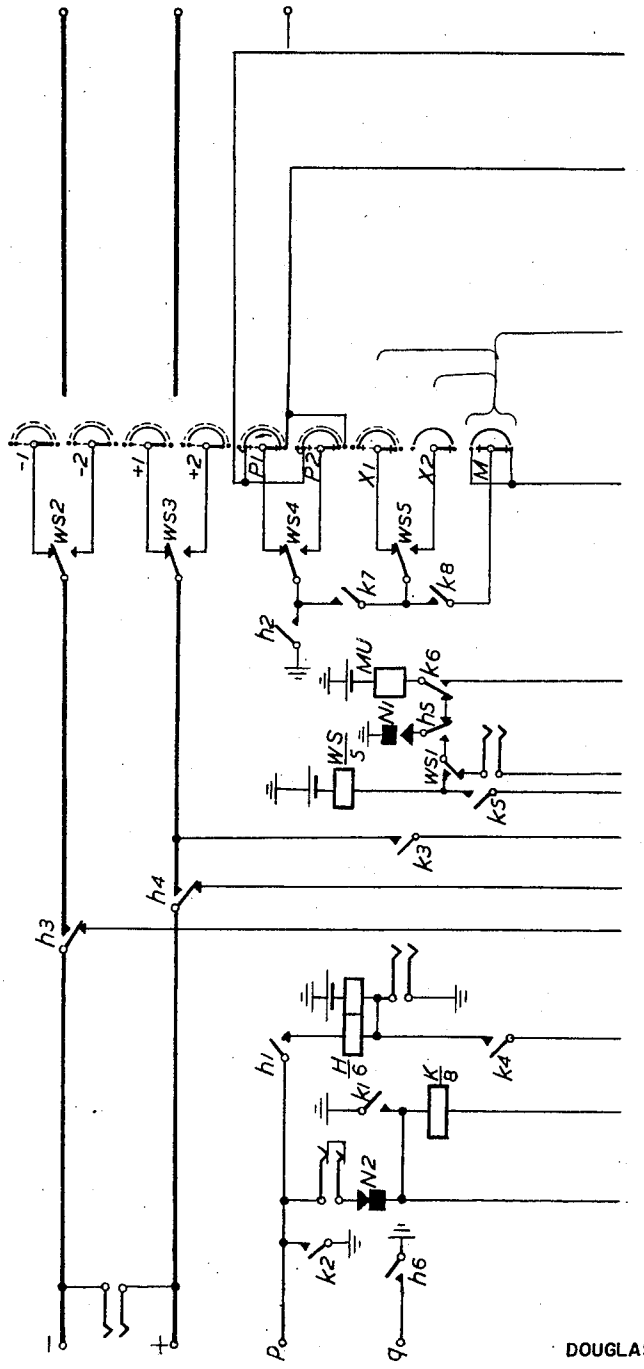


FIG. 1.

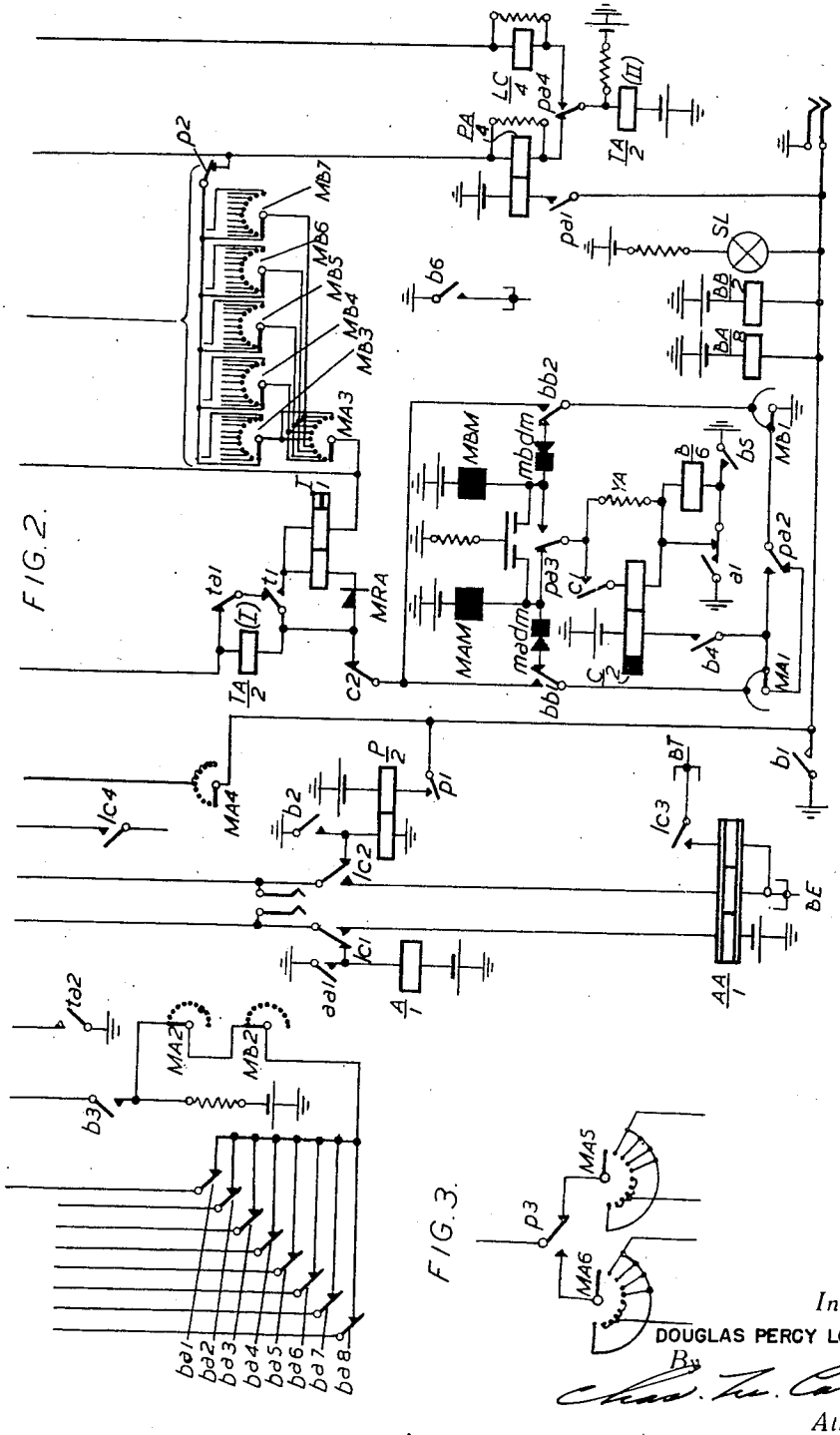
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MARKING ARRANGEMENT FOR FINAL SELECTOR SWITCHES

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Patented Nov. 7, 1950 2,529,471

UNITED STATES PATENT OFFICE

2,529,471

MARKING ARRANGEMENT FOR FINAL SELECTOR SWITCHES

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Application April 25, 1946, Serial No. 664,963
In Great Britain May 4, 1945

6 Claims. (Cl. 179—18)

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This invention relates to automatic telephone systems and more particularly to final selectors in such systems. It has especially in view improved arrangements for the setting of a 200-outlet final selector by the marking method.

Selecting switches have been proposed in which the outlets are connected in paired contact arcs, two arcs of a pair being associated with different ends of a wiper which in the movement of the selector pass over the two arcs in succession, one end of the wiper entering its associated arc of contacts when the other end of the wiper leaves its associated arc of contacts. This arrangement provides the equivalent of an arc containing twice the number of contacts. The number of wipers and contact arcs may be included in two sets connectible over contacts of a wiper switching relay thereby doubling the number of outlets connected to the selector. In this way 200 outlets may be had from a selector furnished with arcs of 50 outlets each.

In the present invention a final selector of this kind is used and it is a feature of the invention that for marking purposes a single arc of contacts containing as many contacts as there are in one of a pair of arcs is employed, the contacts in the marking arc being individually connected to as many contacts on a marking switch or other selective marking device. A single marking contact on the selector therefore serves for the marking of four outlets, one in each arc of a pair in each set of arcs. The wiper associated with the marking arc of the selector is of the ordinary double-ended kind in which both ends sweep over the same contacts in succession.

In the case of a 200-line final selector the marking in respect of the tens digit is common to two values of that digit and differentiation between them is effected on that basis. Differentiation between the same digital value in two "hundreds" groups may be effected by means of a signal received at the time the final selector is taken into use or any other differentiating condition such as between two paths of entry may be used. The differentiation in one case takes the form of a wiper switching operation and in the other case it takes the form of a preliminary movement of the selector wipers over one arc of a pair to bring them to a predetermined contact position at the commencement of the other arc of the pair. The preliminary movement may take place on seizure of the final selector if this movement is utilised for differentiating between "hundreds" groups or it may be delayed until the tens digit has been received. The differentiating signal may consist of the application or non-application of a potential to one of the speaking wires at the preceding selector whereby a discriminating relay in the final selector is operated or prevented from operating. The operation or non-operation of the discriminating relay may, by itself or by means of another relay controlled by it, prepare or close driving and test circuits for the selector, the test circuit being completed immediately to prevent movement of the selector wipers or as a result of the wipers being driven to the predetermined contact position. The closure of the test and driving circuits may be delayed until the tens digit has been received whereupon a steering relay may be operated to complete circuits prepared according to the condition of the discriminating relay. The operation of the steering relay may take place immediately after the release of the relay that determines the end of an impulse train, generally called the dialling relay, if no preliminary movement of the selector wipers is required or it may be delayed until the wipers have reached the predetermined contact position. The steering relay is conveniently operated in series with the test relay in the circuit controlling the preliminary movement of the selector.

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The registration of the tens impulse train may determine whether wiper switching is required or not and the marking device as set by the tens digit may open or close a circuit for the wiper switching relay accordingly. The two digits concerned in the setting of the final selector may be registered on two single motion digit switches of 10 outlets each, contacts of the tens digit switch being connected in pairs to wipers of the units digit switch the contacts of which are connected to the 50 contact marking arc in the selecting switch. It is convenient that the pairing of digits of the "hundreds" groups should be on an odd and even basis, and that of the tens group, the digits 1 and 6, 2 and 7 and so on should be paired. The initial operating circuit for the dialling relay may include normal contacts and wipers of both digit switches and a back contact of the steering relay while for its re-operation prior to receipt of the units digit the operating winding of the dialling relay is connected over a front contact of the steering relay and the normal contact and wiper of the units digit switch. The wiper switching relay may be connected to appropriate contacts in an arc of the tens digit switch.

The final selector, besides being suitable for selection of any one of 200 individual outlets may, by the provision of additional wipers and con-

tact arcs be adapted for use with P. B. X lines. If the number of contact arcs is to be limited to 16, one additional pair of arcs and one single arc may be added and this will provide for P. B. X lines in three arcs of 50 outlets out of the total of 4 such arcs. If there is no objection to 17 arcs, two additional pairs of arcs may be added allowing for P. B. X lines in all four arcs of 50 outlets. The contacts in the additional arcs corresponding to outlets to lines of a P. B. X group are commoned to the contact in the marking arc of the selector that would be marked by the number allotted to the P. B. X group as a whole and conveniently termed the first line. In this way a P. B. X group may consist of from 2 to 50 lines, all the lines of a group being connected in the same arc, but not necessarily in consecutive order, i. e. they may appear anywhere in the arc, interspersed with lines of other P. B. X groups or individual lines if need be.

The last contacts in each test arc are connected to a circuit for a "last contact" relay and to permit the selector wipers in their preliminary movement to pass these contacts, it may be arranged that the circuit for the "last contact" relay is only connected up when the selector wipers are positioned at the commencement of the arc in which selection is to be made, the test circuit including a contact in the common marking arc. The impulse receiving relay may be of low impedance and for the reversion of tones to the caller it may be substituted by a high impedance relay over which balanced tone currents may be reverted.

Provision may be made for registering unsuccessful calls to one line or group of lines connected in each arc of the final selector.

The digit switches and control relays may be included in a common control circuit, the only relays in the individual selector circuit being a coupling relay and the switching and wiper switching relays.

The arrangements of the invention are especially suitable for use with a high speed uniselector with individual motor drive.

Reference will now be had to the accompanying drawings which show by way of example an embodiment of the invention.

The drawings show, in Fig. 1, the circuit of a final selector and in Fig. 2 a common control circuit for the control of a final selector of the kind shown in Fig. 1, and in Fig. 3 a modificatio' to the circuit for registering unsuccessful calls. The final selector illustrated is a single-motion motor-driven switch having 200 outlets of which outlets in one hundreds group are connected in the arcs shown in full lines and the outlets of the other hundreds group are connected in the arcs shown in broken lines. The arcs containing outlets of a hundreds group are divided into two, one arc of 50 outlets being accessible over back contacts of a wiper switching relay and the other arc of 50 outlets being connected over front contacts of the wiper switching relay. The contact bank of the selector comprises 16 arcs of 52 contacts each, the arcs, with the exception of the two shown lowermost, being paired, the two arcs of a pair being traversed respectively by the two ends of a wiper in succession, the ends of the wipers shown in broken lines entering the broken line arcs when the ends of the wipers shown in full lines leave the full line arcs. The wipers are designated −, + and P for the negative and positive speaking wire wipers and the test wipers respectively. M is a marking wiper of the double-ended type of which both ends traverse the same arc of contacts and X1 and X2 are wipers associated with arcs in which lines of P. B. X groups are connected, wiper X1 being of the same type as the speaking and test wire wipers and wiper X2 being a single-ended wiper normally positioned at the commencement of the full line arc. Each arc comprises a normal contact, 50 contacts connected to outlets and a last contact. The contact in the normal position in the broken line arcs is one to which the selector wipers are automatically rotated in accordance with a signal denoting that a particular hundreds group is required and is hereinafter referred to as the predetermined contact. In the test wire arcs this contact is connected to a circuit for stopping the selector in this position and in the arc of wiper M the contact is connected to the last contact for stopping the switch in the last contact position. Contacts in the arc of wiper M corresponding to the first lines of P. B. X groups are also connected in the arcs of wipers X1 and X2 to contacts corresponding in position to all the lines of their respective groups and it may here be remarked that P. B. X lines may appear in any position in one hundreds group, that connected to the full line arcs, but only in the outlets in the other hundreds group reached in response to a tens digit of value 0 to 4, i. e. in the broken line arc of wiper X1.

If selection is to be exercised in the hundreds group connected to the full line arcs a signal will be received from the preceding switching stage to prevent movement of the selector after receipt of the tens digit. If selection is to be exercised in the hundreds group connected to the broken line arcs, no signal will be received from the preceding switching stage and after the tens digit has been received the selector will be driven to the predetermined contact position. The tens digit will determine whether wiper switching is required or not; a tens digit of from 1 to 4 and 10 impulses will not require wiper switching while this latter operation will be performed on receipt of a tens digit of from 5 to 9 impulses. The selector is driven by an individual electric motor under the control of a magnet, the driving mechanism being represented generally by the magnet MU. The switch has two off-normal contacts designated N1 and N2 respectively which are operated when the wipers leave their normal position. Beside the wiper switching relay already referred to which is designated WS, the selector includes the switching relay H and coupling relay K for coupling it to the common control circuit serving it.

The common control circuit includes the low impedance impulse receiving relay A, release relay B and its auxiliaries BA and BB, slow releasing dialling relay C, high speed test relay T and its auxiliary TA, last contact relay LC, the relay P responsive to a signal for determining the hundreds group in which selection is to be exercised, steering relay PA and a high impedance relay AA over which balanced tone signals are reverted. There are also two digit switches each with banks of 11 contacts, switch MA with magnet MAM and magnet-operated contacts *madm* for registering the tens digit and switch MB with magnet MBM and magnet-operated contacts *mbdm* for registering the units digit. The former switch has four wipers designated MA1 . . . MA4 and the latter seven wipers designated MB1 . . . MB7. Of the two digit switches wipers 1 and 2 are off-normal wipers, wipers MA3 and MB3 . . .

MB7 are marking wipers and wiper MA4 is concerned with wiper switching. As regards wiper MA3, the first five contacts following the normal are commoned respectively to the next five contacts, each pair of commoned contacts being connected to one of the wipers MB3 . . . MB7. The normal contacts of wipers MB3 . . . MB7 are commoned and connected to the steering relay PA over a break contact of relay P while the remaining 10 contacts in each bank are connected individually over marking wires to contacts in the arc of wiper M of the final selector.

A detailed description will now be given of the operation of the final selector and the common control circuit.

The selector and common control circuit test free by reason of the battery conection to wire *p* over wipers MA2 and MB2 at normal, contacts *ba1* and N2. Contacts *ba2* . . . *ba8* are included in the test-in circuits for seven other final selectors served by the same common control circuit. When the selector is taken into use, relay A is operated and relay P may or may not be operated in series with it. If a differentiating signal is transmitted from the preceding selecting stage, earth will be present on the + wire at this time and relay P will be short-circuited, the circuit for relay A then being from this earth over a preceding loop, the negative wire, contacts *h3* and *lc1*. If the differentiating earth is not present, relay P will be operated in a circuit from earth over its left-hand winding, contacts *lc2* and *h4* and the preceding loop in series with relay A. When relay A operates, contact *a1* closes a circuit for relay B over resistance YA, contact *pa3* and magnet MAM. Relay B operates but the magnet does not operate in this circuit and contact *b1* closes circuits for relays BA and BB and lights the supervisory lamp SL. Contact *b2* applies earth over the loop for relay A independently of that over relay P or the earth connected to the + wire at the preceding switching stage and prevents operation of relay P in series with relay A when the signalling earth is disconnected. Contact *b3* connects battery to relay K which operates to the earth applied to wire *p* in a preceding circuit, contact *b4* closes a circuit from earth over wiper MB1 at normal, contact *pa2* and wiper MA1 at normal for the left-hand winding of relay C, contact *b5* prepares a holding circuit for relay C during impulsing and contact *b6* closes a circuit for starting the tone generator. Relay BA on operation opens all the test-in circuits and relay BB at contacts *bb1* and *bb2* opens the homing circuits for the digit switches and closes points in the selector test circuit and the circuit for the selector magnet MU. Relay C operates and at contact *c1* prepares an operating circuit for magnet MAM by shunting resistance YA by the low resistance winding of relay C by means of which this relay is held during impulsing. Contact *c2* opens a point in the circuit for magnet MU to guard against operation during impulse reception. Relay K operates and locks up at contact *k1*, applies a guarding earth to the holding wire *p* at contact *k2*, closes a point in the circuit for a busy call meter at contact *k3*, closes a point in the operating circuit of relay H at contact *k4* and a point in the operating circuit of relay WS at contact *k5*, connects up magnet MU at contact *k6* and the test circuit at contacts *k7* and *k8*.

If relay P has been operated, it will lock up over its right-hand winding and contacts *p1* and *b1*. Contact *p2* disconnects the operating winding of relay PA from the normal contacts in the marking bank of wipers MB3 . . . MB7 to prevent operation of relays PA and T on the release of relay C when a differentiating signal has not been received. The non-receipt of this signal therefore indicates that selection is eventually to be made in the broken line arcs of the selector and accordingly, on the release of relay C, the selector wipers are to be driven round to the predetermined contact position. If relay P had not been operated, indicating selection in the full line arcs of the selector, relay T would be operated on the release of relay C and prevent movement of the selector.

The impulses of the tens digit should now be received by relay A and they are repeated at contact *a1* in a circuit from earth over contacts *b5*, *a1*, right-hand winding of relay C, contacts *c1*, and *pa3*, to battery over magnet MAM. Magnet MAM operates and steps the switch in accordance with the number of impulses received. As soon as the switch takes its first step, the operating circuit for relay C is opened at wiper MA1 and the circuits for magnet MU and relay T are prepared. Relay C remains operated during the continuance of the impulses through its right-hand winding and by reason of its copper slug, and after the last impulse of the train when relay A remains steadily operated relay C releases, the resistance of relay B being too high for it to hold in series with the latter relay. The stepping off-normal of wiper MA2 disconnects the test-in circuit for as long as the common control circuit is in use and until it has been completely restored to normal. Wiper MA3 by its setting connects up one of the wipers MB3 . . . MB7. The first five contacts in the bank of wiper MA3 are commoned to contacts 6 to 10 so that any setting of switch MA will connect up the same wiper of the set MB3 . . . MB7 for either of two paired values of the tens digit. Contacts 5 to 9 in the bank of wiper MA4 are commoned and connected to the circuit for relay WS. The marking connections from switch MB are arranged in the order 00 . . . 49 and 50 . . . 99, consequently wiper MB3 will mark outlets corresponding to the tens digits 5 and 0, wiper MB4 will mark outlets corresponding to the tens digits 1 and 6 and so on. Differentiation between the two digital values of a commoned pair is effected by means of the connection over wiper MA4, relay WS being operated for values 5 to 9 of the tens digit and remaining unoperated for values 0 to 4 of the same. Wiper M, the contacts in the arc of which are connected to the bank contacts of wipers MB3 . . . MB7, is common to both sets of wipers of the selector and the marking connection is extended over this wiper and contact *ws4* in one or other of its positions for marking and testing the required line. Wiper M is also common to the two arcs of a pair associated with the speaking and test wire wipers and differentiation between the two arcs of a pair is effected by the receipt or non-receipt of the differentiating signal at the time the final selector is taken into use.

When relay C releases at the end of the tens train of impulses, contact *c2* closes a circuit from earth over wiper MB1 at normal, contact *pa2*, wiper MA1 off normal, contacts *bb1*, *c2*, *t1*, *ta1* and *k6* for magnet MU. It also applies earth to relay T so that if a differentiating signal has been received and relay P has not been operated, relay T will be operated over the above traced circuit as far as contact *c2* thence over rectifier MRA, both windings of relay T in series, wiper MA3, the selected wiper of the set MB3 . . . MB7,

normal bank contact, *p2*, shunt round the right-hand winding of relay PA, contact *pa4*, shunt round winding (II) of relay TA to battery. Contact *t1* opens the circuit for magnet MU and switches winding (I) of relays TA in series with the magnet but the resistance of this winding is too high to permit the magnet to operate or hold and in consequence the selector wipers remain in their normal position. The windings of relay PA and TA shunted in the circuit for relay T become energised and the former relay operates and locks up over its left-hand winding, early-make contact *pa1* and contact *b1*. Both windings of relay TA are energised and these windings are connected so that they oppose one another and the relay does not operate and consequently the circuit for relay H is not closed. Selection by the selector will therefore, take place in the full line arcs in which the lines of one of the hundreds groups, say the odd hundred, are connected.

If a differentiating signal has not been received, relay P will be operated and the circuit traced for relay T will be open at contact *p2*, consequently relay T will not be operated and magnet MU will operate and the selector wipers will be driven to the predetermined contact position at the commencement of the broken line arcs. In this position a circuit for relay T will be closed over the 52nd contact in the arc of wiper M, the wiper, contacts *k8*, *k7*, *ws4*, contact in the predetermined position in the arc of wiper P1 or P2, whichever is connected up over contact *ws4*, and the shunted relays PA and TA. Relay T operates and cuts the magnet circuit at contact *t1* thereby switching in winding (I) of relay TA and the windings of relays PA and TA are energised with the before-mentioned results. The selector wipers are now positioned at the commencement of the broken line arcs and selection will take place in these arcs in which the lines of the even hundred group will be connected. At the end of the tens impulse train it has therefore been determined in which arc of a pair and in which set of arcs selection is to be made, that is the selection is to be made in a particular arc of 50 outlets to the exclusion of all other arcs of 50 outlets.

To prevent a false selection in a broken line arc of an outlet marked in common with it in the full line arc should the latter outlet be engaged, it is arranged to stop the selector on the 52nd or last contacts in whichever arc selection is required. Accordingly a test circuit is provided over last contacts in each of the four arcs accessible over wipers P1 and P2. To enable the selector wipers to pass this position in their preliminary movement to the predetermined contact position, the test circuit over the last contacts is not connected up until it has been determined in which arc of a pair selection is to be made. This connecting up is performed by the steering relay PA and will be referred to later.

Consequent on the operation of relay PA which takes place at different times according to the differentiating conditions mentioned, contact *pa2* closes a circuit for the re-operation of the dialling relay C independently of wiper MA1 and contact *pa3* substitutes magnet MBM for magnet MAM in the impulse repeating circuit. Contact *pa4* connects relay LC in the circuit over the commoned last contacts in the arcs of the test wipers. The impulses of the units train of impulses are now received and are repeated to magnet MBM by contact *a1* in a similar manner to those of the tens impulse train and the wipers of switch MB are set in accordance with the units digit to select one of 50 marking wires. Wiper MB1 on being stepped from normal opens the operating circuit for relay C leaving that relay dependent on impulses for its continued operation and wiper MB2 performs a similar function to that of wiper MA2. At the end of the units impulse train, relay C releases and closes the circuit for magnet MU as before and prepares the test circuit, both at contact *c2*, and the selector is driven in search of the marked line. When the selector wipers leave their normal position, either for selection or in a preliminary movement, the off-normal contacts N1 and N2 are operated.

When the marked line is reached, a test is made by relay T over wiper MA3, the connected wiper of the set MB3 . . . MB1, the marking wire marked over these wipers, marked contact in the arc of wiper M, wiper M, contacts *k8* and *k7* and *ws4*, the test wiper and the test wire corresponding to the marked outlet. If this is free, relay T operates, cuts the circuit of magnet MU and switches winding (I) of relay TA in series with the magnet so that the selector is stopped. Contact *t1* in its front position short-circuits the high resistance winding of relay T and extends a low resistance earth over the marking circuit to operate the subscriber's cut-off relay and to mark the line engaged. Relay TA operates and at contact *ta1* opens a further point in the circuit for magnet MU and at contact *ta2* operates relay H over its right-hand winding which is of high resistance. Relay H locks up over its two windings in series, the left-hand winding being of considerably higher resistance than its right-hand winding, and contact *h1* to earth on wire *p*, applies an engaging earth to the test wire of the selected line at contact *h2* thereby releasing relay T by short-circuit, switches the speaking wires through and releases relay A at contacts *h3* and *h4*, closes a locking circuit for relay WS, if that relay has been operated, over contacts N1, *h5* and *ws1* and at contact *h6* earth a wire *q* for the operation of a relay in a preceding circuit for switching in a feeding bridge as described in United States Patent No. 1,971,501 granted 28th August 1934 to W. H. Grinsted et al. from which feeding bridge the connection is held by means of earth applied to the holding wire *p*. The very high resistance connection of relay H guards against false seizure after the holding earth is removed at the end of a conversation should another selector test-in at at the moment, by the operation of the test relay in series with a number of parallel-connected switching relays. On the release of relay A, relay B is short-circuited and is released and at contact *b1* releases relays BA, BB, PA and P if operated and extinguishes lamp SL. Contact *b3* releases relay K. On the release of relay BA, points in the test-in circuits for the several selectors are closed and the release of relay BB closes homing circuits for the two digit switches. One of these circuits is from earth over wiper MB1, contact *bb2* and *mbdm* for magnet MBM and when switch MB has homed, the circuit of the magnet is opened at wiper MB1 at normal and earth is then extended over this wiper, contact *pa2*, wiper MA1, contacts *bb1* and *madm* to magnet MAM and switch MA is homed. Wipers MA2 and MB2 then complete the test-in circuits. Contacts *bb1* and *bb2* disconnect earth from contact *c2* and relay TA releases, re-imposing a short circuit about its winding (I) at contact *ta1* and opening the operating circuit for relay H at

contact *ta*2. On relay K releasing, the selector becomes disconnected from the common control circuit. The test-in circuit for the selector is maintained open at contact N2.

At the end of the conversion when the caller clears, earth is disconnected from wire *p* at the feeding bridge circuit and relay H is released. Contact *h*1 disconnects relay H from wire *p*, contact *h*2 removes the engaged marking from the called line and releases the cut-off relay thereof, contacts *h*3 and *h*4 disconnect the incoming speaking wires from the wipers and connect them to the impulse receiving relay A and relay P, contact *h*5 releases relay WS if that relay was operated and closes the selector homing circuit and contact *h*6 disconnects earth from wire *q*. Magnet MU operates in a circuit from earth over contacts N1, *h*5 and *h*6 and the selector is homed, the magnet circuit being opened at contact N1 when the wipers reach their normal position. Contact N2 closes in the test-in circuit to enable the selector to be taken into use for another call.

If the called line is the first line of a P. B. X group, it is marked in the arc of wiper M and tested similarly to an ordinary line. The contact in the arc of wiper M is also connected to the contacts in one of the arcs of wipers X1 and X2 corresponding to lines of the P. B. X group so that all the lines of the group will be tested over the appropriate arc of wiper X1 or X2, contacts *ws*5, *k*7, *ws*4 and the relevant P wiper. If a line of a P. B. X group other than the first line is called, there will be no connection between the arc of wiper M and that of wiper X1 or X2 and action will be as for a call to an ordinary line.

If an ordinary line or a numbered line other than the first of a P. B. X group or all the lines of a P. B. X group called by dialling the number of the first line is or are found busy, the final selector continues in rotation until the last contacts in the selected arc are reached. A circuit is then completed for relay T over the last contact in the arc of wiper M, the wiper, the test wiper, last contact in the selected arc, shunted relay LC, contact *pa*4 and shunted winding (II) of relay TA. Relays T and LC operate but relay TA does not for the reason previously given and the switch is stopped in the last contact position in the selected arc. Contacts *lc*1 and *lc*2 disconnect the incoming loop from relay A and connect it to the high impedance relay AA which operates and at contact *aa*1 holds relay A. Contact *lc*3 applies busy tone over wire BT and the right-hand winding of relay AA and this is repeated by induction over the other two windings of the relay and the calling loop. Battery and earth over wire BE are applied alternately to the + wire to give the well known flashing signal. Contact *lc*4 connects up a busy call meter to the + wire. It may be arranged to record on this meter all ineffective calls to a particular line or group of lines and for this purpose the relevant contact in the arc of wiper M would be connected to the last contact in the relevant arc in the + wire so that in the event of a busy condition being encountered earth over relay T and the marking wire will be extended over the last contact in the + wire arc concerned, the + wire wiper, contacts *k*3 and *lc*4 to the battery-connected busy call meter.

The arrangements shown in Fig. 3 may be used if it is desired to meter ineffective calls to particular lines or groups of lines, the lines in respect of which such metering is to be performed being connected in different arcs of the selector. In this way calls to four different lines or groups of lines may be dealt with. The arrangements shown in Fig. 3 are intended to be considered as being connected below the contact *lc*4 in Fig. 2, the relevant contacts in the arc M being connected to the last contact in the relevant arcs in the + wire. Two additional wipers and banks of the tens digit switch are provided, these being designated MA5 and MA6 and the wipers are connected to back and front contacts respectively of a change over spring set *p*3 or relay P. The contacts in the two additional banks of switch MA are commoned in the same manner as those in the bank of wiper MA4, i. e. contacts 5 to 9 are commoned in one group and connected to one busy call meter and contacts 1 to 4 and 0 are commoned and connected to another busy call meter, providing connections to 4 busy call meters corresponding to the 4 arcs of the selector in which selection can be exercised. Since relay P is operated for connections over one arc of a pair and not for the other, differentiation between ineffective calls over the two arcs of the odd or even numbered wipers is effected by contact *p*3 and since the contacts in the additional banks of switch MA are commoned to agree with the connections of the wiper switching relay WS in the bank of wiper MA4, differentiation between ineffective calls over the two sets of arcs associated respectively with the odd and even-numbered wipers is effected by the position of wiper MA5 or MA6.

Release from the last contact position follows in the manner previously described, the disconnection of the holding earth from wire *p* releasing relays AA and A.

I claim:

1. In a telephone system, a final selector switch including a plurality of wiper sets and sets of contacts, subscribers' lines accessible thereto, said lines divided into four groups, each group appearing in a different set of contacts in said switch accessible to one wiper set, marking devices operated responsive to received series of impulses representing digits of a subscriber's number for marking a corresponding line in each of said groups, means for determining which of the marked lines will be seized, said means responsive to a signal received independent of said impulses and to one of said series of impulses.

2. In a telephone system, a switch having wipers having access to a plurality of groups of subscribers' lines each having a directory number said lines divided into four groups of contacts in the bank of said switch, marking means operated in response to impulses received in accordance with the number of the called line for marking the contacts of a line in each group, and means for selecting the group in which the marked line is to be seized by either moving the wipers to an advanced position or starting testing from a normal position and by either performing a wiper switching operation or using a normal set of wipers.

3. In a telephone system, an automatic switch having wipers and banks of contacts accessible thereto, subscribers' lines connected to said banks of contacts and each having a directory number, said contacts divided into four groups, means in the switch responsive to the receipt of impulses corresponding to a subscriber's number for marking a set of contacts in each group, means in the switch responsive to a received signal for rendering the markings on certain of

said groups ineffective, and means responsive to certain of said impulses for rendering the markings on another group ineffective, whereby only one marking is effective to thereby cause seizure of only one of the marked lines.

4. In an automatic telephone system, a single motion final selector switch having a plurality of wipers each having access to a set of contacts, an incoming line connecting with said switch, a different group of subscribers' lines connected to each of said sets of contacts, control equipment associated with said switch, said equipment including a marking device responsive to the receipt of a train of impulses for causing said incoming line to be connected to certain of said wipers having access only to certain of said sets of contacts, means in said equipment controlled in response to a signal received prior to said train of impulses for selecting a particular set of contacts in said certain sets for engagement with its respective wipers, and means including a marker switch responsive to the receipt of another train of impulses for causing said switch to connect said incoming line to a particular subscriber line in the group of subscribers' lines connected to said particular set of contacts.

5. In a telephone system, an automatic switch having two sets of wipers, two sets of bank contacts accessible to each set of wipers, a group of subscribers' lines connected in each set of contacts, means in the switch for marking the contacts of a line in each group selectable responsive to received impulses, means responsive to a received signal other than said received impulses for determining the set of contacts to be selectable by either set of wipers, and means for selecting the particular set of wipers to be used to render only one marked set of contacts accessible.

6. In a telephone system, an automatic switch

having access to a plurality of groups of subscribers' lines each having a directory number, a plurality of sets of wipers each having access only to certain of said groups, a wiper switching relay, means in the switch responsive to the impulses corresponding to the tens digit of said number for determining whether or not said relay is to be operated and for preparing a marking circuit for part of the lines in all of said groups, a second means in the switch operated in response to impulses corresponding to the units digit of said number for completing the marking circuit to a particular line in the groups selected, and means responsive to a received signal independent of said impulses for causing only certain of said markings to be effective.

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