April 10, 1951 D. P. LONG 2,548,673

MARKER CONTROL APPARATUS FOR GROUP SELECTORS

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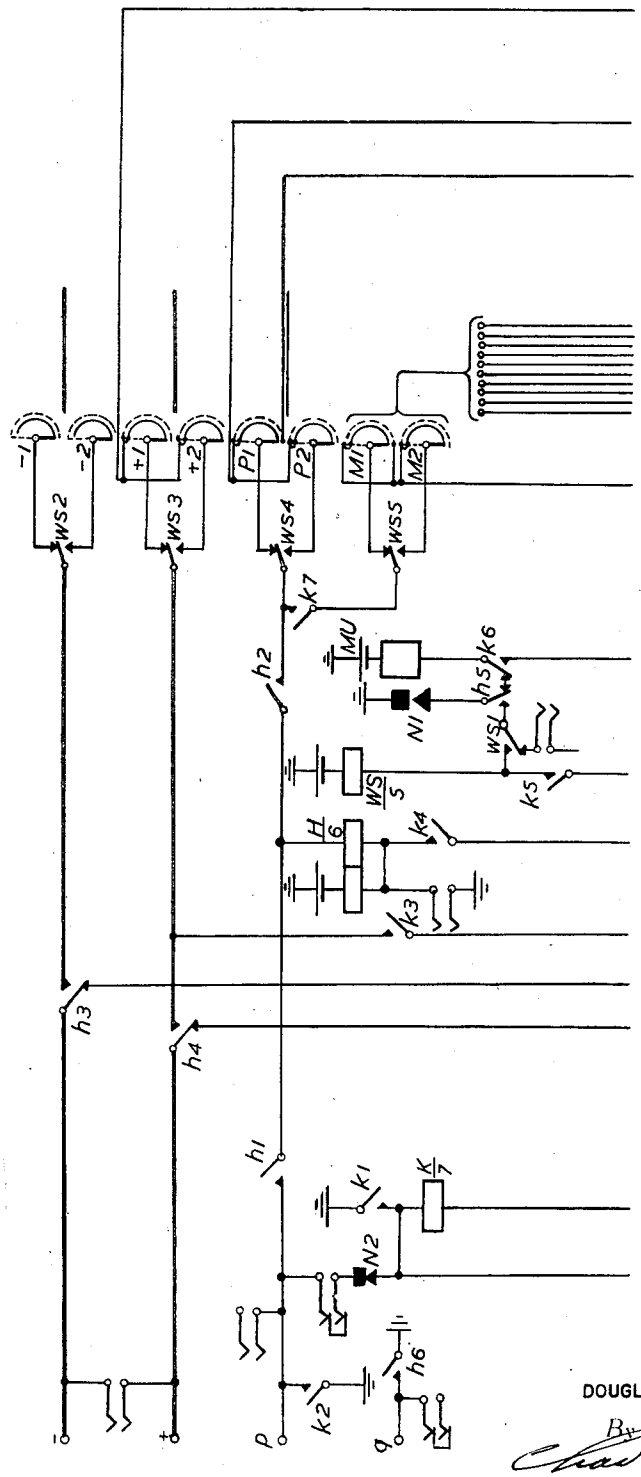

FIG. 1.

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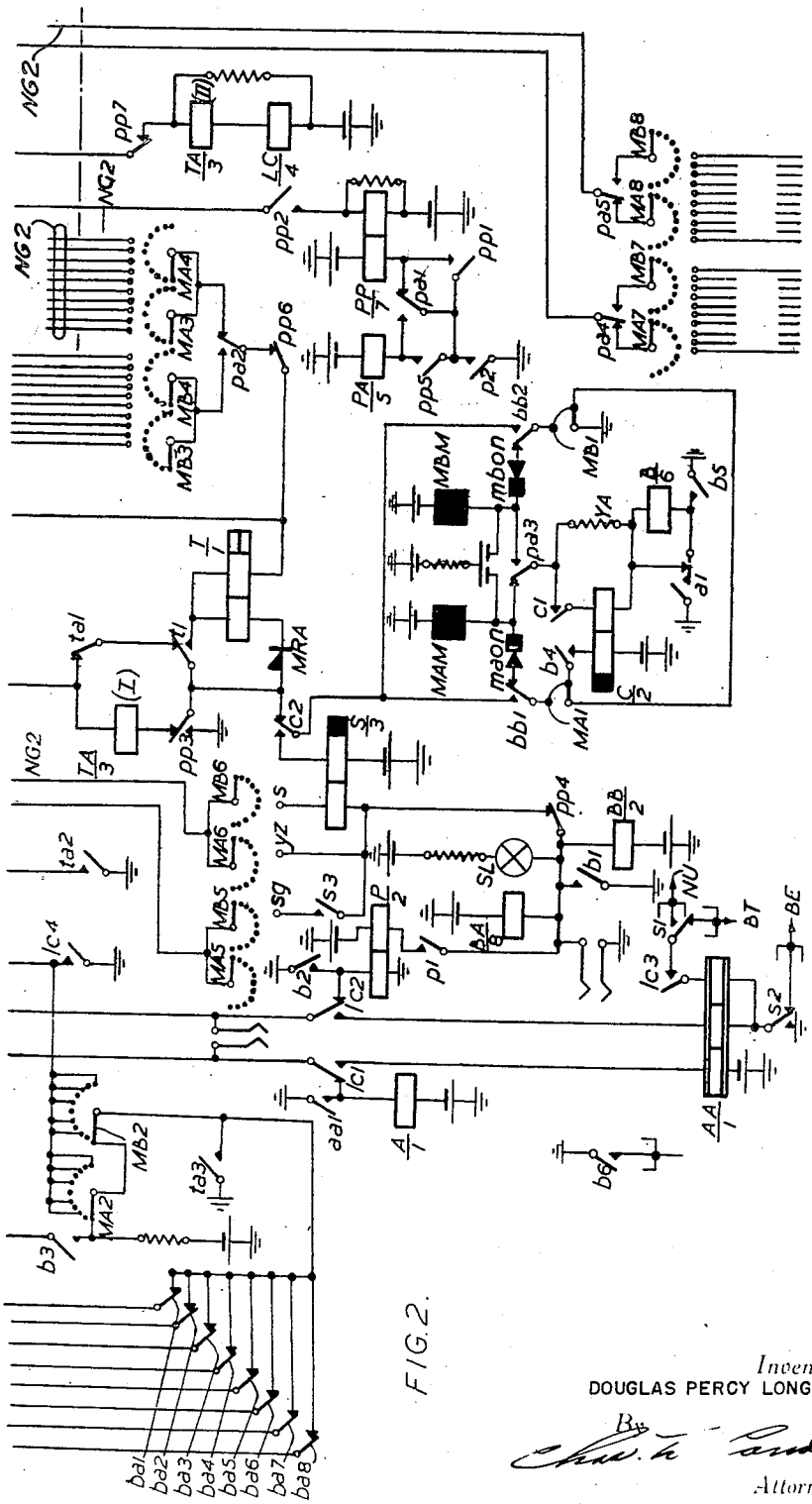

FIG. 2.

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MARKER CONTROL APPARATUS FOR GROUP SELECTORS

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6 Claims. (Cl. 179—18)

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This invention relates to automatic telephone systems and more particularly to systems in which a group of outlets from a selecting switch of one rank to a selecting switch of another rank carries traffic represented by more than one digit of the same digit place and a differentiating signal is transmitted to cause a corresponding separation or segregation at the subsequent rank. The signal is utilised at a selecting switch receiving it to direct the call to one of a plurality of sets of outlet groups, the selection of a particular outlet group of a set being effected by means of a marking applied thereto consequent on the receipt of a train of impulses.

In the present invention the marking of an outlet group is effected over one or other of a pair of contact-making members of a marking device, the particular contact-making member to be used depending on the receipt or non-receipt of the differentiating signal. The contact-making members may be wipers of the same stepping switch or wipers of different stepping switches. The differentiating signal may effect discrimination between odd and even digits of the same digit place so that, in effect one wiper or stepping switch serves for marking odd digits and the other even digits. Arcs associated with these wipers will be cross-connected accordingly to the arcs of the selecting switch. If selection is, as is usual, on a decimal basis, the marking switches may have 10 outlets each. The marking device is also used to control the transmission of a differentiating signal to the subsequent rank of switches and here again differentiation is conveniently effected according to whether the digit received at the selecting switch is odd or even. The differentiating signal may take the form of a potential applied temporarily to one of the speaking wires whereby a relay connected to this wire in the subsequent switch at the time of seizure is short-circuited and prevented from operating. This potential may be applied over contacts of the marking device, in either the odd or even contact positions. Other sets of wipers of the marking device may be used to effect other switching operations such as wiper switching, and the operation of overflow meters. Other forms of differentiation may be employed.

If the signal receiving relay is operated, it may lock up and bring about the operation of a further relay to effect the driving of the switch wipers to a predetermined contact position. This position may be at the commencement of an arc of contacts reached by the wipers after a rotation of 180°, one wiper of a pair being associated

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with one arc, and another, electrically connected to it but staggered along the switch shaft and set at 180° to the first being associated with another arc, at the commencement of which the said predetermined contact position is situated. The further relay is conveniently arranged to be released by differential action in the test circuit over the predetermined contact position.

If two marking switches are used, a contact of the signal receiving relay or an auxiliary thereto is connected in the impulse repeating circuit in order to direct the received impulses to the magnet of the appropriate marking switch, the circuit including a low resistance winding of the relay that determines the end of an impulse train, generally called the dialling relay, which is preoperated over a second winding in the usual manner. The driving and test circuits for the selecting switch may include off-normal contacts and wiper of the marking switch or one of the marking switches and a break contact of the dialling relay. The forward discriminating signal may be applied over contacts of the marking switch in use, the circuits being connected up by the operation of the test relay.

A 200-outlet selecting switch using arcs of 50 outlets each requires a wiper selecting operation. This may be performed by a relay operated over contacts of the marking device in appropriate positions. A group of outlets may also be disposed some in one set of arcs and some in another and it may be arranged that if those in the first arc are all found busy a wiper switching operation takes place whereby those in the other arc are tested. To this end the early contacts of a split group are connected to early contacts, preferably at the commencement of the first arc of a pair of successively swept arcs with the wiper switching relay operated and the later contacts of the group are connected to the later contacts, preferably at the end of the second arc of the successively swept pair with the wiper switching relay released. For this purpose the wiper switching relay may be cross connected over appropriate contacts of the marking device to a wire that is earthed over a make contact of a slow releasing relay operated on receipt of the first impulse of a train and released after the end of the train following a period of delay. The delayed release of this relay gives time for the selecting switch to search the early contacts of the split group before the circuit of the wiper switching relay is opened to connect up the wipers associated with the other set of arcs.

The marking device and control relays may be

assembled in a common control circuit and by the use of two marking switches and by providing the arcs of the marking switches in pairs to give two independent sets of markings, selecting switches in two different numerical groups may be served by the common control circuit.

The incoming speaking wires may be normally connected over back contacts of a "last contact" relay to a low impedance impulse receiving relay and a signal receiving relay and over the front contacts of the "last contact" relay to a high impedance relay, a contact of one of these latter relays, when operated holding the impulse receiving relay. The high impedance relay may be utilised to repeat in a balanced circuit a tone fed through a third winding.

The arrangements of the invention are especially applicable to selecting switches of the high speed uniselector type, such as the motor driven uniselector.

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 group selector and in Fig. 2 a common control circuit for the control of a group of selectors of the kind shown in Fig. 1. The group selector illustrated is a single-motion motor-driven switch having 200 outlets, access to one hundred outlets being had over back contacts of a wiper switching relay and access to the other hundred outlets being had over front contacts of the wiper switching relay. The contact bank of the selector comprises 16 arcs of 52 contacts each, the arcs being paired, the two arcs of a pair being traversed respectively by the two ends of a wiper in succession, one end of the wiper entering the bank after the other end of the wiper has left it. The arcs over which the wipers first sweep are indicated in full lines and are swept by the ends of the wipers shown in full lines and the arcs over which the wipers sweep after traversing the full line arcs are indicated in broken lines and are swept by the ends of the wipers shown in broken lines. The wipers are denoted by the characters −, +, P and M for the negative and positive line wire wipers, the test and holding wire wipers and the marking wipers respectively, a numeral indicating the wipers associated with arcs of contacts of a particular group of one hundred outlets. 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. There are two off-normal contacts N1 and N2 operated when the wipers leave the position at the commencement of the bank on which they normally rest. The normal contacts in the bank are not connected to outlets, outlets from the selector being connected to the next 50 contacts. The 52d contact is a "last contact" position and is commoned in the two pairs of test arcs to the 52d contacts in the broken line arcs and connected to a "last contact" relay LC. Commoned contacts in similar positions in the + wire arcs are connected for the operation of overflow meters and commoned contacts in similar positions in the marking arcs are connected to the test relay in the common control circuit. These latter contacts are also commoned to the first contact in the broken line arc of wiper M1. The first contact in the broken line arc of wiper P1 is adapted to be connected in the common control circuit to a relay for restoring certain circuits following a preliminary rotation of the wipers to this contact position, hereinafter referred to as the predetermined contact position. The selector also includes the coupling relay K for coupling it to the common control circuit serving it, the switching relay H, and wiper switching relay WS.

The group selector is adapted to be taken into use by two values of the same digit, say, an odd value and an even value and therefore carries traffic for lines designated by two different values of the same digit. Traffic in respect of one digital value is routed over contacts in the full line arcs and traffic in respect of the other digital value is routed over contacts in the broken line arcs. Also, the outlets from the switch carry traffic for lines designated by two different values of the digit appropriate to the preceding switching stage, one of which may be an odd value and the other an even value. Differentiation between the two digital values of the digit appropriate to the preceding switching stage is effected in the common control circuit by arranging that in response to a signal from the preceding switching stage different stepping switches for marking purposes are taken into use for the two values, one for the odd value, and one for the even value of a pair by which the group selector illustrated may be selected. Similarly, differentiation between the two values of the digit received at the group selector is effected in the common control circuit and a signal is transmitted to the succeeding switching stage. The signal, in the present example, is the connection of earth to the + wire when the connection is switched through at the particular switching stage and its effect is to prevent a relay in the succeeding stage from operating. In the absence of the signal the relay operates at the time the selector is seized and brings about a preliminary rotation of the selector wipers to the predetermined contact position.

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 for determining whether the signal differentiating the two values of the digit by which the associated group selector may be seized has been transmitted or not and its auxiliaries PA and PP. Relay PA is used as a steering relay to direct repeated impulses to one or other of two marking devices, in the present example stepping switches, and to connect up the several banks of one or other of the two stepping switches. There is also a relay S, slow to release, which is concerned with reverting a signal if a dead number is received at the group selector and with the search of an outlet group that may be connected in two like arcs of the group selector, e. g. the full line arcs in both sets, or the broken line arcs in both sets. There is also a high impedance relay AA over which balanced tone signals may be reverted and which permits the use of a low impedance impulse receiving relay.

There are two stepping switches MA and MB each having 8 wipers and banks. Their magnets are designated MAM and MBM and each has an armature-operated contact maon and mbon respectively. Switch MA is concerned with outlets connected in the full line arcs of the selector and switch MB is concerned with outlets connected in the broken line arcs of the selector. Their wipers are connected in pairs, the banks of wipers 1 being off-normal banks, those of wiper 2 being concerned with the transmission forward

of the differentiating signal, those of wipers 3 and 4 being marking banks, those of wipers 5 and 6 being concerned with wiper switching and those of wipers 7 and 8 being connected to overflow meters. The common control circuit is adapted to operate in conjunction with group selectors of two numerical groups and with the exception of the wipers and banks of the stepping switches numbered 1 and 2, one wiper and bank of a pair is concerned with group selectors in one numerical group and the other wiper and bank of the pair is concerned with group selectors in the other numerical group. The selector illustrated is assumed to be one in the numerical group 1 and its connections to the control circuit are shown in full, while connections for the control group selectors in the other numerical group where these are not commoned with those for group selectors of numerical group 1 are designated NG2.

The group selectors of the numerical group 2 are identical to the group selector shown in Fig. 1. Calls to group selectors of numerical group 2 are routed over different paths than calls to group selectors of numerical group 1 in well known manner. Calls thru the bank contacts of group selectors of numerical group 2 are routed to different points than calls thru the bank contacts of the group selectors of numerical group 1. The ten marking leads provided for the contacts associated with wipers such as M1 and M2 of Fig. 1 may be connected in any desired manner in the bank contacts shown in solid lines and also in any desired manner in the bank contacts shown in broken lines and multipled to similar contacts in the banks of each of the group selectors of the group. These ten marking leads may be connected in any desired manner in the bank contacts associated with the wiper MA3 (Fig. 2) and also in any desired manner in the bank contacts associated with the wiper MB3. The normal or operated condition of relay PA determines whether the marking thru wiper MA3 or MB3 will be effective and the normal or operated condition of relay PP determines whether the bank contacts shown in solid lines or broken lines will be used. In the same way the marking leads designated NG2 are connected at the bank contacts associated with the wipers M1 and M2 of the group selectors of numerical group 2 and at the bank contacts associated with the wipers MA4 and MB4. It may be seen that each time a marking is extended from the common control equipment to the group selectors of numerical group 1 a marking is also extended to the group selectors of numerical group 2. However, as the K relay of only one of the group selectors controlled by the common control equipment (Fig. 2) can be operated at any one time the operating group selector will test only for the marking extended to the numerical group to which it belongs.

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

The selector and common control circuit test free by reason of the battery connection 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 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 discriminating condition is applied at the preceding selecting stage, earth will be present on the positive wire at this time and relay P will be short-circuited, the circuit for relay A then being from this earth over contacts *h4* 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 *h3* 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 the preceding circuit, contact *b4* closes a circuit from earth over wipers MB1 and 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 stepping switches and closes points in the test circuit and the circuit for magnet MU of the group selector. 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 its 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*, connects the + wire to contacts in the banks of wiper MA2 and MB2 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 *k* and the test circuit at contact *k7*.

If relay P has been operated, it will lock up over its right-hand winding and contacts *p1* and *b1*. Contact *p2* closes a circuit over contact *pa1* for the left-hand winding of relay PP and this relay operates and locks up over contacts *pp1* and *p2*. Contact *pp5* closes an operating circuit for relay PA which operates and locks over contacts *pa1* and *p2* and at the former contact opens the operating circuit for relay PP. Contact *pa2* changes over the connections to the marking wipers of the stepping switches from wipers MA3 and MA4 to wipers MB3 and MB4, contact *pa3* substitutes magnet MBM for magnet MAM and contacts *pa4* and *pa5* change over the connections of wipers 7 and 8 of switch MA to those of switch MB in the circuit of overflow meters to correspond with the connections made over contact *pa2*. Contact *pp2* connects the right-hand winding of relay PP to the predetermined contact in the arc of wiper P1, contact *pp3* closes a circuit for magnet MU and a test circuit independently of relay C, contact *pp4* disconnects earth from the left-hand winding of relay S, contact *pp6* disconnects the normal marking circuit and contact *pp7* disconnects relay LC. Consequent on the change over of contact *pp3* earth is connected over contacts *t1*, *ta1* and *k6* to magnet MU and over rectifier MRA and both windings of relay T in series to the contact in the prede-

termined position in the bank of wiper M1. Magnet MU operates and the selector wipers are driven round until they reach the predetermined contact position whereupon the test circuit is extended over wiper M1, contacts *ws*5, *k*7, *ws*4, wiper P1, contact *pp*2 to battery over the non-inductive resistance shunting relay PP. Relay T operates in this circuit and cuts the circuit for magnet MU and the right-hand winding of relay PP becomes energized in the test circuit. The two windings of relay PP are connected in opposition so that the relay is released and the test circuit is opened releasing relay T. Contact *pp*3 re-imposes the short circuit about winding (I) of relay TA and the points opened at contacts *pp*4, *pp*6 and *pp*7 are closed. Relay PA remains locked up.

When impulses are received, relay A will respond and at contact *a*1 repeat them in a circuit from earth over contacts *b*5, *a*1, low-resistance winding of relay C, contacts *c*1 and *pa*3 to whichever of the two magnets is connected up. The stepping switch magnet 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 1 of the stepping switch. Relay C remains operated during the continuance of impulse repetition by means of the repeated impulses to the stepping switch magnet and by reason of its copper slug and after the last impulse of a 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. Contact *c*2 closes and a circuit is closed from earth over wiper MB1 at normal, wiper MA1 off-normal and contact *bb*1 or over wiper MB1 off-normal and contact *bb*2, thence over contacts *c*2, *t*1, *ta*1 and *k*6 for magnet MU and the selector is driven in search of a free outlet in the group marked by the operated stepping switch. The outlets of the group to be searched, if connected in the full line arcs of the selector will be marked over wiper MA3 with relay PA unoperated and if connected in the broken line arcs of the selector the group will be marked over wiper MB3 with relay PA operated, the search by the selector starting at the normal contact position in the former case and at the predetermined contact position in the latter case. Wipers MA4 and MB4 are used for marking outlet groups in selectors of another numerical group and the connections between their banks and the marking arcs of the selectors of the other numerical group may differ from those for the selector of the group illustrated.

When a free outlet in the marked group is found by the selector, relay T is operated from earth over the previously traced circuit to contact *c*2, thence over rectifier MRA, both windings of the relay in series, contacts *pp*6 and *pa*2, the marking wiper connected up by relay PA, connection to the marking arc of the selector, marking wiper, contacts *ws*5, *k*7, *ws*4, test wiper to battery on the test wire outlet. Contact *t*1 changes over, busying the outlet by shunting the high resistance left-hand winding of relay T and stopping the selector by switching winding (I) of relay TA in series in the circuit of magnet MU. Magnet MU will not hold in series with relay TA so that it releases and stops the switch. Relay TA operates and opens a further point in the circuit for magnet MU at contact *ta*1, operates relay H at contact *ta*2 and at contact *ta*3 connects earth to wiper MB2, or if switch MA has been used, to wiper MA2. Relay H operates and locks up over its two windings in series and contact *h*1 to the earth on wire *p* and at contact *h*2 extends this earth to the test outlet to engage the seized circuit and at the same time release relay T by short-circuit. Contacts *h*3 and *h*4 switch through the speaking wires and contact *h*6 earths wire *q* to operate a relay in a feeding bridge circuit if one precedes the group selector, for switching in a feeding bridge as described in United States Patent No. 1,971,501 granted August 28, 1934, to W. H. Grinsted et al. The operating winding of relay H is of high resistance and the right-hand winding which is connected in series with it is of higher resistance so that when the holding earth is removed from wire *p* at the end of a conversation there will be no danger of a test relay in a selector that happens to be testing in to one of the selectors that are about to release operating in series with a number of parallel connected switching relays that may at that moment be connected to the *p* wire.

The foregoing operations apply generally to the selection in any of the four sets of contact arcs of the selector. If the desired outlet group is situated in the even-numbered arcs, a cross connection will be made between the appropriate contact in the bank of wiper 5 of the stepping switch concerned and terminal *yz* so that earth over contact *b*1 and this connection will be extended over contact *k*5 to relay WS and that relay will be operated. Contacts *ws*2—*ws*5 change over the connections from the odd-numbered to the even-numbered wipers of the selector so that search will be controlled over wipers M2 and P2 and on the eventual operation of relay H relay WS will lock up over contacts *ws*1, h5 and N1. Suitable cross connections would be made between terminal *yz* and the banks of wipers 6 of the two stepping switches for wiper switching purposes in selectors of the other numerical group. It will be appreciated that, by the use of two stepping switches or two different banks of a single stepping switch, wiper switching may take place in response to a digital value received at the selector when the selector has been seized to the same digital value received when the selector has been seized in respect of the other digital value of the pair. The use of two stepping switches, however, allows different wiper switching connections in two different numerical groups of selectors. Consequent on the operation of relay H, relay A is released at contacts *h*3 and *h*4 and at contact *a*1 short-circuits relay B. After an interval relay B releases, releasing relays BA, BB, and P if operated and extinguishing the lamp SL at contact *b*1, releasing relay K at contact *b*3 and opening points in the operating circuits of relay C and the stepping switch magnets at contacts *b*4 and *b*5 respectively. On the release of relay BB the homing circuit for the stepping switch used is closed over its wiper 1 off normal, contact of relay BB, magnet-operated contact of the switch and the switch magnet and the stepping switch is homed in known manner. Release of relay P releases relay PA at contact *p*2 and relay TA is released at a contact of relay BB. Release of relay BA re-closes points in the test-in circuits for the associated selectors, this circuit being completed on the homing of the stepping switch.

It has been assumed that all the outlets of a group will be connected in one arc of the selector. As however, 50 is not an integral multiple of 20, and 10 is the usual number of groups to be

catered for, either the groups must vary in size or, if 10 groups of 20 outlets each are required, some of the outlets of one group must be connected in one arc and the remainder in another. The group selector illustrated caters for such an arrangement and allows the first 10 outlets of a group to be connected to the first 10 outlet positions in an even numbered arc and the remaining 10 outlets to be connected to the last 10 outlet positions in the corresponding odd numbered arc. The marking arcs in the selector banks would be cross-connected to the marking banks of the stepping switches accordingly and the search of such a group of outlets would then take place as follows. When the first impulse is received, relay C will be in an operated condition and earth over wiper 1 of the stepping switch responding to impulses will be extended over contacts of relay BB and front contact *c*2 to relay S. Relay S operates and at contact *s*3 connects earth over contacts *b*1 and *pp*4 to terminal *sg*. In the position to which the stepping switch is set by impulses, this earth is extended over the appropriate contact in the bank of wiper 5 or 6 of the stepping switch concerned and contact *k*5 to relay WS which operates and switches over the connection from the odd-numbered wipers to the even-numbered wipers. At the end of the impulse train relay C releases and the search commences. If a preliminary rotation of the selector had been required, it would have taken place before the release of relay C. Relay S is slugged to allow it to maintain its contacts operated for a time sufficient to allow the selector wipers to pass over the first 10 contacts in the bank but the relay will release before the 40th contact is reached. If none of the first 10 outlets is found free, the selector is continued in motion until the 40th contact is reached and search then continues over the last 10 outlets in the odd-numbered arcs, relay S having released by this time and released relay WS. If one of the outlets of the marked group is found free, operations take place in the manner already described but if no free outlet is found, rotation continues until the last contacts in the arc are reached whereupon the selector is stopped by the operation of relay T in a circuit independent of the marking bank of the stepping switch, the circuit being from relay T over the last contacts and wipers in the arcs of wipers M1 and P1, contact *pp*7 and the shunt across winding (II) of relay TA and relay LC. These two windings become energised in series with relay T but the two windings of relay TA are connected in opposition so that that relay does not now operate. Contacts *lc*1 and *lc*2 disconnect the loop circuit for relay A and substitute the high impedance relay AA, contact *lc*3 applies busy tone over wire BT and the right hand winding of relay AA whence it is induced over the other windings of the relay into the line and contact *lc*4 applies earth over contact *k*3, the +wire wiper, contact *pa*4 and wiper 7 of the stepping switch concerned for the operation of an overflow meter. Contact *aa*1 holds relay A. Battery and earth are applied alternately over wire BE, contact *s*2 and the +wire to give the well known flashing signal. By the inclusion of contact *pp*4 in the circuit over terminals *sg* and *yz* wiper switching is prevented during a prelminary movement of the selector. It will be seen therefore that a divided group of outlets may be connected in either or both arcs of a pair. The operations described as taking place if no free outlet is found in a divided group are exactly the same as those that will take place if no free outlet is found in any group.

It will be remembered that when a stepping switch leaves its normal position, relay S is operated. Terminal *s* is connected to contacts in the banks of wipers 5 and 6 of the stepping switches corresponding to dead numbers and if one of these is called, earth over contacts *b*1 and *pp*4 is extended over the left-hand winding of relay S, terminal *s*, the bank contact and wiper of the stepping switch concerned and contact *k*5 to relay WS. The selector wipers are driven to the last contacts in the arc in which the selector is stopped and relay LC is operated. Relay A is disconnected and relay AA connected to the calling loop, earth being connected over contact *s*2 and the middle winding of the relay. N. U. tone is fed over contacts *s*1 and *lc*3 to the right hand winding whence it is repeated by induction over the two other windings of the relay and the calling loop.

When the caller clears under busy or dead number conditions relay AA is released and in turn releases relay A which brings about the release of the common control circuit in the manner before described.

When the caller clears after a conversation, earth is disconnected from wire *p* at the point from which the connection is held and relay H releases. The through circuit is disconnected at contacts *h*1, *h*2, *h*3 and *h*4 and contact *h*5 releases relay WS if this relay has been operated and closes the homing circuit over contacts N1 and *k*6 for magnet MU. Contacts *h*6 disconnects earth from wire *q*. The selector wipers are rotated to their normal position in which the circuit of magnet MU is opened at contacts N1. Contacts N2 close in the test-in circuit and the selector is again in a condition for further use.

For the differentiation between two values of the digit which may result in selection of an outlet in the same group, earth is connected, when an outlet is seized, to the + wire over contact *ta*3, wiper 2 of the stepping switch concerned and contact *k*3 for even values of the digit and this prevents operation at the next switching stage of a relay corresponding to relay P herein or effects some other differentiating action. The signal is disconnected on the release of relay TA. If the digit has an odd value, the earth is not connected and relay action will take place at the succeding switching stage. If the differentiating arrangements at the succeding switching stage are suitable, it may be arranged for action to take place when the + wire is earthed and not when it is not earthed as described.

I claim:

1. In an automatic telephone system, a selector switch, two main groups of lines, sub groups of lines in each of said main groups, a pair of marking devices one for each main group, a plurality of marking leads, means including said marking leads for connecting one of said marking devices to the sub groups of lines in one of said main groups and for connecting the other of said marking devices to the sub groups of lines in the other of said main groups, means in the switch responsive to a received signal for selecting a particular marking device of one main group and means in the switch responsive to a series of impulses for operating the particular marking device to thereby mark a sub group only in the main group of the selected marking device.

2. In an automatic telephone system, a selector switch having two sets of wipers, each set of

wipers having access to a plurality of main groups of lines each divided into sub groups, a pair of marking devices one for one main group of both wiper sets and the other for the other main group of lines of both wiper sets, means for connecting said marking devices to their respective main groups of lines, means in the switch responsive to a received signal for electing one of the main groups of each wiper set by selecting one of the marking devices and means in the switch responsive to a received series of impulses for then operating the selected marking device to thereby mark a trunk in only one main group and means controlled by the selected marking device for selecting one of the two sets of wipers to be used for selecting a line in the selected main group.

3. In an automatic telephone system, selector switches of one numerical group having access to main and sub groups of lines, selector switches of another numerical group having access to other main and sub groups of lines, a common control equipment for controlling the operation of the switches of said one numerical group and the switches of said other numerical group, means for connecting a switch of either numerical group to said control equipment, a pair of marking devices in said control equipment, means in said equipment responsive to a signal received by a connected switch for selecting a particular marking device and means responsive to received impulses to operate the selected marking device to thereby mark a sub group of lines in one main group accessible to the switches of said one numercial group and to mark a sub group of lines in one main group accessible to the switches of said other numerical group, and means in a connected switch for rendering effective the mark for the sub group of lines accessible to the switches of the numerical group to which the connected switch belongs.

4. A selector switch such as claimed in claim 2 having also means whereby the wipers are stepped to a predetermined position responsive to said received signal to prepare the switch for selecting a line only in one main group and before the marking devices are operated.

5. In a telephone system, a first group of selector switches, a second group of selector switches, control equipment, means for connecting said equipment to a selector of said first group, means for connecting said equipment to a selector of said second group, a pair of marking devices in said control equipment, means for selecting one

of said marking devices, means for operating a selected one of said marking devices, means including an operated marking device for extending a marking to the switches of said first group and for extending a marking to the switches of said second group, and means in a selector to which said equipment is connected for rendering effective the marking extended to the group of switches in which said last mentioned selector is included.

6. In a selector switch, a first wiper set, a second wiper set, outlets for each wiper set, operating means for simultaneously moving said wiper sets over their respective outlets, conductors, a wiper switching relay having a normal position and an operated position, means for connecting said conductors to said first wiper set with said wiper switching relay in its normal position, means for connecting said conductors to said second wiper set with said wiper switching relay operated, a marking device, a relay, a circuit for said relay, control means for operating said device and for completing said circuit to operate said relay, means including said device and said relay for operating said wiper switching relay to connect said conductors to said second wiper set, said control means effective after operating said device and said relay for controlling said operating means to move said wiper sets over said outlets and to open said circuit to said relay, means for releasing said relay a predetermined time after the movement of said wiper sets is started, and means responsive to the release of said relay for releasing said wiper switching relay to its normal position to connect said conductors to said first wiper set.

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