

April 24, 1934.

D. A. CHRISTIAN

1,956,371

TELEPHONE SYSTEM

Filed June 2, 1932

3 Sheets-Sheet 1

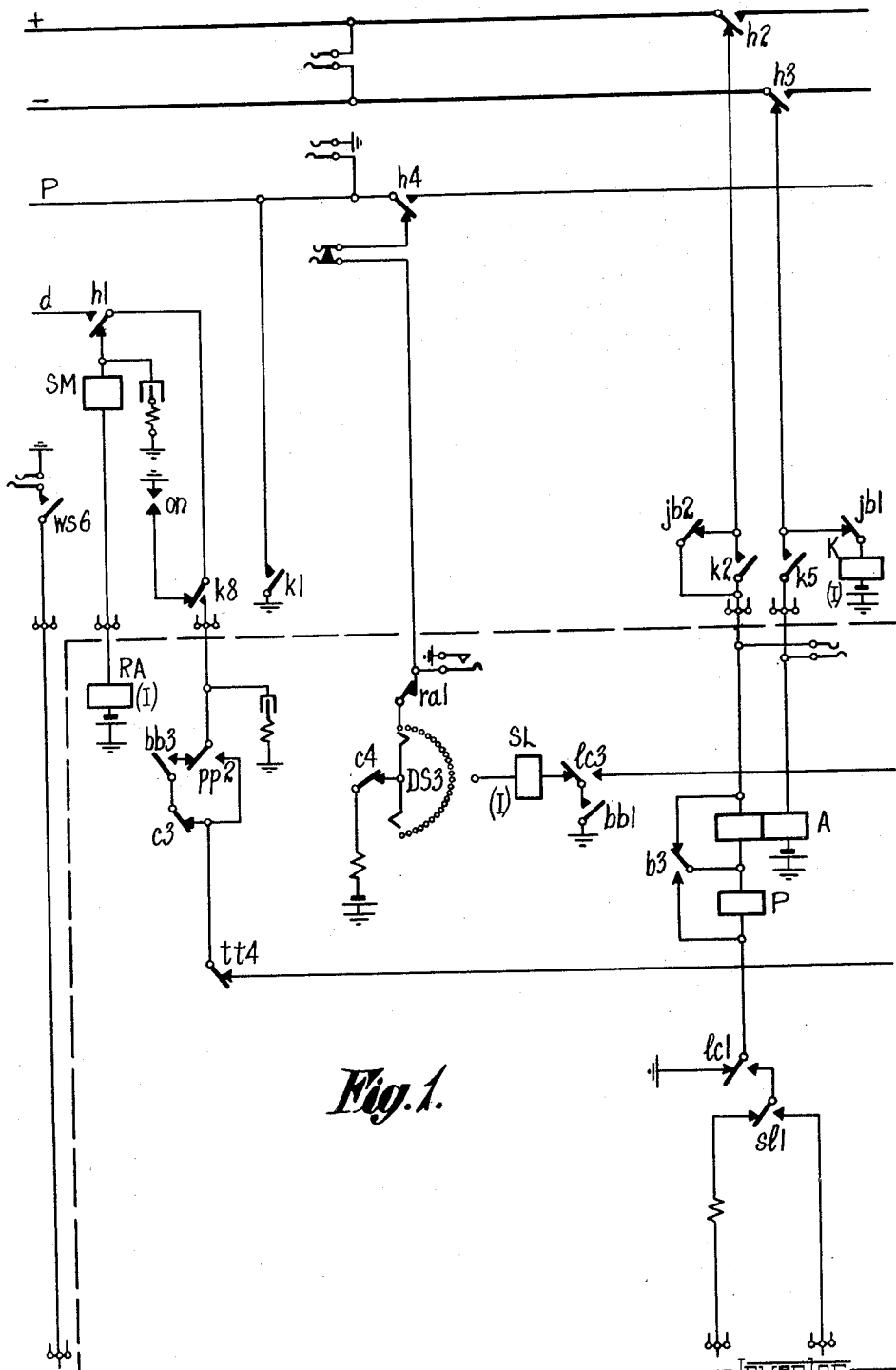


Fig. 1.

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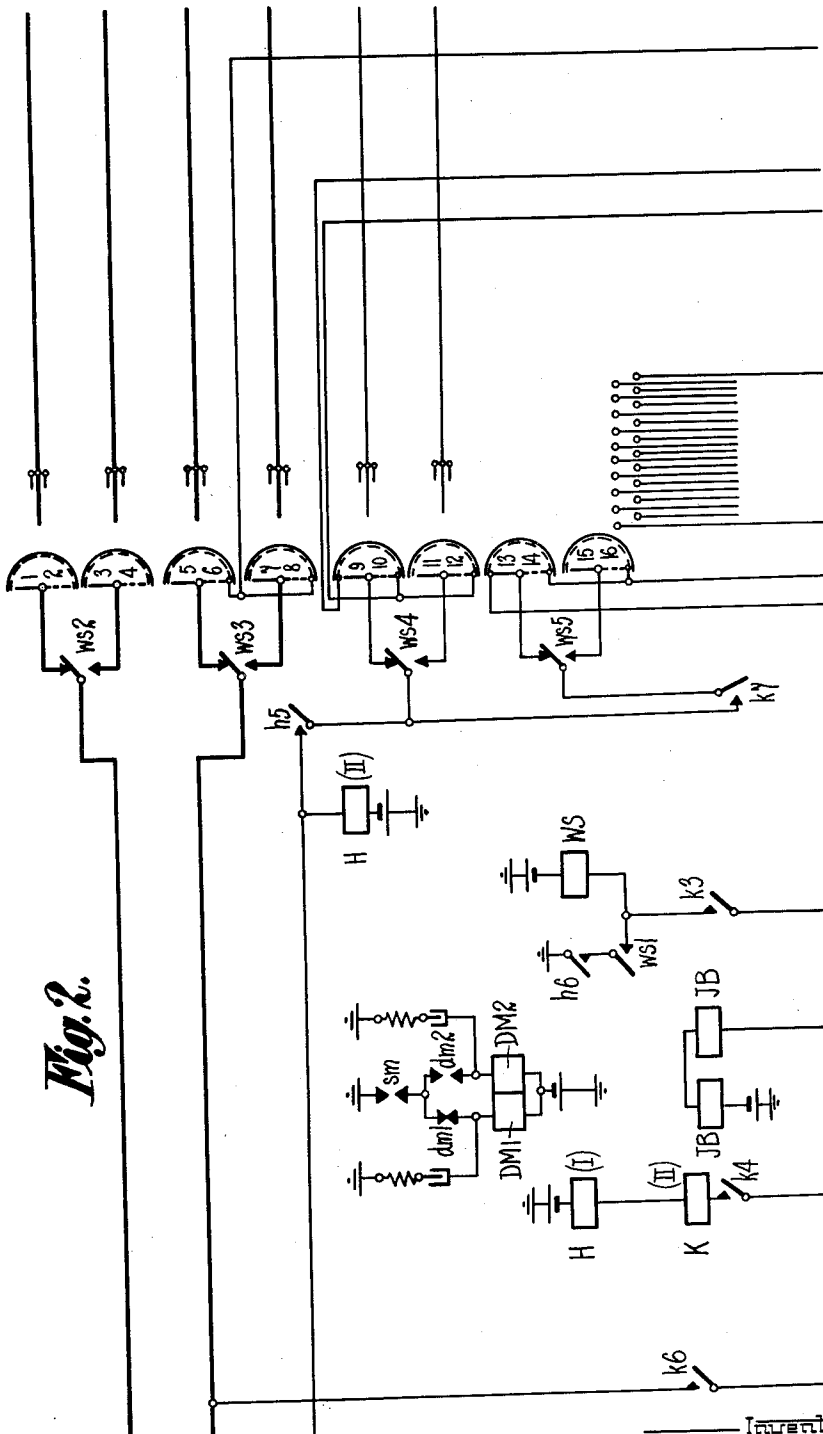
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3 Sheets-Sheet 2



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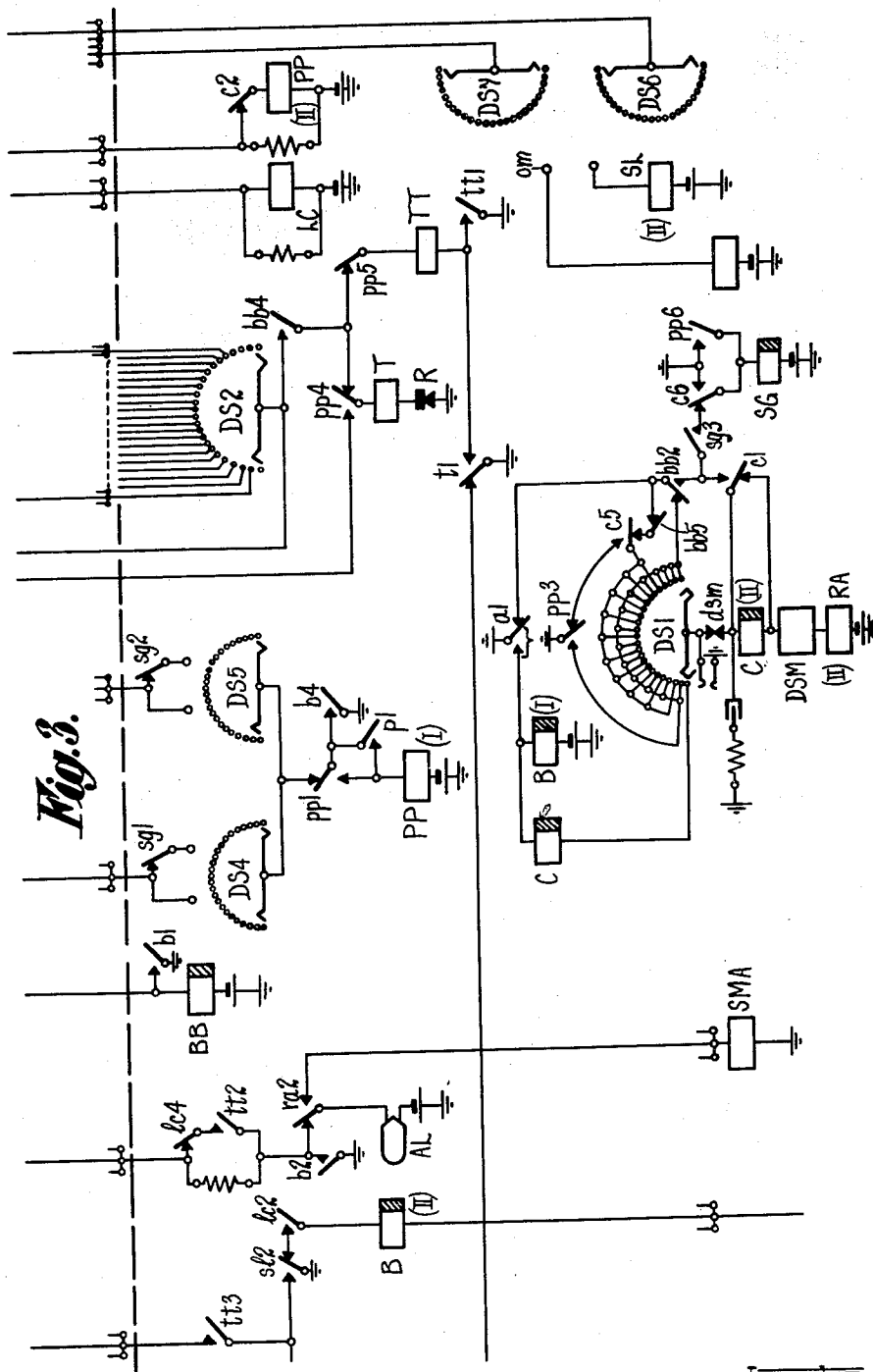
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

David Adam Christian, Charlton, London, England, assignor to Siemens Brothers & Company Limited, London, England

Application June 2, 1932, Serial No. 614,911
In Great Britain June 13, 1931

7 Claims. (Cl. 179—18)

The present invention relates to automatic telephone systems and has in view improved arrangements for setting a selecting switch to a particular contact or group of contacts.

5 The invention is applicable to selecting switches which search for a contact or contact group marked in consequence of the receipt of a train of impulses whether or not the train is received at the switch or in some common control circuit. 10 It is immaterial to the present invention whether the selecting switch selects a conversational route and is used in the conversational connection or whether it is acting as a by path switch.

15 In the present invention the contact or contact groups on which the switch is set is dependent on two factors, one of these being a train of impulses, so that to that extent an ordinary numerical selection is carried out. The other factor is available at the switch or its control circuit before the train of impulses is received or the full train is received and exercises a discriminating action on the routing of the call. It is utilized to cause if necessary the movements of the switch to a preliminary position, whereby 25 time is saved in searching for the marked contact or contact group when finally a marking is applied. The factor moreover is of a discriminating nature which may be termed non-decimal.

30 The preliminary positioning of the switch may alternatively or in addition operate to the effect that unwanted groups of a plurality of groups arranged to be marked in common have been passed over before the marking is applied.

35 The significance of this expression may be perceived if consideration is given to one or two examples. In a selecting switch it may be conducive to economy to route a call over the same group of outlets although either one of two digits is dialled e. g. 1 or 2. However, at some subsequent selecting stage it will be necessary to differentiate between the groups of subscribers represented by the digits 1 and 2 and a differentiating signal would have to be passed to the switch where a separation takes place. This discriminating signal would be a factor such as mentioned and its receipt or non-receipt at the latter selecting switch considered could cause a prepositioning of the switch wipers so that the obviously unwanted group of subscribers is passed 50 over prior to the hunting for a marked contact or contact group. The factor is a non-decimal discrimination in that discrimination is not exercised between the individual digits of the ten 1.2 . . . 0 used in dialling but merely between two 55 digits within the ten.

Again it may be desired to concentrate traffic from two groups of selecting switches which are concerned with the routing of calls to differently numbered subscriber groups at a single group of selecting switches and diverge the routing in the outlets of the latter. The route over which traffic arrives at the single group may be the factor aforesaid. 60

As a contrast it may be pointed out that at a final selector which selects in accordance with 65 two trains of impulses the first train exercises a discrimination between each of the "tens" digits of the numbering systems. The non-decimal discrimination contemplates discrimination between a small number of digits or groups of 70 digits. We include in non-decimal discrimination a case such as one in which preliminary impulses are received at a selecting switch or its control circuit and if more than a certain number are received pre-positioning of the switch 75 takes place and a subsequent train of impulses determines the group of contacts to be searched for, in the other case the marking is in accordance with the preliminary impulses and the next train passes to a subsequent switch. 80

A further possible case in which non-decimal discrimination is exercised is the case of a selecting switch in the first rank of switches of a system in which subscribers' numbers commence with one of two alternative digits, for instance, 85 1 and 2. The selecting switch may accordingly have two main groups of outlets in each of which a decimal selection is made. The first digit received can settle the main group required and if this be the later group in the contact banks 90 the switch is prepositioned in preparation for the second train of impulses.

Another aspect of the invention is that the switch outlets are divided into main groups the number of main groups being less than ten and 95 the switch wipers are prepositioned if it is ascertained that the main group concerned involves switch wipers passing over another main group.

If the selecting switch is of the kind in which the wiper sets comprise double ended wipers, 100 the opposite ends of the wipers being in different planes, and only one end being in contact with bank contacts at a time, there are two main groups of contacts. Pre-positioning here could mean the moving of the switch wipers through 105 180° from the normal or resting position. The same pre-positioning may be brought about if single ended but staggered wipers are used.

To avoid any confusion it may be pointed out that the pre-positioning action concerned in the 110

present invention is not a movement of the kind in which as a digital train is received at a switch, the switch as far as possible steps so as to pass over groups of contacts which are unwanted as determined by the impulses that have already arrived.

The invention is also applicable to a final selector which deals with more than one group of a hundred subscribers pre-positioning being carried out in respect of groups appearing later in the contact banks.

An embodiment of the invention will now be described by way of example in conjunction with the accompanying drawings.

The drawings comprising Figs. 1, 2 and 3 show a group selector switch which is preceded by a numerical selecting switch and which is controlled by a common control circuit, the group in which a free line is to be selected being marked by a digit switch in the common control circuit which responds to a train of impulses. The circuits of the group selector are shown above the dotted line and those of the common control circuit below this line.

The selector is of the rotary single motion type and rotates at a high speed. It is rotated by a pair of electromagnets DM1 and DM2 acting on a rotatable armature, the armature spindle being suitably connected to the wiper shaft by means of gear wheels in order that a desirable speed of wiper rotation may be attained. For controlling rotation of the switch a magnet SM is provided the armature of which operates a sprag having teeth in its edge for engaging the teeth of one of the gear wheels in the driving mechanism of the switch. When the sprag magnet is not energized the sprag engages a gear wheel of the driving mechanism and prevents rotation of the wiper shaft. When the magnet SM is energized the sprag is withdrawn and contact *sm* is closed by the magnet armature thereby closing a circuit for one of the driving magnets DM1 or DM2. It may here be remarked that it is convenient for the driving magnets to be arranged with their pole faces 90° apart with respect to the circle of rotation of the armature energization of a magnet effecting a 90° rotation of the armature, this rotation being the amount required to advance the switch wipers from one contact to the next. Associated with the armature is a cam device acting on contacts *dm1* and *dm2* for directing current to the two driving magnets alternately. In the drawing contact *dm1* is shown closed and *dm2* open. When the sprag magnet is energized contact *sm* closes and magnet DM1 energizes and the armature commences to rotate. The cam now comes into operation, opens contact *dm1* and closes *dm2* and this is timed so that magnet DM2 is energized when a pole of the armature has been sufficiently rotated so as to be attracted by magnet DM2, and the armature is rotated a further 90°. During this second quadrantal rotation the cam again comes into operation, and opens contact *dm2* and closes contact *dm1* so that another quadrantal rotation is commenced. The switch is stopped by de-energizing the sprag magnet which thereupon opens the driving magnet circuit at contact *sm* and brings the sprag into engagement with the gear wheel of the driving mechanism.

The selector is provided with 8 double ended wipers, 4 such wipers comprising a set, a set having two speaking wire wipers, a test wiper and a control wiper. Each wiper may consist of two arms mechanically and electrically connected or

it may be formed from one piece. In either case the two ends of the wipers rotate in different planes, the two ends in their rotation engaging different sets of contacts in a contact bank. One end of a double ended wiper is shown by a full line and it rotates in engagement with an arc of contacts denoted by the full line semi-circle and the other end of the wiper is shown by a dotted line and it rotates in engagement with an arc of contacts denoted by a dotted semi-circle. Each arc contains 52 contacts these being a normal contact at the commencement of the arc in the direction of rotation of the wipers a "last" contact at the opposite end of the arc and 50 contacts between these connected to outlets to further apparatus, for example to final selectors. The normal position of the switch is as shown in the drawings with off numbered wiper arms resting on the normal contacts of the set of contacts indicated by full line semi-circles. In this position contact *on* is open and in all other positions it is closed. The wiper arms are numbered from 1 to 16, the numerals 1 and 2 indicating a double ended wiper in the positive wire, 5 and 6 the corresponding wiper in the negative wire, 9 and 10 the corresponding test wiper, and 13 and 14 the corresponding control wiper. These wipers form a set and connection over them is had with the wiper switching relay WS in its unoperated condition. When this relay is operated the other set of wipers viz. 3 and 4, 7 and 8, 11 and 12, 15 and 16 is brought into use. Besides the relay WS the selector circuit includes a coupling relay K and a switching relay H. A relay JB in the common control circuit has contacts in each of the selecting switch circuits accessible to it and provides a circuit over the incoming speaking wires for relay K and the impulse relay in the control circuit when the selector is taken into use and disconnects relay K from the line during impulsing. Incoming to the selector are four wires, the positive and negative speaking wires, test wire and wire *d* which extends from a preceding circuit containing a feeding bridge at which the holding and supervising of the connection is controlled and over which a signal is transmitted to the feeding bridge. The selector is accessible to a preceding selector in response to different digits and discrimination between these digits effects a choice of outlet groups in the seized selector.

The common control circuit includes an impulse relay A, release relay B, dialling relay C and test relay T with an auxiliary relay TT. There is also a digit switch of the single motion reverse drive type with 25 contacts per bank, the switch having 7 banks and corresponding wipers. These are designated DS1 . . . DS7 and the switch magnet is designated DSM. Wiper DS1 is the control wiper, DS2 the marking wiper, the associated bank contacts of which are connected to marking wires connected as required to contacts in the control banks of the selector. There is a marking wire per group of outlets from the selector and since the selector has 200 outlets these may be divided into any number of groups not exceeding 20, the maximum number of impulses in a train being assumed to be 10 as is the case in a decimal system. Utilizing the 10 numerals of a decimal system together with a differentiating signal to distinguish between 2 groups having the same numerical value for the selecting stage in question, 20 groups of 10 outlets each may be taken from the selector. Alternatively, groups of outlets may be selected by either of a pair of

digits giving 10 groups of 20 outlets each. In this case a signal for discriminating between the pairs at a subsequent switch is transmitted dependent on the value of the digit gave access to the group, i. e. whether it is odd or even or some other distinguishing factor.

In order that there may be no limitations of the size of the groups due to the fact that the number of contacts associable with any wiper arm is not evenly divisible by the number of contacts in a group, a group may be divided, some of the contacts being connected in the early part of one bank the remainder being connected to the later part of another bank, the two banks being accessible over different wipers rotated together over their respective banks and selectable by means of the wiper choosing relay. The only limitation in the size of groups is then imposed by the number of contact positions in the switch in any pair of contact sets over which a pair of wipers move simultaneously.

Since it has been assumed that there are 50 contacts connected to outlets in each arc or set of contacts, that is, 100 contacts in the sets engaged either by the odd numbered wiper arms or by the even numbered wiper arms, five groups of 20 contacts each may be had per set by connecting the first 10 outlets of one group to the first ten contacts in the sets engaged by wiper arms 1, 5, 9, 13 and the second 10 outlets of the same group to the last ten contacts in the sets engaged by wiper arms 3, 7, 11, 15, the other groups of 20 then each occupying the remaining contacts in these sets, 2 groups in one set and 2 in the other. For the control of searching over a split group relay SG is provided which by its slow releasing property closes a circuit for the wiper switching relay only after the selector has had time to search the first ten outlets of the group.

Continuing the reference to the digit switch, wiper DS3 is an off normal wiper which opens the test in circuit when it moves from its normal position and also controls the transmission of the differentiating signal referred to. Wipers DS4 and 5 are concerned with the operation of relay WS in the selector and wipers DS6 and 7 are concerned with the operation of overflow meters and differentiating between "live" and "dead" groups of outlets. The selector multiple may be divided into two parts some of the selectors served by a common control circuit being connected to one part and others to the other part. In order to provide flexibility in the arrangement of the groups in the two sets of selectors served by the same common control circuit two banks are provided for the control of the wiper switching relay and two for the control of tone transmission. Banks of wipers DS4 and DS6 respectively are associated with selectors multiplied to the selector shown in the upper part of the drawings while banks of wipers DS5 and DS7 are associated with selectors connected to the other part of the multiple.

There is a relay P with an auxiliary PP which by an operation or non-operation serves to differentiate between two groups of outlets having the same numerical selecting designation. Relay P, if operated, is energized over the speaking wires when the circuit is taken into use and causes the selector to rotate until the even numbered wiper arms are positioned at the commencement of their associated sets of contacts, that is to say the selector wipers are rotated through an angle of 180°. The outlets are accordingly connected to the selector banks so that

the outlets in one main group are connected to the contacts indicated by the full line semi-circles and outlets in the other main group are connected to contacts indicated by the dotted semi-circles. Of each group some sub-groups of outlets are reached directly while for others, the wiper switching relay WS must be operated and this is controlled from the common control circuit in accordance with the digit received therein.

A detailed description of the operation of the selector will now be given. A selector associated with an idle control circuit tests free to a preceding circuit by means of battery potential on the test wire. This potential is applied over contact c4, wiper DS3 and normal bank contact of the digit switch, contact *ra1* of relay RA, and contact *h4* of the selector switching relay. When the speaking wires are switched through relay K operates in a circuit from battery over its winding (I), contacts *jb1*, *h3* to the negative wire which may be earthed or which may be looped to the positive wire in which case the earth connection is found over this wire, contacts *h2*, *jb2*, *b3*, relay P and contact *lc1*. For the time being it will be assumed that the negative wire is earthed in a preceding circuit and the speaking wires being looped relay P is accordingly short circuited and does not operate. Relay K operates and connects the selector with the common control circuit and earths the incoming test wire at contact *k1*. Contact *k3* prepares a circuit for relay WS which circuit is completed or not depending on the setting of wiper DS4. Contact *k4* prepares a locking circuit for relay K in series with relay H the latter relay not being operated until a free line has been reached owing to the resistance included in the circuit. Contact *k7* connects the test wipers to the control wipers to enable the switch to search in a marked group and contact *k8* closes a point in the circuit of the sprag magnet SM, but since relay PP, is not operated and relay C operates before relay BB this circuit is not closed until the end of the impulse train. Contacts *k2* and *k5* being closed relay A operates over its right hand winding and the negative wire and at its contact *a1* closes circuits for relays B and C which operate by means of their windings (I), the circuit of the latter being over normal contact and wiper DS1, self-interrupting contact *dsm* of the digit switch magnet, contact c1, digit switch magnet DSM, winding (II) of relay RA to battery. The magnet DSM does not operate in this circuit. Contact *b1* operates relays BB and JB, the latter disconnecting relay K from the speaking wires. Relay K locks up over its winding (II) and contact *b2*. Contact *b3* removes a short-circuit from the left hand winding of relay A and short circuits relay P preventing its operation when the earth on the negative wire is removed and brings the left hand winding of relay A into circuit. Contact *bb2* prepares the impulsing circuit for magnet DSM over the front of contact c1 and low resistance winding (II) of relay C, contact *bb3* closes a further point in the circuit of magnet SM which circuit is however open at contact c3, contact *bb4* connects relay T to the marking wiper DS2 and contact *bb5* opens the homing circuit of the digit switch. Contact *c4* opens to prevent possible operation of relay SL during the stepping of the digit switch and contact *c5* connects earth over back contact *pp3* to the 3rd and subsequent odd contacts commoned in the bank of wiper DS1. Contact *c6* closes a circuit for relay SG.

Impulses are received on relay A and are repeated at contact *a1* to magnet DSM in a circuit including contacts *bb2*, *c1*, winding (II) of relay C, and winding (II) of relay RA. The magnet and relay RA operate in this circuit, contact *ra1* opening a further point in the test in circuit and contact *ra2* connecting lamp AL in series with a slow alarm relay SMA.

Magnet DSM energizes on the impulse break and on the subsequent make it releases and steps the wipers of the digit switch to the second contacts. Winding (I) of relay C is now de-energized but the relay remains operated by virtue of its copper slug and by energization of its winding (II) at each impulse break. On receipt of the second impulse magnet DSM energizes again and at the end of the impulse steps the wipers to the 3rd contacts. The magnet then immediately re-energizes in a circuit from earth over contacts *pp3*, *c5* and the commoned odd contacts in the control bank and wiper DS1 and the switch self steps to the 4th contacts where it awaits the receipt of the next impulse which steps it to the 5th contacts whence it self steps to the 6th contacts. A similar action takes place for each impulse received, the digit switch wipers resting on an even contact after the end of each impulse. At the end of the impulse train relay A remains steadily operated and relay C releases. A particular group of contacts in one of the control banks of the selector has been marked over wiper DS2 and one of the wires connected to an even contact in the bank of this wiper. Contact *c3* connects earth over contacts *ti*, *bb3*, *pp2*, *k3*, and *h1* to the magnet SM which withdraws the sprag from the selector gear wheel and closes contact *sm*. The selector magnets DM1 and DM2 are alternately energized and the switch commences to rotate. As soon as it leaves its normal position contact *on* closes, and the switch continues to rotate until a free contact in the marked group is reached. A free outlet is denoted by battery potential on the test bank contact and when a battery connected contact is met by the selector relay T operates from earth over the rectifier R, winding of relay T, contacts *pp4*, *bb4*, wiper DS2, the marking wire connected to the contact on which the wiper rests, the bank contacts in one of the control banks connected to the marking wires, the control wiper, contacts *ws5*, *k7*, *ws4*, test wiper and bank contact to battery. Contact *ti* changes over releasing the magnet SM which stops the switch and relay TT is operated over contact *pp5* in parallel with relay T. Relay TT locks up over contact *tt1* and at contact *tt2* short circuits the resistance in the circuit of windings (II) of relay K and (I) of relay H thereby permitting relay H to operate, and at contact *tt4* opens a further point in the circuit of magnet SM. Relay H operating disconnects magnet SM at contact *h1* and prepares a circuit for connecting earth to wire *d*. Contacts *h2* and *h3* disconnect relay A from the speaking wires and switch these wires through to the switch wipers, contact *h4* disconnects the test in circuit and switches the incoming test wire through to the test wiper over contact *h5*, earth on the test wire applied at a preceding circuit from which the holding of the connection is controlled energizing relay H in its second winding and short-circuiting relays T and TT. The conversational route is now extended to the next switch and release of the common control circuit takes place.

When relay A releases due to its disconnection from the speaking wires the circuit of relay B is

opened and after a short interval relays K and BB release. Circuits are now closed alternately over contacts *a1* and *bb2* and the even contacts in the bank of wiper DS2, and over contacts *a1*, *bb5* and *c5* and the odd contacts in the same bank for magnet DSM which homes the switch, interrupting its own circuit at contact *dsm*. Relay BA operates in this circuit and maintains the test-in circuit open until the switch has come to rest on its normal contacts, over which there will be no circuit for magnet DSM.

At the end of the conversation when the calling subscriber clears, earth is disconnected from the test wire and relay H releases, disconnecting the wipers and closing a circuit for magnet SM over contacts *h1*, *k8* and *on* and the selector rotates until it reaches its normal position whereupon contact *on* opens the circuit of magnet SM which releases and stops the switch. During the homing of the selector relay RA operates by means of its winding (I) and opening its contact *ra1* prevents seizure of the selector while homing.

If the selector fails to find a free outlet in the marked group it continues to rotate until the last contacts available to it are reached; these are the last contacts in the dotted semi-circles and the last contacts in the banks associated with wiper arms 10 and 12 are connected to relay LC providing a circuit for the operation of relay T when they are reached by the selector test wipers. Relay T operates, releases magnet SM and operates relay TT as before. Relay LC also operates and at contact *lc1* disconnects direct earth from the positive wire and connects earth over the secondary winding of a busy tone transformer and contact *sl1*. This circuit may include an interrupter for the alternate application of busy tone and lamp flash battery in the well known manner. Since relay C is unoperated a momentary flick of relay A is without effect on the digit switch. Contact *lc2* connects earth over contact *sl2* to a second winding of relay B to hold this relay during the lamp flash period, battery being connected to this winding at the same time as it is connected to the positive wire.

Contacts in the banks of wipers DS7 and DS8 corresponding to live groups of outlets are connected to terminal OM which is connected to an overflow meter and this meter is operated from earth over contacts *bb1*, *lc3*, *tt3*, *k6*, *ws3*, wiper arm 6 or 8 and last bank contact, wiper DS6 and the cross connection from its bank contact to terminal OM. Contact *lc4* opening also prevents operation of relay H.

If the group marked by the digit switch is a "dead" group the corresponding contact in the bank of wiper DS6 would be cross connected to winding (II) of relay SL instead of the terminal OM and the closure of contact *lc3* in its front position would operate this relay. Contact *sl1* changes over and connects a distinctive tone (N.U.T.) over contact *lc1* to the positive wire instead of the busy tone and flash signal.

If the wanted group is connected in one of the banks associated with wipers 3, 4; 7, 8; 11, 12; 15, 16, a cross connection is made from the relevant bank contact of wiper DS4 to a wire connected over contact *k3* to relay WS and this relay is operated from earth over contact *b4*. The speaking, test and control wires are switched over from the normal set of wipers and banks to those referred to above and on the operation of relay H relay WS locks up over contacts *ws1* and *h6*.

If the group selected is split into two parts as

previously described the relevant contact on the digit switch is connected over a break contact of relay SG to the wiper switching relay WS. When the dialling relay releases contact *c6* opens the circuit of relay SG which commences to release. Its release period is long enough to cover the rotation by the selector over the first 10 contacts and when the relay releases contact *eg1* closes a circuit over wiper DS4 for relay WS which switches over the wiper connections so that by the time the wipers have reached their 40th contacts test wiper arm 11 is connected over contacts *ws4*, *k7*, *ws5* and wiper 15 so that the switch is enabled to test in to a free outlet in the last 10 contacts accessible to wiper arms 3, 7 and 11.

If a group of outlets is selectable in response to either of 2 digits the numerical significance of the digit received by the digit switch determines whether a signal is to be sent forward or not for the non-operation or operation of the P relay in the succeeding circuit for the choice of route to be taken. If such a signal is to be sent, that is if relay P in the next switch is to be prevented from operating, earth must be connected to the negative wire at the time of switching through. All contacts in the bank of wiper DS3 corresponding to groups for which the signal is to be transmitted are connected to winding (I) of relay SL which is connected to earth over contacts *lc3* and *bb1* after the control circuit is taken into use. At the end of the impulse train relay C releases and relay SL operates over contact *c4* and wiper DS3 and when relay TT operates earth over contacts *sl2*, *tt3* and *k6* is connected to the negative wire and short circuits the P relay of the next switch. It should be noted that the transmission of this signal must take place before relay B in the succeeding circuit operates.

If the required group is connected to contacts in the dotted semi-circles as denoted by the value of a preceding digit a considerable amount of time will be occupied by the selector in searching the group and the rotation of the selector and the search for a free line must be completed within the time known as the intertrain pause. If the switch does not commence to move until the impulse train has been terminated it may not be possible to find a free outlet in the time available. For the searching of such a group therefore the switch is automatically rotated over the first set of contacts, i. e. those in the full line semi-circles associated with the odd numbered wiper arms prior to or during the reception of the impulse train until its even numbered wiper arms reach the first contact position of their associated banks. When the dialling relay releases the selector has then to rotate over a lesser number of contacts in its search. This preliminary movement takes place if no signal is received when the selector is picked up, that is if relay P is not short-circuited and consequently relay P is operated. Relay P operates in series with relay K over a loop closed at a preceding circuit and at contact *p1* prepares a circuit for winding (I) of relay PP. When relay B operates contact *b4* closes this circuit and contact *b3* short circuits relay P and connects the left-hand winding of relay A in circuit. Relay PP locks up over contact *pp1* and at contact *pp2* closes a circuit from earth over contacts *tl1*, *tt4*, *k8* and *h1* for magnet SM. The magnet operates and the selector rotates until its even numbered wiper arms reach the first contacts in the dotted semi-circles. In this position a circuit is closed for relay T

from earth over the rectifier R, winding of relay T, contact *pp4*, the first contact in the set associated with wiper arm 14, the wiper, contacts *ws5*, *k7* and *ws4*, wiper arm 10 and the first contact in its associated set, resistance to battery. Relay T operates and stops further rotation of the selector but relay TT does not operate as contact *pp5* is open. Windings (I) and (II) of relay PP act in opposition to each other and the relay consequently releases when the dialling relay releases and closes contact *c2*, and T is then released. Contact *pp2* opens a point in the circuit of magnet SM. The selector wipers are now in such a position that they have not more than 50 contacts to traverse in their search for a free outlet and the speed of drive of the switch is such as to permit this during the intertrain pause.

Returning now to the digit switch, when the common control circuit is taken into use and relay PP is operated contact *pp3* changes over, disconnecting earth from the commoned odd contacts in the bank of wiper DS1 and connecting earth to the commoned even contacts. On the occurrence of the first impulse make after a break the digit switch is stepped to its second contacts whereupon a self stepping circuit is closed from earth over contact *pp3*, second bank contact and wiper DS1, contacts *dsm*, winding (II) of relay C, magnet DSM, winding (II) of relay RA to battery and the switch steps to its 3rd contacts. On the occurrence of the next impulse the switch is stepped to its 4th contacts and then self steps to its 5th contacts and at each subsequent impulse it is stepped in a similar manner so that after the end of the impulse train its wipers will be resting on odd contacts. The marking wires from the bank of wiper DSM are 20 in number corresponding to 20 groups of outlets, wires from the odd contacts being connected to groups of contacts in the arcs associated with wiper arms 14 and 16 of the selector and wires from the even contacts being connected to groups of contacts in the arcs associated with wiper arms 13 and 15 of the selector.

Relay SG is operated by closure of contact *pp6* which holds relay SG independently of relay C until the even numbered wiper arms have reached the first contact positions of their associated banks.

It will be clear from the foregoing that the operation of relay WS, the transmission of the signal to prevent operation of the P relay in the succeeding selector, the operation of the overflow meter and the giving of busy or N.U. tone as the case may be should no free outlet be found will proceed in exactly the same manner as described for the case in which relay P is not operated. The switching through of the selector, the release of the common control circuit and eventually of the selector also takes place in an identical manner.

The rectifier R in the circuit of relay T is provided to meet the case in which the selector precedes the circuit controlling holding and supervision to prevent operation of relay T should the selector pass a contact at the time when a booster battery metering impulse is being transmitted over it. In a selector in this position in the chain of switches the incoming *d* wire need not be provided.

It will be apparent to those skilled in the art that two different paths of access to the selecting switch may be available relay P being included in one of the paths only so that the preliminary rotation to bring the even numbered wiper arms

to the commencement of their associated contact sets may be dependent on the path over which the selecting switch is taken into use.

What I claim as new and desire to secure by Letters Patent is:

1. In a telephone system, a selector switch, a marking device responsive to a series of impulses to mark a group of contacts in the bank of said selector switch, means for advancing said selector switch to the marked group, and means responsive to a non-decimal control for preliminarily advancing said selector a portion of the way to the marked group so that the final movement responsive to the marking will be shortened.

2. In a telephone system, a selector switch having a normal position from which all groups of contacts in its bank may be reached and a sub-normal position from which a portion of said groups may be reached, means for advancing the switch to its sub-normal position if one of the latter groups is desired, and means responsive to a series of impulses for further advancing the switch to the desired group.

3. In an automatic telephone system, a selector switch having access to groups of contacts, there being two main groups and a plurality of decimally designated sub-groups in each main group, and said selector having a normal position from which the sub-groups in the first main group are accessible, means responsive to a series of decimal impulses for advancing the switch to a desired sub-group, and means for preliminarily advancing the switch past the first main group if the sub-group desired is in the second main group.

4. In an automatic telephone system, a selector switch of the rotary type which selects a group by advancing its wipers over all contacts in the preceding groups, means for preliminarily ad-

vancing the switch past a certain number of groups if a group beyond is wanted, and means for then advancing the switch to the wanted group responsive to a series of impulses.

5. An automatic telephone system as set forth in claim 4, which includes means for transmitting a special signal to the selector switch in order to initiate the preliminary advance thereof.

6. In an automatic telephone system, a selector switch of the single motion rotary type having access to groups of contacts, the total number of contacts being so great that the time required by the switch in advancing from normal position to the last group exceeds the normal time interval between the receipt of successive digits in a number, means responsive to a digit for marking a group of contacts in the bank of said switch, means for advancing the switch to the marked group, means for receiving a supplementary control which is transmitted prior to such digit if the last group is wanted, and means responsive to such control for moving the switch to a sub-normal position from which the wanted group can be reached by a curtailed movement.

7. In an automatic telephone system, a selector switch of the rotary type which selects a group by advancing its wipers over all contacts in the preceding groups, talking conductors leading to said switch, means for preliminarily advancing the switch past a certain number of groups if a group beyond is wanted, and means for then advancing the switch to the wanted group responsive to a series of impulses, and means for transmitting a special signal to the selector switch over one of said talking conductors to initiate the said preliminary advance thereof.

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