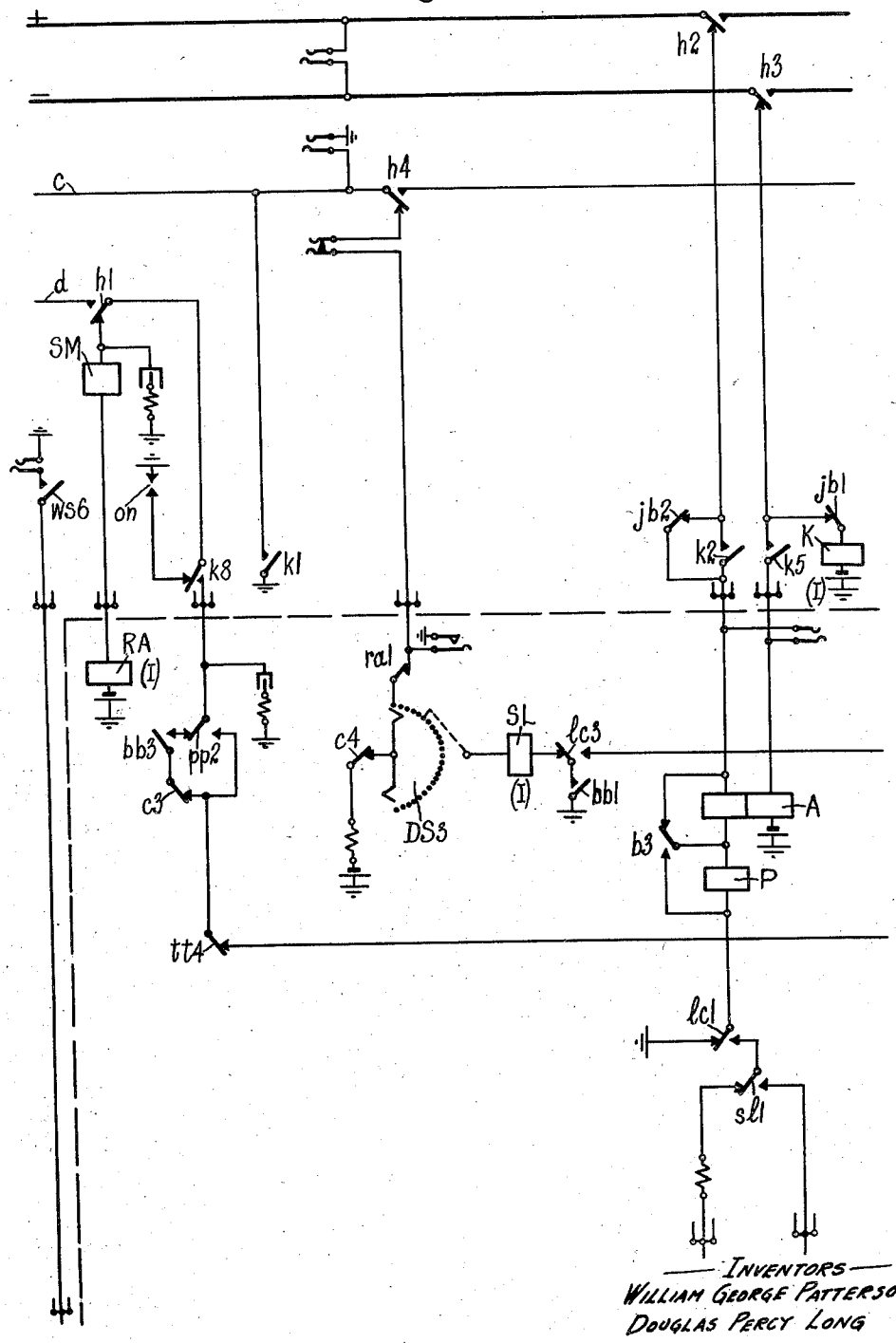
Sept. 3, 1935. W. G. PATTERSON ET AL 2,013,169

SELECTING SWITCH FOR USE IN TELEPHONE SYSTEMS

Filed Oct. 15, 1932 3 Sheets-Sheet 1

Fig. 1.



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Filed Oct. 15, 1932 3 Sheets-Sheet 2

Fig. 2.

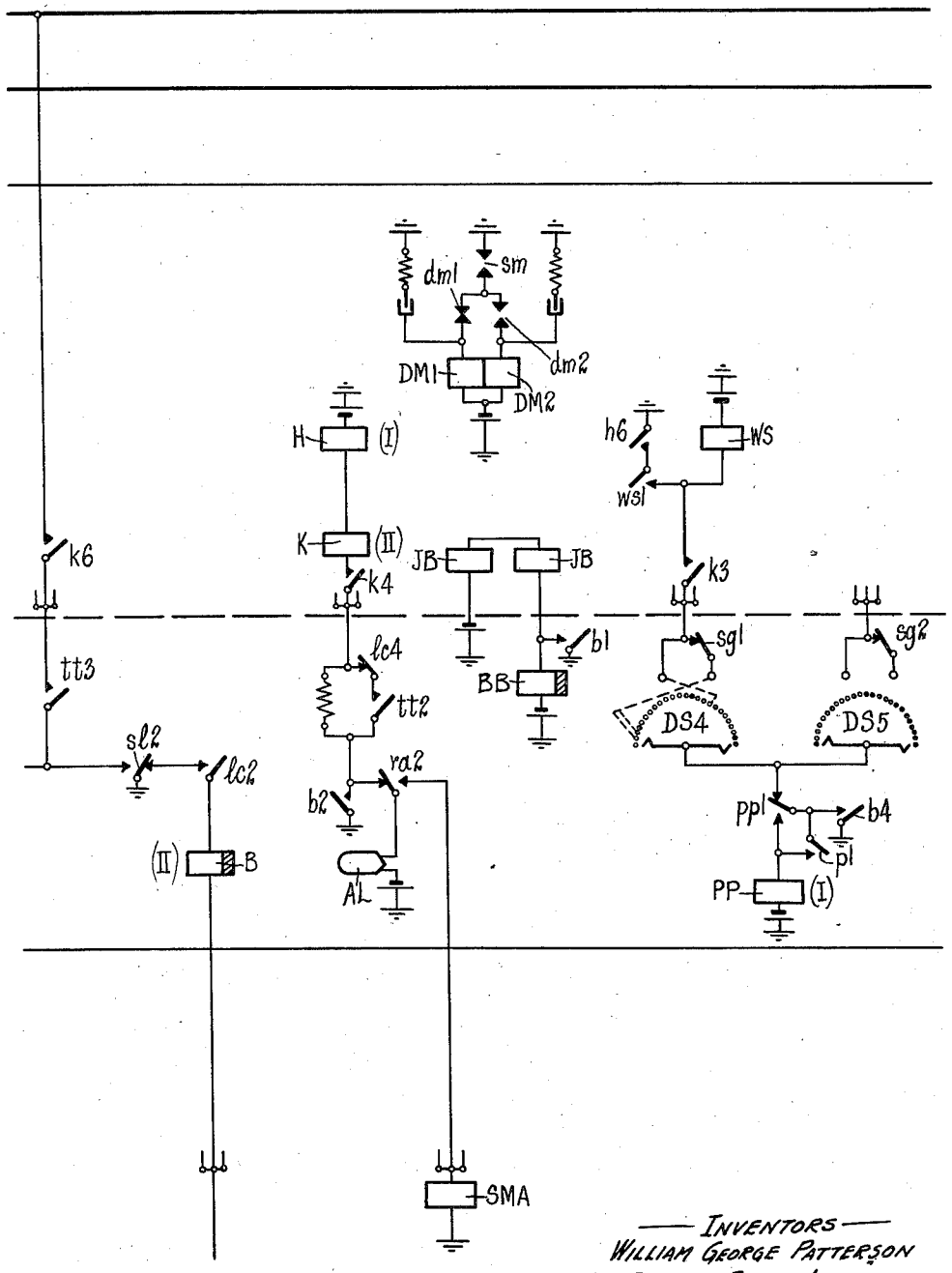

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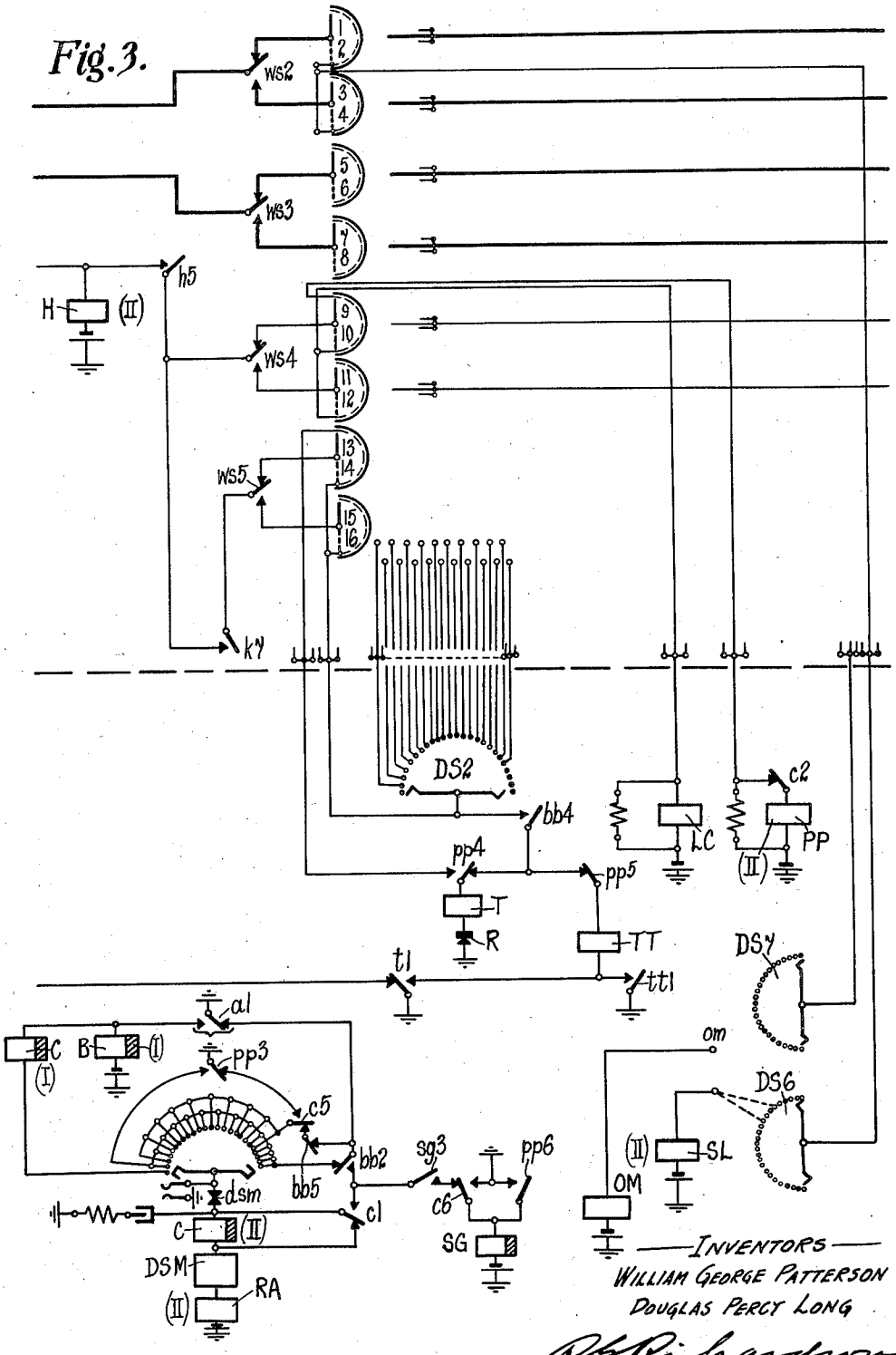
Fig. 3.



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UNITED STATES PATENT OFFICE

2,013,169

SELECTING SWITCH FOR USE IN TELEPHONE SYSTEMS

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Application October 15, 1932, Serial No. 637,888
In Great Britain October 20, 1931

7 Claims. (Cl. 179—18)

The present invention relates to automatic telephone systems and is more particularly concerned with "last" or "overflow" contact arrangements in a selecting switch.

According to this invention instead of a "last" or "overflow" contact position being provided for each group of outlets a single contact position is provided common to all the groups of outlets in the switch on which the switch is stopped after an unsuccessful search in a group of outlets and arrangements are provided whereby action distinctive of the group which has been searched unsuccessfully is effected. This action may be the operation of an overflow meter appropriate to a particular group or the giving of a distinctive tone or both or any other desirable operation.

The selecting switch in this invention is provided with a marking device for marking the group to be searched. This device may be individual to the selecting switch or may be in a circuit common to a number of selecting switches and connectable to one of them at a time. The device is connected as required to apparatus for performing the operations distinctive of the marked group.

The marking device may take the form of a single motion digit switch, one bank of which is connected to the apparatus to be controlled in accordance with the outlet group searched if this search is unsuccessful, and the wiper associated with this bank is connected to the last contact position in a bank of the selecting switch. This connection is preferably made to one of the speaking wire banks, a suitable potential being applied to the appropriate bank wiper for the operation of the apparatus to be controlled. If the switch is testing for a "free" potential the connection of this potential to the test bank contact in the overflow position may include a relay which operates in series with the test relay and applies the potential to the speaking wire wiper for operating the apparatus connected to the digit switch bank. The relay connected to the test bank contact in the overflow position may effect the connection to the calling line of busy tone, the connection of any other tone being brought about by a relay connected to the digit switch bank, a change over contact of this relay being connected in series with the contacts of the relay connecting the busy tone.

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

Figures 1, 2 and 3 when placed side by side represent a circuit diagram of the essential parts of the system.

The drawings show a group selector 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 drawings 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 a wiper 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 odd 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. In coming to the selector are four wires, the positive and negative speaking wires, test wire and wire *d* which may extend 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 feeding bridge may however be connected at a subsequent point in the switch train and its operation is fully described in co-pending application Serial No. 617,018, filed June 13, 1932. 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 which 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 limitation 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 contracts 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 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 which it moves from its normal position and also controls the transmission of the differentiating signal referred to. Wipers DS4 and DS5 are concerned with the operation of relay WS in the selector, this relay being directly connected over contact *k3* to the digit switch bank contacts corresponding to groups all the outlets of which are connected in one only of the selector banks and over contact *sg1* to contacts corresponding to the split groups, i. e. groups in which some of the outlets are connected in the early part of the upper banks and the remainder of the outlets are connected in the later part of the lower banks of the selector. Wipers DS6 and DS7 are connected to the last (52nd) contacts in the positive wire banks and control the operation of overflow meters and the connection of a special tone (N. U. T.) if the group searched is unconnected. Since a group of outlets may be common to two digits two overflow meters per group of outlets are provided, a meter corresponding to one of the routes reached over a common outlet group being shown

at OM. The meters are connected to contacts corresponding to connected or "live" groups in the banks of wipers DS6 and DS7 and relay SL (winding (II)) is connected to contacts in the same banks corresponding to unconnected or "dead" groups, there being a contact in these banks corresponding to each path or outgoing route selectable by the selector, that is to say, two for each digit, one corresponding to the digit selecting in one contact set and one corresponding to the same digit selecting in the other contact set of the selector. 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 multipled 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.

Relay LC is connected to the last contacts of each set of contacts in the selector test banks for the transmission to the calling subscriber of a busy signal and for providing a circuit for the test relay for stopping the selector. Relay SL operates on the last contacts of unconnected or "dead" groups for the substitution of a special "number unobtainable" tone in place of the busy tone.

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*, the negative wire, a preceding loop, the positive wire which may be earthed directly at the preceding switch or if not over contacts *h2*, *jb2*, *b3*, relay P and contact *lc1*. For the time being it will be assumed that the positive wire is earthed in a preceding circuit and 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. Contact *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 positive wire is removed. 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 *t1*, *tt4*, *bb3*, *pp2*, *k8*, 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 wire, the control wiper, contacts *ws5*, *k7*, *ws4*, test wiper and bank contact to battery.

Contact *t1* 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 *tt3* 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 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 DS1, and over contacts *a1*, *bb3*, 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 RA operates in this circuit and maintains the test-in circuit open until the switch has to 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 arcs denoted by 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 DS3 and DS7 corresponding to "live" groups of outlets are connected to terminals such as *om* which are connected to overflow meters one of which is shown at OM and the appropriate meter is operated from earth over contacts *bb1*, *lc3*, *tt3*, *k6*, *ws2*, wiper arm 2 or 4 and last bank contact, wiper DS3 and the cross connection to terminal *om*, overflow meter OM to battery. 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 to a terminal such as *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.

Release of the switch from this position and also of the control circuit takes place when the calling subscriber clears on hearing the tone. The control circuit is restored in the manner previously described releasing relay K. Relay H not being operated the selecting switch is now restored by the operation of magnet SM over contacts *h1*, *k8* and *on*.

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. If a free outlet is found among the first 10 outlets of the divided group switching through takes place and consequent upon the operation of relay H relay A releases. Relay SG is sufficiently slow to release and the speed of the switch is high enough to prevent relay SG releasing until search over the first 10 outlets has been completed and relay A has released if the 10th outlet has been found free. If one of the first ten outlets is found free, relay SG is held over contacts *c6*, *sg3*, *bb2*, and *a1*, until relays B and BB and K have released and operation of relay WS is thereby prevented. If however no free outlet among the first 10 is found the switch continues to rotate and relay A remaining operated relay SG releases before the fortieth contacts are reached and by closure of contact *sg1* operates relay WS which changes over the connections from one wiper set to the other so that search over the last 10 con-

tacts is made over wipers 11, 12 and 15, 16 in place of wipers 9, 10 and 13, 14.

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 positive 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 positive wire and short circuits the P relay of the next switch. It should be noted that the transmission of this signal must not take place until relay B in the succeeding circuit operates.

If the required group is connected to contacts in the dotted semicircles as denoted by the value of a preceding digit a considerable amount of time will be occupied by the selector in reaching the group and the rotation of the selector and the search for a free outlet 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 semicircles 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 *t1*, *tt5*, *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 semicircles. 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 add contacts. The marking wires from the bank of wiper DS2 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 take 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 we claim as new and desire to secure by Letters Patent is:

1. In an automatic telephone system, a selecting switch, groups of trunk lines accessible thereto, means for operating said switch to hunt for an idle trunk in any one of said groups in response to different received digits, a single overflow position having overflow terminals common to all groups, means effective when all trunks in any group being tested are busy for stopping the switch in said overflow position, and

means controlled through said common overflow terminals for giving an all trunk busy indication distinctive of the group tested.

2. In an automatic telephone system, a selecting switch, groups of trunk lines accessible thereto and corresponding respectively to digits, means for operating said switch in accordance with any one of a plurality of digits to search for an idle trunk in the corresponding group, a single overflow position having terminals common to the groups, means for stopping said switch in said position if all trunks in any group being tested are busy and means controlled through said common terminals for performing a distinctive operation dependent upon the digit by which the switch was operated.

3. An automatic switch having a plurality of groups of trunk lines accessible thereto, means for operating the switch to test for an idle trunk in any group, a single overflow terminal common to the groups, a plurality of overflow meters, one for each group, operable from said one terminal, means for stopping the switch on said terminal when all trunks in any tested group are busy and for only operating the meter of that group through said terminal.

4. In an automatic telephone system, an automatic switch having access to a plurality of groups of trunk lines, a common overflow position for the groups, means for operating the switch to test for an idle trunk in any group, means for stopping the switch in said position if all trunks are busy in a group tested, and means in the switch for transmitting a distinctive tone to the calling subscriber dependent on the group tested.

5. In an automatic telephone system, an automatic switch having access to a plurality of groups of trunk lines, an auxiliary switch, means for operating said auxiliary switch to mark a particular group of trunk lines and then operate the switch to test for an idle line in that group, an overflow position, means for stopping the switch in said position when all trunks in a group are busy, and means for performing a distinctive operation when the switch is stopped in such position determined by the position of said auxiliary switch.

6. In an automatic telephone system, an automatic switch having access to a plurality of groups of trunk lines, a digit switch, means for operating the digit switch by impulses to mark a group of trunks, means for then operating the switch to test for an idle trunk in the marked group, an overflow position for said groups, a wiper of the digit switch connected to said position, tone signalling means and overflow meters connected to the bank accessible to said wiper, and means for operating said signalling means and meters when all trunks in a group are busy in a manner dependent on the group tested.

7. In an automatic telephone system, a plurality of automatic switches, a common controlling equipment for said switches, groups of trunk lines accessible to the switches, a marking switch in the common equipment, means for seizing the switch and associating the common equipment therewith, means for operating the marking switch to mark a group of trunk lines, an overflow position common to the groups of trunks for said automatic switch, means for operating the automatic switch to test for an idle trunk in the marked group and stopping it in said position when the trunks in the group are all busy, and means controlled by the marking switch for performing an operation when the switch stops in said position distinctive of the group marked.

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