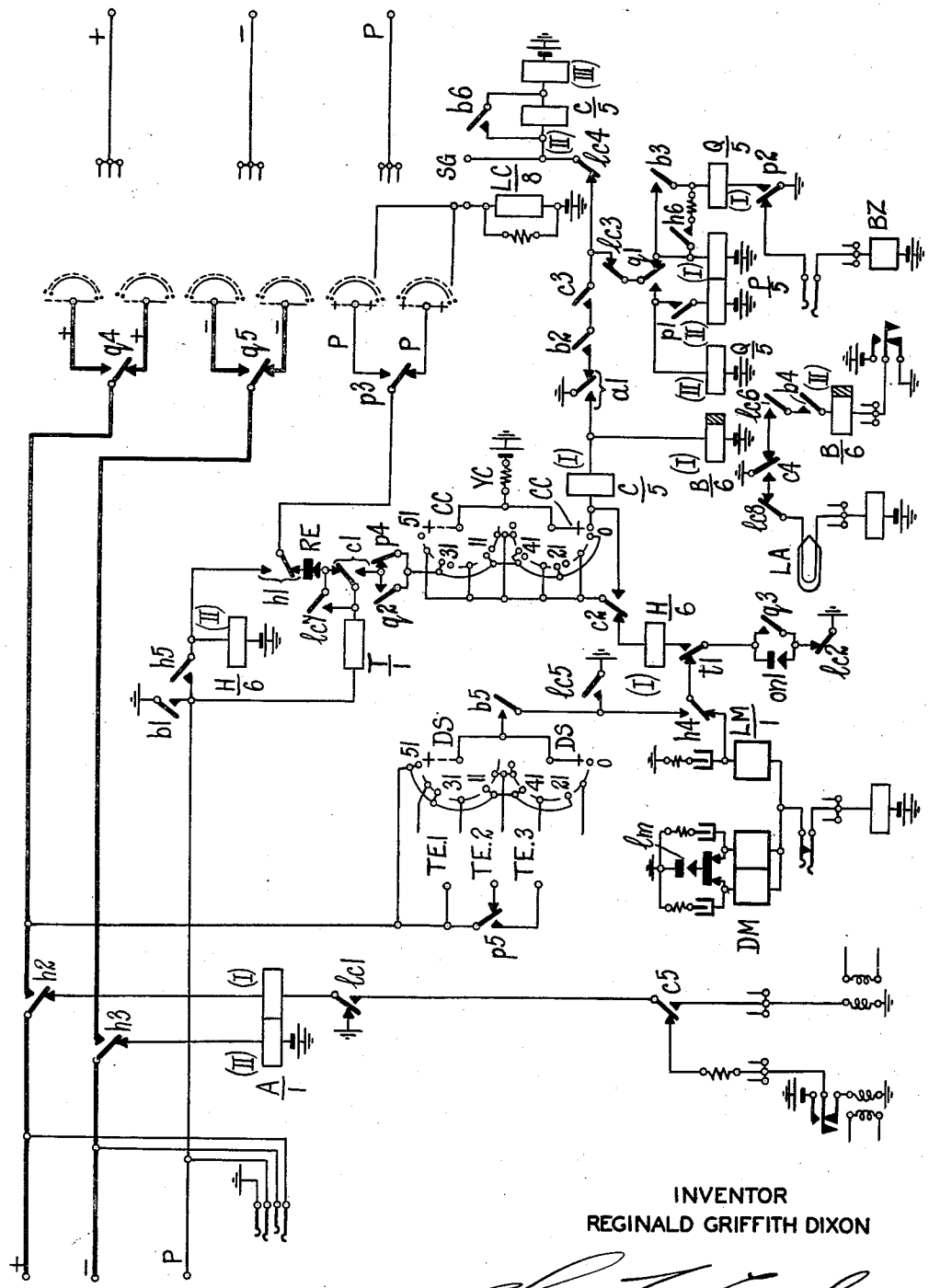
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AUTOMATIC SWITCH FOR USE IN TELEPHONE OR LIKE SYSTEMS

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AUTOMATIC SWITCH FOR USE IN TELEPHONE OR LIKE SYSTEMS

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This invention relates to automatic telephone and like selective systems, and is more particularly concerned with systems in which the selecting switches of a selecting stage are single-motion switches of the kind wherein the setting of wipers to the commencement of a required group of outlets is effected without using an associated digit receiving switch and in which the links or junctions in a group outgoing from the selecting stage carry traffic represented by more than one digit of a digit place with which the stage is concerned, discriminating signals being transmitted forward over the links or junctions to bring about the necessary divergence of routing at a succeeding selecting stage.

The invention has in view improved arrangements for the combining and resolving of traffic in such systems.

According to the invention, in a selecting switch of the kind mentioned the control of the giving of a discriminating signal over a link or junction taken into use is vested in a wiper or wipers of the switch, the said wiper or wipers moving over bank contacts at the same time as speaking wire wipers move over bank contacts and the link or junction having one appearance in the banks of the switch for each digit which when received at the switch may bring about the seizure of the link or junction in question. The path of approach to the link or junction via the selecting switch thus effects the necessary discrimination as regards the giving of the signal. The several appearances would normally be directly multipled. The position of the said wiper or wipers may determine whether or not a special signalling condition is to be applied to the link or junction or may determine which one of a plurality of signals is to be transmitted.

An advantage of the arrangements is that it provides for the combination at a selecting switch of traffic represented by any two or more digits of the digit place concerned, and for the subsequent resolution of the combined traffic, without requiring the association with the switch of an auxiliary device for recording the number of impulses received.

In the case where a through connection over the selecting switch can be set up over any one of a plurality of wiper sets, a particular set being chosen dependent on the value of the received digit or on some other received intimation, there may be a corresponding number of wipers or wiper sets concerned in the control of the giving of a discriminating signal. Alternatively, a contact or contacts of a wiper choosing relay or relays may provide for changing the connections made to the bank of a wiper concerned in such control. Wiper choosing may be effected by contacts of a relay combination which assists in setting the switch in response to received impulses.

By way of example, a specific embodiment of the invention will now be described with reference to the accompanying drawing. The embodiment takes the form of an incoming selector in an automatic telephone system, and the drawing shows the circuit of a selector generally similar to that disclosed in British Patent No. 385,384 accepted Dec. 29, 1932. The selector may serve to give access to groups of links to local selectors or other local equipment, or to groups of junctions, or to groups of both kinds.

The selecting switch is a motor-driven rotary switch. All its eight wipers are double-ended wipers of the type in which the two ends cooperate with different arcs of bank contacts. In the drawing, the two ends of each of the speaking and private wire wipers and the two corresponding arcs of contacts are indicated diagrammatically by full and dotted lines. In order to simplify the drawing, the two ends of each of wipers CC and DS and the two corresponding arcs of contacts are shown divorced from each other, although actually wipers CC and DS and the corresponding bank contacts are identical with the private wire wipers and the bank contacts associated therewith. The selector wipers rotate in a counter-clockwise direction. The end of a double-ended wiper represented by a full line traverses the associated arc of bank contacts before the end represented by a dotted line traverses the arc of bank contacts associated therewith, the arrangement being equivalent to a single-ended wiper co-operating with a large bank The speaking and private wire wipers and the associated contact banks fall into two sets, each set comprising a positive wiper, a negative wiper, and a private or "P" wiper. Wiper CC is a controlling wiper which takes part in setting the switch in response to a received train of impulses and wiper DS serves to control the giving of a discriminating signal.

The driving motor of the selector is indicated diagrammatically at DM and is of the type in which two fixed magnets operating on a magnetic rotary armature are adapted to be alternately energized by cam contacts controlled by the movement of the armature. The movement of the selector is under the control of a latch magnet LM. When the latch magnet LM is energized, a latch is withdrawn from a toothed wheel

forming part of the driving mechanism of the switch and the circuit of the motor is closed at contact *lm*, and the wipers are rotated at a high speed. When magnet LM is deenergized the motor circuit is opened and the latching member engages the toothed wheel referred to, bringing the switch substantially instantaneously to rest. The circuit for supplying current to the driving motor and latch magnet includes a winding of an alarm relay. Contact *on1* is an off-normal contact of the selector which is operated when the switch leaves its normal position and remains operated as long as the switch is away from this position.

As regards the relays in the selector circuit, A is the impulse-receiving relay, B is the release relay, and C is the dialing relay. For any one connection, only one train of impulses is received on relay A. Relay H is the switching relay, relay LC is concerned with stopping the switch at a "last contact" position when it fails to find a free outlet in a selected group, and relay T is a high-speed test relay for stopping the selector when required, e. g. on a free outlet in a wanted group. Relays P and Q together form a relay combination which co-operates with the controlling wiper CC and its bank during the setting of the switch, the relays being adapted to be operated and released under the control of the impulse-receiving relay A in such a manner that they are both operated at the end of an odd impulse and are both released at the end of an even impulse. The relays P and Q co-operate with the controlling wiper and bank in the manner described in the British specification previously referred to so that the switch is advanced over groups of switch positions whilst impulses are being received, each group of switch positions corresponding to a pair of adjacent digits. At the end of a received impulse train, the switch is advanced over the group of switch positions corresponding to the pair of adjacent digits which includes the digit received, search for a free outlet taking place in the relevant one of the two groups of outlets reached over the two sets of speaking and private wire wipers. The set of wipers used depends on whether relays P and Q are operated or released, i. e. depends on the digit actually received. A maintenance man can determine which set is in use by closing a circuit between the test jack contacts shown connected to back contact *p2*, BZ being a buzzer.

Each arc of bank contacts comprises fifty-two contacts, so that the switch can occupy any one of one hundred and four switch positions. One contact in each of the arcs associated with wiper ends represented by full lines is a normal contact on which the relevant wiper normally rests, and the last contact in each of the same arcs is left spare. The twenty-first, forty-first, sixty-third, eighty-third, and one-hundred-and-third positions from normal of the switch are "last contact" positions and the first, twenty-second, forty-second, sixty-fourth, and eighty-fourth positions from normal are stopping positions not used to give access to outlets, it being arranged that each wiper set in making a complete rotation from normal passes in succession over a group of nineteen outlets, a group of eighteen outlets, a group of nineteen outlets (made up of two sub-groups of eight and eleven outlets), and two groups of eighteen outlets each. As regards the bank contacts with which the wipers make contact in the several "last contact" positions, those in the banks of the "P" wipers are connected to relay LC, those in the banks of the positive wipers are connected to overflow meters or to terminal SG depending in the case of each contact on whether the group of outlets concerned is "live" or "spare", those in the bank of the controlling wiper CC are left unconnected, and those in the bank of wiper DS are connected directly to the selector positive wire. The contacts with which wiper CC makes contact in the first, twenty-second, forty-second, sixty-fourth, and eighty-fourth positions from normal (i. e. in the stopping positions) are connected to contacts *p4* and *q2*. Contacts in the bank of wiper CC which have not yet been specifically mentioned are connected to contact *c2*. Contacts in the bank of wiper DS corresponding to positions of the selecting switch other than normal, "last contact", or spare positions are connected as required to terminals TE 1–3.

The selector circuit is arranged so that any two groups of outlets (from the speaking and private wire banks) corresponding to two different received digits may be multipled together and connected to a common group of outgoing links or junctions, a discriminating signal being transmitted forward over a seized link or junction to bring about the necessary divergence of routing at a succeeding selecting stage. If one of two groups of outlets it is desired to multiple in this manner contains nineteen outlets while the other only contains eighteen, one outlet in the larger group is left unconnected. Since any two groups of outlets may be multipled together, a link or junction may have two appearances in the same set of banks or an appearance in each of the two sets of banks. The discriminating signal transmitted forward over a link or junction takes the form of applying earth for a period to the outgoing positive wire when the link is approached over one outlet but not when it is approached over the other associated outlet. Actually, earth is applied as stated when an outlet is seized if the bank contact on which wiper DS is resting is connected to the positive wire. Owing to the fact that there is only one wiper DS corresponding to two sets of speaking and private wire wipers, it is arranged that a set of cross-connections between contacts in the bank of wiper DS and the positive wire may pass over front contact *p5* while another set may pass over back contact *p5*. Where a contact in the bank of wiper DS is cross-connected to terminal TE1, then the earth condition is applied to the positive wire if either of the corresponding outlets is seized. Where such a contact is left disconnected, then the earth condition is not applied when either of the corresponding outlets is seized. Where such a contact is cross-connected to terminal TE2, then the earth condition is applied when the corresponding outlet which is reached with relays P and Q unoperated is seized but not when the other corresponding outlet is seized. Similarly, where such a contact is cross-connected to terminal TE3, the earth condition is applied when the corresponding outlet which is reached with relays P and Q operated is seized but not when the other corresponding outlet is seized.

When the incoming selector is taken into use over the associated junction, relay A is operated over a calling loop on its two windings in series. Contact *a1* operates relays B and C on their windings (I), the circuit for the latter relay

passing over winding (I) of the relay, normal bank contact and wiper CC, and resistance YC. Contact *b1* connects earth to the private wire and thus prepares a circuit for relay T, and contact *b6* short-circuits low-resistance winding (II) of relay C to make relay C slow in releasing. Contact *c4* closes a circuit for a "loop alarm" lamp LA in series with an alarm relay of a delayed alarm device. The circuit is now in a condition to receive the impulses of the impulse train in response to which the selector is to be set. It will be assumed for the time being for the sake of example that a train of three impulses is received.

When the train of impulses is received, the release of relay A on the commencement of the first impulse of the train closes a circuit over back contact *a1* for operating relay P on its winding (I), the circuit passing over contacts *b2*, *c3*, *lc3* and *q1*. At the end of the impulse, relay A is again operated, relay Q is operated on its winding (I) in the circuit earth, contact *p2*, winding (I) of relay Q, contact *b3*, winding (I) of relay P, battery. Relay P holds on its winding (I) for the time being. Contact *q3* closes a circuit over contacts *lc2*, *t1* and *h4*, for latch magnet LM, and the switch is advanced to the first position from normal, i. e. to the first stopping position. When wiper CC encounters the first bank contact from normal, high-speed test relay T operates in the circuit earth, contact *b1*, winding of the relay, contacts *c1* and *q2*, bank contact and wiper CC, resistance YC, battery. Contact *t1* opens the circuit of the latch magnet and the switch is brought to rest in the first position from normal. As usual, dialing relay C holds during the receipt of the impulse train, circuits for its windings (I) and (III) being completed during the train over front contacts *a1* and *c2* and bank contacts and wiper CC and over back contact *a1* and contacts *b2*, *c3*, *lc4*, and *b6*. The release relay B also holds during impulsing. The release of relay A on the commencement of the second impulse of the train closes a circuit over back contact *a1* for energizing windings (II) of relays P and Q. The two windings of relay P oppose each other and the relay releases, opening the circuit of windings (I) of relays P and Q at contact *p2*. Relay Q is held on its windings (II) for the time being. The circuit of winding (II) of relay P is opened at contact *p1*. At the end of the impulse, when relay A is again operated, the circuit of winding (II) of relay Q is opened at contact *a1* so that relay Q releases.

The release of relay A on the commencement of the third and last impulse of the train closes a circuit over back contact *a1* for operating relay P on its winding (I), and the consequent opening of contact *p4* releases relay T. Contact *t1* closes a circuit over contacts *lc2*, *on1* and *h4* for latch magnet LM, and the switch is advanced over the first group of switch positions. At the end of the impulse, when relay A is again operated, relay Q is operated on its winding (I) in series with winding (I) of relay P. Relay P holds on its winding (I). Contact *q2* closes before the switch reaches the stopping position preceding the second group of switch positions, i. e. before it reaches the twenty-second position from normal. Consequently, when wiper CC encounters the twenty-second bank contact from normal, high-speed test relay T operates in the circuit earth, contact *b1*, winding of the relay, contacts *c1* and and *q2*, bank contact and wiper CC, resistance YC, battery. Contact *t1* opens the circuit of the latch magnet and the switch is brought to rest at the stopping position preceding the second group of switch positions. Since all the impulses of the train have now been received, relay A remains steadily operated and the switch remains in the twenty-second position from normal until dialing relay C releases. The dialing relay releases owing to the fact that contact *a1* remains operated and the circuit over front contact *c2* remains open. When the dialing relay releases, the falling back of contact *c1* releases relay T and prepares the circuit for testing for a free outlet in the selected group of outlets, the group in the particular example taken being one reached over the upper speaking and private wire wipers. The falling back of contact *c4* extinguishes the "loop alarm" lamp LA. Contact *t1* again completes a circuit for latch magnet LM, and the switch is advanced in search of a free outlet in the selected group of outlets.

The selection of a group of outlets in response to a received train of impulses comprising a number of impulses other than three takes place in a similar manner.

In any case, when the selector wipers are rotated in search of a free outlet in a selected group of outlets, and the set of wipers connected in circuit by contacts *q4*, *q5*, and *p3* encounters a free outlet in the group, high-speed test relay T operates in the circuit earth, contact *b1*, winding of relay T, contact *c1*, rectifier RE, contacts *h1* and *p3*, the relevant "P" wire of the link or junction circuit connected to the outlet. Contact *t1* opens the circuit of latch magnet LM, thereby bringing the wipers to rest, and closes a circuit for operating switching relay H, the circuit being earth, contacts *lc2*, *on1*, and *t1*, winding (I) of the relay, contact *c2*, bank contact and wiper CC, resistance YC, battery. Contacts *h1* and *h5* close a circuit for the holding winding (II) of relay H and form a through "P" wire. The changing over of contact *h1* also releases relay T. Contacts *h2* and *h3* disconnect the windings of relay A from the incoming line wires and extend these wires to the seized outlet. Relay A releases followed after an interval by relay B. Contact *h6* closes a circuit for holding relays P and Q if these are operated, the circuit being earth, contact *p2*, winding (I) of relay Q, resistance, contact *h6*, winding (I) of relay P, battery. The changing over of contact *h4* operates to the end that when contact *t1* falls back the earth over contacts *lc2* and *on1* is applied to wiper DS for the time contact *b5* remains closed, so that the discriminating signal is given if the bank contact on which wiper DS is resting is connected (either directly or over contact *p5*) to the positive wire. After the earth applied to the "P" wire over contact *b1* is removed by the opening of the contact, relay H is held by earth applied to the "P" wire at a succeeding circuit.

Nothing further happens in the selector circuit until the calling party clears. When the calling party clears, the holding earth applied to the "P" wire at another circuit is removed, and relay H releases, a circuit for energizing the latch magnet until the wipers have been rotated to normal being closed over contacts *lc2*, *on1*, *t1*, and *h4*. Relays P and Q if operated are released by the opening of contact *h6*.

If when the selector wipers are rotated in search of a free outlet in a selected group all the outlets of the group are busy when tested, test relay T operates and brings the switch to rest when the "last contact" position at the end of

the group is reached, the operating circuit being earth, contact *b1*, winding of relay T, contact *c1*, rectifier RE, contacts *h1* and *p3*, relevant "P" wiper and bank contact, winding of relay LC and parallel resistance, battery. Relay LC operates in series with relay T. Contact *lc1* applies an interrupted busy tone and lamp condition to winding (I) of relay A in a circuit over back contact *c5*. Contact *lc5* closes a circuit over contact *b5*, wiper DS and bank contact, contact *q4*, and the relevant positive wiper and bank contact for bringing about the operation of an overflow meter. Contact *lc6* closes a circuit over back contact *c4* for holding relay B on its winding (II) during lamp flash periods.

If the selector wipers are caused to search over the outlets of a spare group, test relay T operates followed by relay LC when the "last contact" position at the end of the group is reached as in the case just considered. In the case of a spare group, however, the closure of contact *lc5* brings about the operation of relay C on its windings (II) and (III), since the bank contact in the bank of the positive wiper is connected to terminal SG instead of to an overflow meter. A "number unobtainable" tone is connected to winding (I) of relay A in a circuit over front contact *c5*.

I claim:—

1. In a selecting switch having groups of trunk lines terminating in its switchbanks, a discriminating wiper, cross-connecting means accessible to said wiper, means for directively operating said switch to select a group of trunk lines, for thereafter automatically operating said switch to select a trunk line in the selected group, and for correspondingly operating said wiper, and means for transmitting a discriminating signal from said switch to the selected trunk line dependent upon the connection of said wiper to said cross-connecting means.

2. In a selecting switch having groups of trunk lines terminating in its switchbanks, a discriminating wiper, cross-connecting means accessible to said wiper, means for directively operating said switch to select a group of trunk lines, for thereafter automatically operating said switch to select a trunk line in the selected group, and for correspondingly operating said wiper, and means for transmitting a discriminating signal from said switch to the selected trunk line dependent upon the digit dialed for the group selection, dependent upon the location of the selected trunk line in the switchbanks, and dependent upon the connection of said discriminating wiper to said cross-connecting means.

3. In a selecting switch having a plurality of wiper sets and groups of trunk lines terminating in its switchbanks, one of said trunk lines appearing in a plurality of said trunk groups, means for operating said wiper sets, means responsive to received impulses for operating said operating means to move said wiper sets over said trunk groups to select one of such groups in accordance with the impulses received, means for seizing said trunk line if idle by way of the selected trunk group, a wiper, discriminating means controlled by said wiper for transmitting a discriminating signal to said trunk line dependent upon the group the trunk line is seized in, and said responsive means controlling a wiper switching operation to select only one of said wiper sets in accordance with the impulses received.

4. In a selecting switch having a plurality of wiper sets and groups of trunk lines terminating in its switchbanks, a discriminating wiper, cross-connecting means accessible to said wiper, means for directively operating said wiper sets and wiper to select a group of trunk lines, for selecting one of said sets of wipers, and for thereafter automatically operating said wiper sets and wiper to select a trunk line in the selected group, and means for transmitting a discriminating signal from the switch to the selected trunk dependent upon the connection of said discriminating wiper to said cross-connecting means and the wiper set selected.

5. In a selecting switch having groups of trunk lines terminating in its switchbanks, one of said trunk lines appearing in a plurality of said groups, means for seizing said trunk line by way of any one of said plurality of groups, a wiper, and discriminating means controlled by said wiper for transmitting a discriminating signal from said switch to said trunk line dependent upon the group by way of which said trunk line is seized.

6. In a selecting switch having groups of trunk lines terminating in its switchbanks, each group divided into a plurality of sub-groups, one of said trunk lines appearing in a sub-group in each of two different groups, means responsive to one received digit for directively selecting one of said two different groups and the sub-group thereof containing said trunk line or responsive to a different digit for directively selecting the other of said two different groups and the sub-group thereof containing said trunk line, means for thereafter selecting said trunk line if idle, and discriminating means for transmitting a discriminating signal from said switch over said trunk line dependent upon the digit received for directively selecting one of the two different groups.

7. In a selecting switch having access to groups of trunk lines, one of said trunk lines appearing in each of two different trunk groups, means responsive to one received digit for directively selecting one of said two different trunk groups or responsive to a different digit for directively selecting the other of said two different trunk groups, means for thereafter automatically selecting said trunk line if idle, a wiper, and discriminating means controlled by said wiper for transmitting a discriminating signal from said switch to said trunk line dependent upon the digit received for directively selecting one of the two different trunk groups.

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