

Aug. 15, 1933.

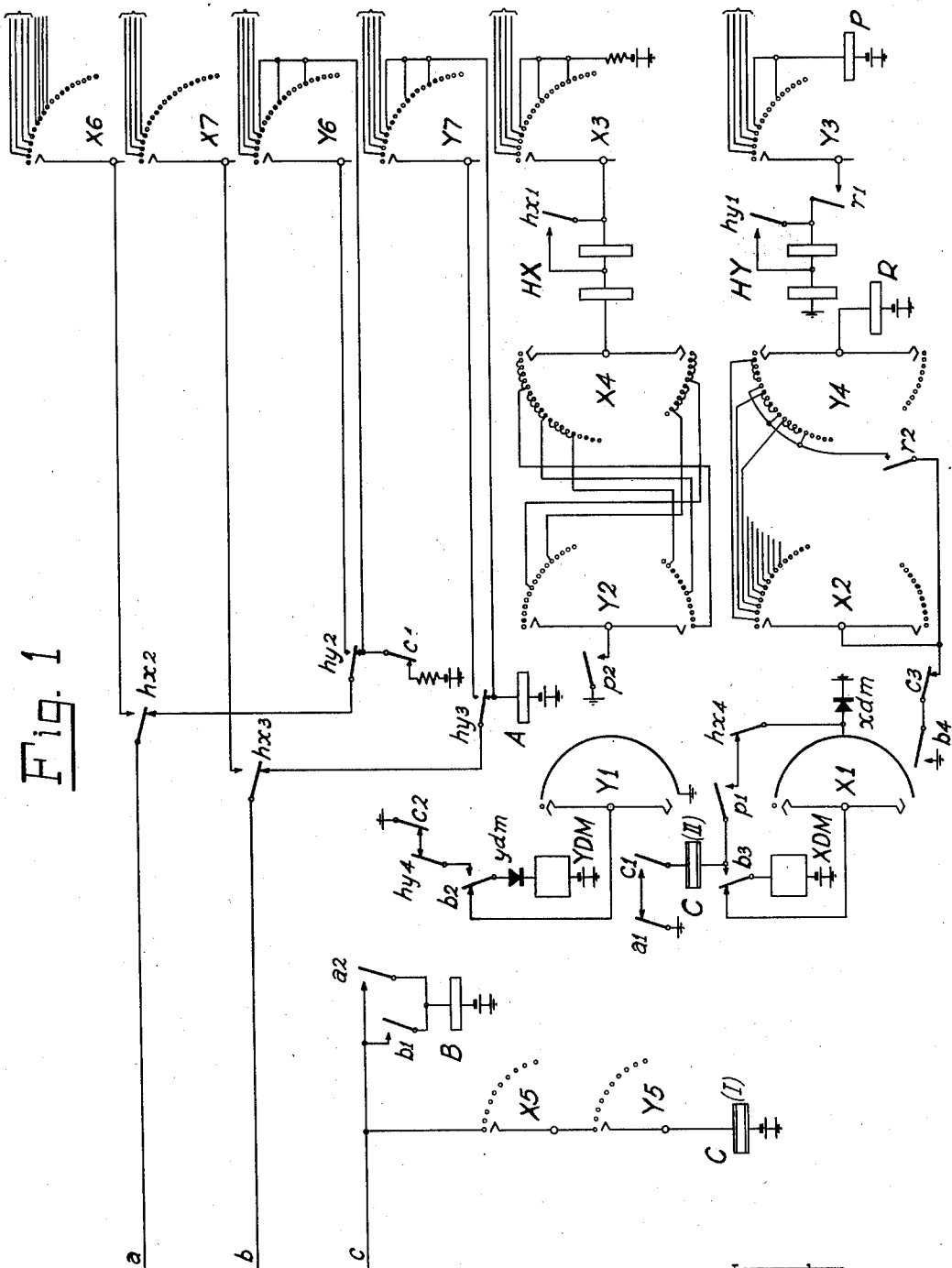
A. J. ESCOTT

1,922,237

AUTOMATIC TELEPHONE SYSTEM

Original Filed July 13, 1931

2 Sheets-Sheet 1



Inventor
Alexander John Escott

Richardson
Attg.

Aug. 15, 1933.

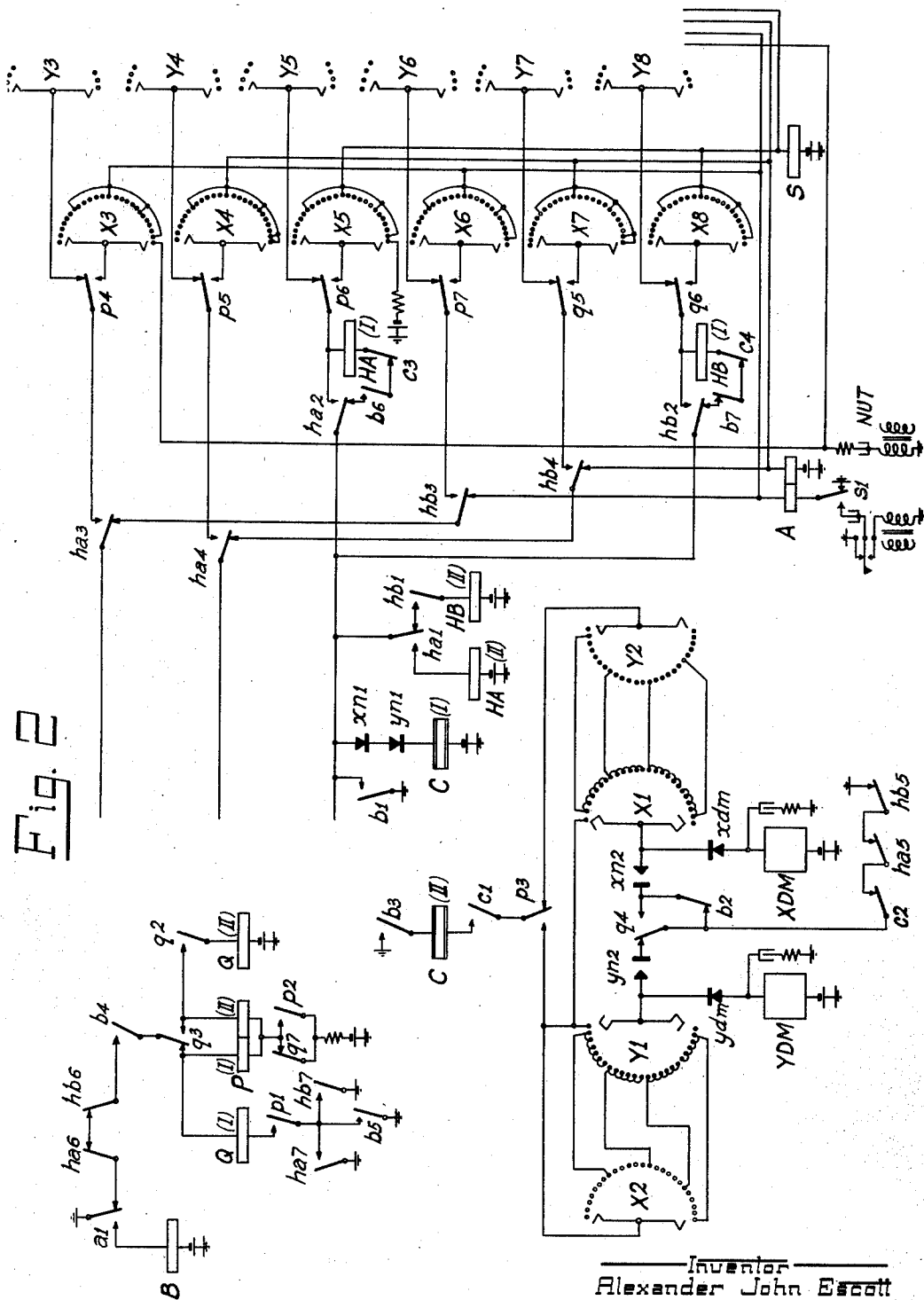
A. J. ESCOTT

1,922,237

AUTOMATIC TELEPHONE SYSTEM

Original Filed July 13, 1931

2 Sheets-Sheet 2



Inventor
Alexander John Escott

R. B. Richardson
Attg.

UNITED STATES PATENT OFFICE

1,922,237

AUTOMATIC TELEPHONE SYSTEM

Alexander John Escott, London, England, assignor to Siemens Brothers & Company Limited, London, England

Application July 13, 1931, Serial No. 550,323, and in Great Britain August 7, 1930. Renewed October 17, 1932

30 Claims. (Cl. 173—18)

The present invention relates to automatic telephone systems, and more particularly to the selecting switches for use in such systems.

The selecting switches employed in automatic telephone systems are usually arranged to step in response to a train of impulses consisting of from one to ten impulses, to an initial position at one end of a group of outlets, and then to hunt automatically for a free outlet in the group. Where the selecting switch is of the type which has motion in one plane only, usually a rotary motion, and in which all the wipers on the switch shaft partake in the hunting motion, it is sometimes arranged that the impulses take effect on a marking switch which marks in the banks of the selecting switch the group of outlets to be searched, the selecting switch being stepped automatically to the commencement of the marked group for a free outlet. The marking switch is thus used temporarily until a selecting switch has found a free outlet and may then be released, and arrangements have been provided whereby a marking switch may be available in common to a number of selecting switches. In the present invention two single-motion switches are combined to form a single selector, outlets being provided in the banks of each switch, and one switch may be used as a marking switch for the other.

It may be arranged that outlets of a group are provided in both switches, and a set of outlets of a group in one switch is marked by the other switch in response to an impulse train, and if these outlets are all busy the switch which applied the first marking has a marking applied to it and it thereupon steps to the marked position and commences hunting for a free outlet in a further set of outlets in the same group.

This arrangement, whilst suitable for use with a system in which the selectors are set under the control of a register controller in which the pause between successive impulse trains can be controlled so as to permit of the complete searching of a group, may not be convenient in a direct impulsing system except for small groups of outlets such as lines to a small private branch exchange, owing to the time required to step the switches to the marked positions and to hunt over a complete group of outlets.

In a modification suitable for use with a direct impulsing system, it may be arranged that the two switches comprising a selector act in turn as markers at each impulse of a train, one switch being marked by an odd number of impulses and the other switch by an even number of impulses.

This may be done as follows: Both switches step on receipt of the first impulse of the switch setting train, one being stepped to the commencement of the first group of outlets, the other to the commencement of the second group of outlets. The succeeding impulses drive the switches alternately, that resting at the commencement of the first group being the first to drive, the switch last driven preparing a circuit for the driving of the other switch. At the end of the switch setting impulse train the switch which rests at the commencement of the earlier group of contacts hunts over that group for a free outlet.

In order to reduce the hunting time and yet to have a large number of outlets we may connect the outlets of a group to a few consecutive contacts only and provide the switches with more than one set of wipers and contact banks and arrange for simultaneous search over all the wiper sets of a switch.

Reference will now be had to the accompanying drawings. Fig. 1 shows a pair of switches embodying the invention and suitable for use in a register controller system. Fig. 2 shows another embodiment which may be used in a direct impulsing system.

The arrangements shown in Fig. 1 will first be considered.

The selector comprises two single-motion switches each having seven wipers and corresponding contact banks of 51 contacts each. The switch wipers are designated X1—X7 for one switch which will be referred to as switch X, and Y1—Y7 for the other switch which will be referred to as switch Y. Outlets to a further switching stage or other circuits are divided into groups, some of the outlets of a group being connected to switch X and others to switch Y. In the example taken it is assumed that there are ten groups of eight outlets each, the first four outlets of a group being connected to switch Y and the last four outlets of the group being connected to switch X. Further, for the purpose of equalizing the searching time for all the groups the groups are connected to switch X in the reverse order to their connection to switch Y. The selector is of the type which tests free by reason of battery potential on the test wire, the free condition of an outlet also being battery potential on the test wire. The impulse relay is designated A, the release relay B, and the dialling relay C. HX is the test relay for switch X and HY for switch Y. R is a relay which connects up test relay HY when the wipers of switch

Y have reached a group marked by impulses in which search is to be made and relay P is operated when switch Y has failed to find a free outlet to mark the remainder of the group to be searched for by switch X. The driving magnet of switch X is designated XDM and that of switch Y, YDM.

When not in use the selector rests in a normal position with its wipers on the first contacts in their banks as shown in the drawings. For convenience in drawing only parts of the banks have been shown, the remainder of the banks being connected in a manner similar to the parts shown.

The selector tests free by reason of a battery connection over winding (I) of relay C, wipers Y5 and X5 to wire c and when seized from a previous switching stage relay C operates and at contact c2 opens a point in the circuit of magnet YDM to prevent switch Y being stepped by a false impulse. Contact c4 disconnects battery from wire a. Relay A is now operated over wire b from the register controller and at contact a2 connects relay B to the test wire c, and at contact a1 opens a point in the impulsing circuit for magnet XDM. Relay B operates and locks to the test wire over its contact b1. Contact b2 prepares a circuit for magnet YDM, contact b3 prepares a circuit for magnet XDM and contact b4 prepares a circuit for marking switch Y, this circuit being open at this time at contact c3.

Relay A responds to impulses and repeats them over contacts a1 and c1, low resistance winding (II) of relay C, and contact b3 to magnet XDM. Magnet XDM steps switch X in accordance with the impulses received and on leaving its normal position wiper X5 opens the circuit of winding (I) of relay C. At the end of the impulse train relay C releases and connects earth over contacts b4 and c3, and wiper X2 and the contact to which it has been stepped to mark a group of contacts in the bank of wiper Y4. The groups of contacts correspond to the outlets from switch Y, and, as regards the first group, they are connected to contacts 2—5. The second group is connected to contacts 7—10, each succeeding group being connected to four contacts, the first contacts of each group being five contacts apart. Contact c2 closing, a circuit is closed for magnet YDM and this magnet steps switch Y in search of the marked group, the magnet interrupting its own circuit at contact ydm. When the marked group is reached relay R operates over wiper Y4, the group marking contacts in its bank and the bank of wiper X2, contacts c3, b4 to earth. Contact r1 connects test relay HY to test wiper Y3 and contact r2 prepares a holding circuit for relay R should no free outlet be found and switch Y is stepped to contacts 6, 11, 16—succeeding groups of outlets. Switch Y continues to step over the contacts of the marked group in search of a free outlet connected to its wipers Y6, Y7, Y3. If a free outlet is found relay HY operates over wiper Y3 to battery on the test bank contact and opens the magnet circuit at contact hy4, stopping further driving. Contact hy1 short circuits the high resistance winding of relay HY to mark the outlet engaged and contacts hy2 and hy3 connect the speaking wires a and b through over wipers Y6 and Y7. Relay A releases and battery is connected from wire a at contact hy2.

Should all the outlets of the group connected to switch Y be engaged the switch is stepped on to one of the contacts 6, 11—which in the bank of

wiper Y3 are commoned and connected to relay P. Relay P operates in series with relay HY.

The operation of relay HY opens the direct connection of battery over contact c4 to the a wire and of relay A to the b wire but alternative circuits are closed over one of the contacts 6, 11, 16—in the banks of Y6 and Y7 for these battery connections. The battery connection to wire a transmits a signal to the register controller which holds up further impulse transmission until the battery connection is removed.

When relay P operates contact p2 connects earth over wiper Y2, one of the bank contacts 6, 11,—to a set of group marking contacts in the bank of wiper X4. Contact p1 closes a circuit from earth over self-interrupting contact xdm of magnet XDM, contacts hx4 and b3 for magnet XDM. Switch X is thereupon stepped until the marked group is reached after which it continues to step over the outlets of the group in search of a free outlet. When such an outlet is encountered relay HX operates in a circuit from earth over contact p2, wiper Y2, one of the contacts 6, 11, 16—marked group contacts in the bank of wiper x4, relay HX, test wiper X3 to battery on the test bank contact. Contact hx4 opens, stopping further driving of the switch and contact hx1 short circuits the high resistance winding of relay HX to mark the outlet engaged. The speaking wires are switched through at contacts hx2 and hx3 to wipers X6 and X7 and relay A is released and battery is disconnected from wire a, signalling to the register controller that impulsing may be resumed. Relays P and R remain operated.

If all the outlets of the group connected to switch X are busy the switch is brought to rest on contacts next after those connected to the last outlet of the group by the operation of relay HX to a battery connection to contacts 6, 11, 16—in the bank of wiper X3. The corresponding contacts in the banks of wipers X6 and X7 are not connected and the circuits over wires a and b are opened, thereby effecting release of the register controller and switches subsequent to the first selector which remains held over the calling loop and from which a busy signal is given.

The release of the preceding switches, whether due to the above or to release of the first selector by the calling subscriber clearing disconnects earth from wire c and releases relay B. Contact b3 falling back closes a homing circuit over wiper X1 for switch X and the switch is returned to its normal position. Switch Y performs only a hunting function, and, therefore, need not be returned to a normal position, but it may be so restored if required by connecting magnet YDM over its self-interrupting contact and a back contact of b2 to a homing wiper Y1 and earthed segment as shown in the drawings. If, however, switch Y has no normal position, winding (I) of relay C will be connected direct to wiper X5 and no advantage is gained by transposing the connection between the banks of wipers Y2 and X4.

Fig. 2 shows an arrangement suitable for use in a direct impulsing system, and, for the sake of example, a pair of single-motion switches having banks of twenty-five contacts each are used as a selector. Each switch has eight wipers and corresponding contact banks and outlets to a further switching stage or other circuits are grouped, a group of outlets being connected to the banks of one switch, part of the group being in one bank and part in another, simultaneous search over the outlets in the two banks being provided for. As regards the groups themselves

alternate groups are connected in different switches, thus, the "odd" groups are connected to switch X and the "even" groups to switch Y, differentiation between the groups being provided by a pair of relays P and Q, successive impulses of a train being repeated to alternate switches.

The selector tests free by reason of battery potential on the test wire and when seized connects earth to the test wire to mark it engaged and to hold preceding selectors during the setting operation, the holding earth being returned from a succeeding switch on its seizure.

When the selector is picked up relay C operates by means of its winding (I) over the test wire in series with the test relay of the preceding selector which switches through and operates relay A. Contact c1 prepares the impulsing circuit for the switch magnets, contact c2 opens a homing circuit for the switches and contacts c3 and c4 open the circuits of the test relays HA and HB during group selection. Relay A operating, contact a1 closes the circuit of relay B, which operates, and at contact b1 connects earth to the incoming test wire to hold preceding switches and to mark the selector engaged. Contact b2 opens a point in the homing circuit of switch X, contact b3 further prepares the impulsing circuit for the switch magnets, contact b4 prepares the circuit of relay P, and contact b5 that of relay Q, contacts b6 and b7 close points in the circuits of the test relays. Impulses for the setting of the selector are now transmitted to relay A which responds. The first impulse is repeated at contact a1 to relay P which operates by means of its winding (I) and locks up over its contact p2 independently of relay Q. Contact p1 connects winding (I) of relay Q to the impulse repeating circuit but the winding is short circuited at this time over contact a1. Contact p3 connects earth over contact b3, winding (II) of relay C, contact c1, first or normal contact and wiper Y1 of switch Y, self-interrupting contact ydm, magnet YDM to battery; a parallel circuit is closed for magnet XDM, the magnets XDM and YDM operate, and step the wipers of both switches to the second bank contacts. The off-normal contacts xn1, xn2, yn1, and yn2 are operated, contacts xn1 and yn1 opening the circuit of winding (I) of relay C to leave that relay dependent for continued energization on impulsing. At the end of the impulse, relay A releases and the short circuit is removed from winding (I) of relay Q. Relay Q operates over this winding in series with winding (I) of relay P and at contact q1 opens a point in the energizing circuit of relay P. Contact q3 opens a further point in this circuit and in conjunction with contact q2 prepares a circuit for winding (II) of relay Q. Thus, at the end of the first impulse, relays P and Q are operated and switch X is connected up with its wipers resting on its second contacts which are the contacts associated with the first outlet of the first group; switch Y is resting with its wipers on its second contacts which are associated with the first outlet of the second group, but the wipers are not connected. In the example taken it will be assumed that the outlets of the first group are connected to contacts 2—6, those of the third group to contacts 8—12, those of the fifth group to contacts 14—18, and those of the seventh group to contacts 20—23, all in the banks of switch X. The outlets of the even groups are connected to similarly numbered contacts in the bank of switch Y.

If a second impulse is transmitted release of relay A energizes relay Q in its winding (II) over contacts q2, q3, b4, hb6, ha6, and a1, and energizes relay P in its winding (II). Relay P is wound so that its two windings when energized create opposing magnetic fluxes; relay P in consequence releases and at contact p1 opens the circuit over windings (I) and (II) of relays P and Q so that relay Q continues to hold by means of its winding (II). At the end of the impulse when relay A reoperates relay Q releases. When relay P releases due to the commencement of a second impulse a circuit is closed from earth over contact b3, winding (II) of relay C, contacts c1, p3, wiper Y2 and second bank contacts, commoned contacts 2—7 in the bank of wiper X1, contacts xdm, magnet XDM to battery. The magnet operates and by means of its contact xdm, steps the wipers of switch X to contacts 8. Switch Y is now connected up with its wipers resting on contacts 2 which are associated with the first outlet of the second group and switch X is resting with its contacts resting on contacts 8 associated with the first outlet of the third group but its speaking and test wire wipers are disconnected at contacts p4, p5, p6, p7, q5, and q6, which contacts connect the speaking and test wires to wipers Y3—Y8.

If a third impulse is transmitted relay P is operated and a circuit is closed over the front of contacts p3, wiper X2 and its eighth bank contact, commoned contact 2—7 in the bank of wiper Y1 for magnet YDM. The switch Y is stepped to its eighth contacts and its wipers Y2—Y8 are disconnected at contacts of relays P and Q which connect in circuit wipers X2—X3 which are now resting on the first outlets of the third group. Further impulses effect the alternate stepping of switches X and Y in a similar manner.

At the end of the impulse train relay C releases and search over the outlets of the required group takes place. For the sake of example it will be assumed that an "odd" number of impulses have been received and in consequence relays P and Q are operated and locked up over their windings (I) connecting switch X in circuit. On the release of relay C the test relays HA and HB are connected to earth over contact b1 and the impulsing circuit for the switch magnets is opened at contact c1. A stepping circuit is closed, however, at contact c2 for the magnet of the switch which is to search, in the example switch X. Magnet XDM, therefore, energizes in a circuit over contacts xdm, xn2, q4, c2, ha5, hb5, to earth and the wipers are stepped over contacts connected to outlets of an "odd" group, test for a free outlet being made simultaneously by relays HA and HB. Wipers X3, X4, and X5 give access to one set of outlets of a group and wipers X6, X7, and X8 to another set, and when a free outlet in one of the sets is encountered, the corresponding test relay operates. Assuming for a moment that a free outlet is encountered in the first-mentioned set, relay HA operates in a circuit from earth over contacts b1, ha2, b6, c3, winding (I) of relay HA, contact p6, wiper X5, and bank contact to battery connected to the test wire. Contact ha1 operates and opens the locking circuit of relay HB and closes a locking circuit for relay HA over its winding (II). Contact ha2 disconnects winding (I) of relay HA and closes the circuit over the test wire for extending the holding earth which will be fed back from the seized outlet. Contacts ha3 and ha4

extend the speaking wires and disconnect relay A, and contact *ha5* opens the magnet circuit to prevent further stepping, contact *ha6* opens to prevent release of relay Q when relay A releases and contact *ha7* closes a holding circuit for relays P and Q against the release of relay B which takes place shortly after the release of relay A. If the first free outlet is found in the bank of wipers X6—X8, relay HB operates and similar operations ensue. If, however, a free outlet is found simultaneously in both sets both test relays operate but relay HA on operation closes a holding circuit for itself at contact *ha1* and opens the locking circuit of relay HB so that the latter is not held but is released by the subsequent opening of contact *b7*.

Should all the outlets in the group be engaged the wipers are brought to rest on "busy" contacts immediately succeeding those connected to outlets. These contacts are numbered 7, 13, 19, and 24. Relay HA operates over these contacts and relay S, which is connected to them in the test banks and relay HA, locks up. Relay A is held in a circuit from battery over its right-hand winding, "busy" contact in the bank of wiper X4, contacts *p5*, *ha4*, the calling loop, contacts *ha3*, *p4*, wiper X3, and "busy" contacts, left-hand winding of the relay, front contact *s1*, contacts controlled by a busy signal cam device to earth and the subscriber receives a busy signal.

Precisely similar operations take place if switch Y is used instead of switch X.

As only twenty-five contacts are provided in the banks of each switch the number of groups would usually not exceed eight, except in cases where some of the groups are very small. It will be assumed then that eight groups only are provided. At the commencement of the eighth impulse relay P is released, switch X is stepped from its twentieth contact to the twenty-fifth, while switch Y remains on contacts 20. If a ninth impulse is dialled relay P is reoperated and a circuit is closed over the twenty-fifth bank contact and wiper X2, twentieth bank contact and wiper Y1 for magnet YDM and switch Y is stepped to its twenty-fifth contact. The test relay HA operates immediately over a battery connection shown and a circuit is closed over the secondary of the transformer N U T and twenty-fifth contact in the banks of wiper X3 to the *a* wire and the subscriber receives a distinctive tone informing him that he has dialled a non-existent number.

Similarly, if "O" is dialled, relay P will release at the commencement of the last impulse but there will be no circuit for magnet XDM and the subscriber will receive the tone as described above.

The selector is released by disconnection of earth from the test wire in a succeeding circuit. The test relay releases and opens the speaking and test wire circuits, releases relays P and Q if operated, and prepares the operating circuit of relay P. A homing circuit for the switch magnets is closed as follows:—earth over contacts *hb5*, *ha5*, *c2*, then over contacts *b2*, *xn2*, to magnet XDM and over contacts *q4* and *yn2* to YDM and the switches are restored to normal whereupon contacts *xn1* and *yn1* reconnect relay C to the incoming test wire, and contacts *xn2* and *yn2* open the circuits.

What is claimed is:

1. A switching device comprising two automatic switches, groups of outlets accessible to the respective switches, and means in each switch for marking a group of outlets accessible to the other switch.

2. A switching device comprising two automatic switches, groups of outlets accessible to each switch, means for causing either switch to hunt for and connect with an idle outlet in a marked group of outlets, and means in each of said switches for marking outlet groups in the other of said switches.

3. A switching device comprising two single-motion switches, groups of outlets accessible to said switches, means for operating either switch to designate a particular group of outlets accessible to the other switch, and means for operating the said other switch to hunt for and connect with an idle outlet in the designated group.

4. In a telephone system, a trunk line, a switching device comprising two automatic switches terminating said trunk lines, groups of outlets accessible to said switches, means for operating either switch to designate a particular group of outlets accessible to the other switch, and means for causing said other switch to connect said trunk line with an idle outlet in the designated group.

5. In a telephone system, two selective switches, groups of outlets accessible to said switches, means in each switch for marking groups of outlet groups accessible to the other switch, and means in each switch for selecting an idle outlet in a group marked by the other switch.

6. In a telephone system, two selective switches, groups of outlets divided into sub-groups accessible to the respective switches, means for seizing said switches simultaneously, means for causing the first switch to hunt for an idle outlet in one of said sub-groups, and automatic means for causing the other switch to hunt for an idle outlet in the corresponding sub-group when all outlets in said one sub-group are busy.

7. In a telephone system, a selector comprising two single-motion switches, a group of outlets part of which are accessible to one of said switches and the remaining of which are accessible to the other of said switches, means for operating said one switch to hunt over the accessible outlets of the group for an idle outlet, and means responsive to the failure of said one switch to find an idle outlet for operating the other of said switches to hunt over the remaining outlets of the group for an idle outlet.

8. In a telephone system, two selective switches, groups of outlets accessible to said switches, means for directly operating the first switch to mark a group of outlets accessible to the second switch, means for causing the second switch to hunt for an idle outlet in the marked group, means in the second switch for marking a corresponding group of outlets accessible to said first switch when all outlets of the first marked group are engaged, and means for causing said first switch to hunt for an idle outlet in the second marked group.

9. A switching device comprising two automatic switches, groups of outlets divided into sub-groups accessible to respective ones of said switches, means including one switch for marking a sub-group of outlets to cause the other switch to hunt for an idle outlet therein, and means including the other switch effective in case no idle outlets are available in the marked sub-group for marking the corresponding sub-group accessible to said one switch to cause the same to hunt for an idle outlet therein.

10. In combination, a switching device comprising two single-motion switches, groups of outlets divided into sub-groups accessible to the respec-

tive switches, means for operating one switch to mark a sub-group of outlets accessible to the other switch, means for causing said other switch to hunt for an idle outlet in the marked sub-group, means for causing said other switch to mark the corresponding sub-group accessible to said one switch responsive to all trunks of the first sub-group being found busy, and means for causing said one switch to hunt for an idle outlet in the second marked sub-group.

11. In a telephone system, two single-motion switches, wipers for said switches, groups of contact sets accessible to the respective switches via their wipers, means for directively operating the first switch to position its wipers on a set of contacts to mark a particular group of contact sets accessible to the second switch, means for moving the wipers of the second switch over the marked contact group in search of an idle contact set and to a position beyond the last contact set in the group in case no idle contact sets are available, and means including a wiper of said second switch thereafter effective to mark a particular group of contact sets accessible to said first switch.

12. In a telephone system, two automatic switches, each of which is adapted to mark groups of outlets accessible to the other switch and each of which is adapted to hunt for an idle outlet in a marked group, means for directively operating one switch to initiate the marking and hunting operations, and means for restoring both switches to normal position.

13. In a telephone system, a trunk line, two automatic switches each of which is adapted to mark groups of outlets accessible to the other switch and each of which is adapted to hunt for an idle outlet in a marked group, and means controlled over the trunk line for directively operating one switch to initiate the marking and hunting operations whereby said line is connected with an idle outlet accessible to one or the other of said switches.

14. In a telephone system, a switching device comprising two automatic switches each of which is adapted to control the hunting operation of the other by designating a particular group of outlets to be hunted over, and groups of outlets divided into sub-groups accessible to the respective switches so arranged that the order of access to corresponding sub-groups is reversed for the switches.

15. A switching device comprising two automatic switches, means in the device responsive to a series of impulses, and means including said last means for operating said switches simultaneously responsive to the first impulse of the series and for operating said switches alternately responsive to succeeding impulses of the series.

16. A switching device comprising two automatic switches, groups of outlets accessible to said switches, means for alternately causing each switch to mark a particular group of outlets accessible to the other switch, and means for causing the said other switch to pass over the marked outlet group.

17. A switching device comprising two automatic switches, two sets of wipers for each switch, groups of outlets accessible to the respective switches via said wipers, means in the device for determining the particular switch to be used in a connection, and means in the device for determining the particular set of wipers of said particular switch which are to connect with one of said outlets.

18. In a telephone system, a switching device comprising two step-by-step switches, means for transmitting a series of impulses to said device, means in the device for advancing both switches one step responsive to the first impulse of the series, and means for alternately advancing the switches a plurality of steps responsive to succeeding alternate impulses of the series.

19. In a telephone system, a trunk line terminating in a switching device comprising two automatic switches, wipers for the switches, means for transmitting a series of impulses over the trunk line to operate said switches alternately, a pair of relays in said device energized and de-energized responsive to alternate impulses of the series, and means controlled by said relays for connecting the trunk line to the wipers of either of said switches.

20. In a telephone system, a trunk line terminating in a switching device comprising two automatic switches, groups of outlets accessible to the switches, means for transmitting digit impulses over the trunk line, means in the device for responding to said digit impulses, means for causing either of the switches to hunt for an idle outlet in an accessible group responsive to the receipt of a digit designating that particular group, and means for applying a distinctive tone to the trunk line responsive to the receipt of a digit greater than the number of outlet groups accessible to said switches.

21. In an automatic switch, means for receiving a series of impulses, means for operating the switch one step responsive to the first odd numbered impulse of the series, and means for operating the switch a plurality of steps responsive to each subsequent even numbered impulse of the series.

22. In an automatic switch having access to groups of contacts, a control relay, means for operating and releasing said relay, means responsive to the operation of said relay for advancing the switch one step to the first contact of one of said groups, and means responsive to the release of said relay for advancing the switch a plurality of steps to the first contact of a succeeding group.

23. In an automatic switch, means for receiving a series of impulses, means for operating the switch one step responsive to the first odd numbered impulse of the series, and means for operating the switch a plurality of steps responsive to each subsequent odd numbered impulse of the series.

24. In an automatic switch, a control relay, means for repeatedly operating and releasing said relay in response to a received series of impulses, means responsive to the initial operation of the relay for advancing the switch one step, and means responsive to each subsequent operation of the relay for advancing the switch a plurality of steps.

25. In combination, a switching device comprising two separate switches, groups of outlets accessible to the respective switches, means responsive to the receipt of a series of impulses for setting each switch in selective relation with a group of outlets, and means dependent on the value of the impulse series for determining which one of the switches is to hunt for an idle outlet in a selected group.

26. In combination, a switching device comprising two separate switches, groups of outlets accessible to the respective switches, means for transmitting a series of impulses to said device

to set each of said switches in selective relation with a group of trunks accessible thereto, means operative in case the impulse series consists of an even number of impulses for causing one switch to hunt for an idle outlet in its selected group, and means operative in case the impulse series consists of an odd number of impulses for causing the other switch to hunt for an idle outlet in its selected group.

27. In combination, a switching device comprising two separate switches, groups of outlets accessible to the respective switches, a control relay, means for energizing and deenergizing said relay responsive respectively to alternate impulses of a received impulse series, means controlled by said relay for operating said switches alternately to set them in selective relation with groups of outlets, and means controlled by said relay for determining which of said switches is to hunt for an idle outlet in a selected group.

28. In a switching device, four separate sets of wipers, groups of contacts accessible to said wipers, means responsive to the receipt of a series

of impulses for setting said wipers in selective relation with groups of outlets, means controlled by the value of the impulse series for selecting a pair of said wiper sets, and means for automatically selecting a particular wiper set of the selected pair.

29. A switching device as claimed in claim 27 in which the selection of a particular wiper set of a selected pair is controlled by the busy or idle condition of outlets accessible to the wiper sets.

30. In combination, a switching device comprising two switches, a control relay in said device, means for repeatedly energizing and deenergizing said relay responsive to a series of impulses received by the device, means responsive to the initial energization of the relay for operating both switches one step, means responsive to each subsequent energization of the relay for operating one switch a plurality of steps, and means responsive to each deenergization of the relay for operating the other switch a plurality of steps.

ALEXANDER JOHN ESCOTT.

25

30

35

40

45

50

55

60

65

70

75

80

85

90

95

100

105

110

115

120

125

130

135

140

145

150