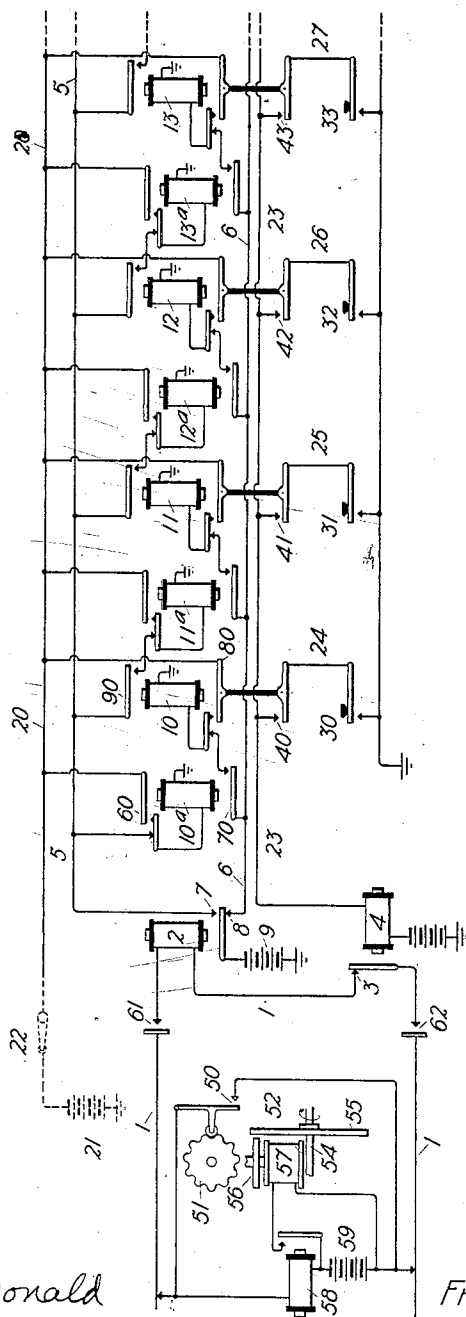


F. R. McBERTY.
SELECTIVE CONTROLLING APPARATUS.
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Witnesses:
Irving Mac Donald
J. P. M. Introch.

Inventor:
Frank R. McBerty
by *J. C. Munner*, Att'y.

UNITED STATES PATENT OFFICE.

FRANK R. McBERTY, OF NEW ROCHELLE, NEW YORK, ASSIGNOR TO WESTERN
ELECTRIC COMPANY, OF NEW YORK, N. Y., A CORPORATION OF ILLINOIS.

SELECTIVE CONTROLLING APPARATUS.

1,127,466.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FRANK R. McBERTY, citizen of the United States, residing at New Rochelle, in the county of Westchester and State of New York, have invented a certain new and useful Improvement in Selective Controlling Apparatus, of which the following is in full, clear, concise, and exact description.

This invention relates to controlling mechanism for automatic selectors of a telephone exchange system. Its object is to provide an improved arrangement of apparatus for controlling the advance movement and stopping of selectors, and more particularly its object is to provide a simple and effective device for predetermining and "counting" the number of current impulses to be transmitted in the selector controlling circuit, to the end that the impulse sending operation will take place with great rapidity and the desired extent of travel of the selector will be accurately determined.

Heretofore, according to a well known method of controlling selectors in telephone exchange systems, there have been employed a number of keys or switches and certain forms of rotary multiple contact switches or "senders", the keys and senders forming the controlling apparatus for the selector, and each key being adapted to close a local circuit at one point which is subsequently closed at another point by the sender. The sender and the selector are operated in unison and are advanced under the control of the current impulses until the local circuit referred to is closed, whereupon an electro-responsive device, the winding of which is included in the local circuit, is operated to open the controlling circuit, or in some other way to stop the advance movement of the selector.

According to this invention the selector controlling mechanism comprises a series of successively operable electrical devices and a series of keys arranged to select for effective operation a variable group of the electrical devices together with a device adapted to respond upon the operation of the last operated electrical device in the selected group.

More in detail the invention comprises a series of electromagnets, which are preferably relays and which are caused to operate successively in response to current impulses from an interrupter, and a series of keys or

other suitable form of contact switches, one key or switch being associated and arranged with each relay in such a manner that upon the conjoint operation of any relay and the corresponding key a responsive device is actuated. The interrupter is preferably in the form of a "stepping" relay, the switch contacts of which alternately make and break a contact in the circuit of the relays. The responsive device is employed as the means of stopping the movement of the selector; it may be in the form of an ordinary cut-off relay and its winding may be included in a local circuit having a plurality of normally open branch circuits, each of which is adapted to be closed by contacts in series of any counting relay and the corresponding switch. A second series of relays is preferably employed in conjunction with the series first mentioned and the two series of relays are associated with two local circuits respectively. These local circuits are arranged to be closed alternately by the stepping relay, the winding of which is included in a main controlling circuit which circuit is provided with some suitable form of contact making device or interrupter, operating in unison with or in the movement of the selector. The relays in the two series which are operated in alternate succession are self-locking. The cut-off relay stops the movement of the selector preferably by opening the main controlling circuit.

The invention may be described more in detail by reference to the accompanying drawing, in which 1 is a main controlling circuit including the winding of a "stepping" relay or interrupter 2 and a contact 3 normally closed but adapted to be opened by a cut-off relay 4. Relay 2 is adapted to alternately close and interrupt two local circuits 5, 6, through its front and back contacts 7, 8, respectively. A battery 9 connected to the switch spring of the relay is adapted to supply current to both local circuits. A series of relays 10, 11, 12 and 13 is associated with local circuit 6 and a second series of relays 10^a, 11^a, 12^a and 13^a is associated with local circuit 5. A third local circuit 20 is associated with all of the relays of the two series and its function, as will appear presently, is to supply current to the windings of the relays to maintain them energized, after being first operated in local circuits 5 or 6. This local circuit 20 may include as shown a

source of current 21 and a switch 22. The winding of the cut-off relay 4 is included in a circuit 23 having branches 24, 25, 26 and 27. A series of keys 30, 31, 32 and 33 are provided, each being adapted to close a contact in one of the branches of circuit 23. Included in these branches are also a series of switch contacts 40, 41, 42 and 43 controlled by relays 10, 11, 12 and 13, respectively.

Any suitable form of interrupter may be provided in the main controlling circuit 1. In the drawing there is shown a contact device 50 cooperating with a starwheel 51 which is rotated in the advance movement of a controlled automatic selector 52. This selector may be employed to perform any desired function in the telephone exchange system, such as the selection of a connection between telephone lines. The advance movement may be secured by an electromagnetic clutch comprising a constantly rotating power shaft 54, cooperating disks 55 and 56 and an electromagnet 57. The circuit of the electromagnet may be controlled in a local circuit by a relay 58 whose winding is in the main controlling circuit. A battery 59 may supply current to both circuits. Upon the closing of the circuit of the clutch magnet 57 the rotating disk 55 engages the normally stationary disk 56 which drives the starwheel 51. Contact 50 is thus caused periodically to close and open a shunt path about the stepping relay 2 in the main controlling circuit 1. This circuit is adapted to be closed initially by contacts 61, 62 when it is desired to start the selecting operation.

The operation of the controlling apparatus is as follows: Consider, for example, that it is desired to advance the selector three steps. Key No. 32 is depressed and contacts 61, 62 are then closed to complete the controlling circuit 1. Relays 58 and 2 are energized and the selector 52 begins its advance movement. The rotation of the starwheel 51 causes the current to be shunted from relay 2, but not from relay 58, once for each step. Upon the first closing of controlling circuit 1 relay 2 operates to close local circuit 5 at contact 7, which circuit normally includes the winding of relay 10^a only. This relay is energized and becomes locked in local circuit 20 and removed from local circuit 5 by the operation of its switch spring 60. Relay 10^a also brings relay 10 into connection with local circuit 6 by the operation of its switch spring 70. Upon the first closing of contact 50, contact 8 of relay 2 is closed and relay 10 becomes energized. This relay in turn becomes locked in local circuit 20 and removed from local circuit 6 by the operation of its switch spring 80. Relay 10 also connects relay 11^a in local circuit 5 by the

operation of its switch spring 90. In a similar manner the relay 11^a is operated upon the second closure of local circuit 5 and relay 11 upon the second closure of local circuit 6. Relays 12^a and 12 are in the same way operated in succession upon the third closing of local circuits 5 and 6, respectively. Finally the energization of relay 12 causes the closing of branch 26 at contact 42, key 32 having already been depressed. Local circuit 23 is now completed and the cut-off relay 4 operates to interrupt the main controlling circuit at contact 3, thereby taking away current from relay 58. The clutch magnet is deenergized and the selector stops after having taken three full steps. Relays 10^a, 10, 11^a, 11, 12^a and 12 are now locked up in local circuit 20. They may be subsequently released by opening that circuit at switch 22. The whole operation may be repeated with any one of the keys depressed.

The series of relays and keys may be extended to any desired extent by continuing the circuit arrangement as shown to other relays and keys.

What I claim is:

1. The combination with a selector and its controlling circuit, of selector controlling mechanism comprising an interrupter, a circuit controlled thereby, a series of electromagnets, means under the control of said interrupter for bringing said electromagnets successively into operative relation to said circuit, a series of keys one for each electromagnet, and a responsive device controlled by the conjoint operation of any one of said electromagnets and the corresponding key for effecting a change in said controlling circuit of the selector.

2. The combination with a selector and its controlling circuit, of selector controlling mechanism, comprising an interrupter, a circuit controlled thereby, a series of relays, means under the control of said interrupter for bringing said relays successively into operative relation to said circuit, a series of switches one for each relay, an electro-responsive device for effecting a change in said controlling circuit of the selector and a circuit for said electro-responsive device having a plurality of branches each including normally open contacts in series of one of said relays and the corresponding switch.

3. The combination with a selector and its controlling circuit, of selector controlling mechanism comprising an interrupter, two circuits adapted to be closed alternately by said interrupter, a series of self-locking relays associated with one of said circuits, a series of switches one for each of said relays, a second series of self-locking relays associated with the other of said circuits, the relays of the two circuits being ar-

5 ranged to be operated in alternate succession in response to current impulses in said circuits and a responsive device controlled jointly by any one of said relays and the corresponding switch for effecting a change in said controlling circuit of the selector.

10 4. Selector controlling mechanism comprising a stepping relay, a circuit therefor having an interrupter, two local circuits adapted to be closed alternately by said relay, a series of relays associated with one of said local circuits, a series of switches one for each of said relays, a series of relays 15 associated with the other of said circuits, the relays in the two local circuits being arranged to be operated in alternate succession in response to current impulses in said local circuits and a cut-off relay responding to the conjoint operation of any one of said switches and the corresponding relay and adapted to open the circuit of said stepping relay.

25 5. The combination with a selector, its controlling circuit and an interrupter operating periodically in unison with the selector, of a circuit controlled by said interrupter, a series of relays, means under the control of the interrupter for bringing said relays successively into operative relation 30 to said circuit, a series of switches one for each relay, and a device responding to the conjoint operation of any one of said relays and the corresponding switch and adapted to change the controlling circuit of the selector.

35 6. The combination with a selector and a controlling circuit therefor, of an interrupter operating in unison with the selector, a stepping relay responding to current changes controlled by said interrupter, two local circuits adapted to be changed alternately by said stepping relay, a series of 40 electromagnets, means associated with one of said local circuits for bringing said electromagnets successively into operative relation to the other of said local circuits, a series of keys one for each electromagnet and a responsive device controlled jointly by any one of said electromagnets 45 and the corresponding key and adapted to change the controlling circuit of the selector.

50 7. The combination with a selector and its controlling circuit, of a relay included in said circuit, an interrupter operating in the movement of the selector and adapted to intermittently shunt said relay, two local circuits adapted to be changed alternately 55 by said stepping relay, a series of relays, means associated with one of said local circuits for bringing said relays successively into operative relation to the other of said local circuits, a series of switches one for each relay in said series, and means re-

sponding upon the conjoint operation of any one of said relays and the corresponding switch to open the controlling circuit of the selector.

8. The combination with a series of electromagnets and means for operating them 70 in succession, of a responsive device controlled by said electromagnets and a series of keys respectively associated with said electrical devices and arranged to select for effective operation a variable group of said electromagnets, said responsive device being directly responsive to the operation of 75 the last operated electrical device in any selected group.

9. The combination with a plurality of relays and means for operating them in succession, of a device adapted to respond 80 upon the complete operation of a variable group of said relays and a series of selective keys respectively associated with said relays and adapted to render ineffective the relays external to said variable group. 85

10. The combination with a series of relays, a circuit therefor and an interrupter 90 in said circuit, said relays being operated successively in a definite order in response to successive impulses of current in said circuit, of a local circuit controlled by said relays, a series of switches adapted to select 95 for effective operation a variable group of said relays, said local circuit being adapted to be changed upon the operation of the last operated relay in any selected group and an electro-responsive device in said local circuit. 100

11. The combination with a series of relays and means for operating them successively in a definite order, of a circuit controlled by said relays, a series of switches, 105 said circuit being adapted to be changed in direct response to the operation of the last of a variable group of said relays and said switches being arranged to select the relays comprising said variable group, and a 110 responsive device in said circuit.

12. The combination with a series of relays, a controlling circuit therefor and an interrupter adapted to transmit impulses in 115 said circuit, said relays being arranged to operate in succession in response to said impulses, of a local circuit controlled by said relays, a series of switches one for each relay, said local circuit being adapted to be 120 changed upon the operation of a variable group of said relays and said switches being arranged to select the relays comprising said variable group, and a responsive device in said local circuit, said responsive device being adapted to change the condition of said controlling circuit. 125

13. The combination with a selector, an interrupter operating in the movement thereof, and a circuit including said interrupter, of a series of electrical devices 130

adapted to operate in succession in response to impulses of current in said circuit, a device directly responsive to the operation of the last of a variable group of said electrical devices for controlling said interrupter circuit and a series of selective keys adapted to render ineffective the electrical devices external to said variable group.

14. The combination with an interrupter, of a series of electromagnets adapted to be successively operated by current impulses therefrom, a series of keys one for each electromagnet, and an electrically operated device directly responsive to the conjoint operation of any one of said electromagnets and the corresponding key.

15. The combination with an interrupter, of a series of relays, means whereby said relays are successively operated by impulses from said interrupter, a series of keys one for each relay, a relay for interrupting the operation of the relays of said series and an operating circuit therefor extending through a key and the corresponding relay.

16. The combination with an interrupter, of a series of electromagnets, means whereby said electromagnets are adapted to be successively operated by current impulses from said interrupter, a series of keys one for each electromagnet, and a device responsive to the conjoint operation of any one of said electromagnets and the corresponding key and adapted to stop the sending of current impulses.

17. The combination with a stepping relay and a controlling circuit therefor, of a series of counting relays, means whereby said relays are adapted to be successively operated by current impulses controlled by said stepping relay, a series of keys one for each counting relay, a cut-off relay, and a controlling circuit therefor having branches, each branch including normally open contacts in series of one of said counting relays and the corresponding key, and said cut-off relay being adapted to open the controlling circuit of said stepping relay.

18. The combination with a main controlling circuit, means for transmitting current impulses therein and a relay included in said circuit, of two local circuits, said relay being adapted to alternately effect changes in said circuits, a series of relays associated with one of said local circuits, a series of switches one for each relay of said series, a second series of relays associated with the other local circuit, the relays in the two series being adapted to re-

spond in alternate succession to current impulses in said local circuits, and a device responsive to the conjoint operation of any one of said switches and the corresponding relay and adapted to stop the sending of current impulses in said main controlling circuit.

19. The combination with a main controlling circuit, an interrupter for transmitting current impulses therein and a stepping relay included in said circuit, of two local circuits, said relay being adapted to alternately close and open said local circuits, a series of counting relays associated with one of said local circuits, a series of keys one for each counting relay, a series of relays associated with the other local circuit, the relays in the two series being adapted to respond in alternate succession upon the closing of said local circuits by said stepping relay, a locking circuit adapted to maintain said relays of the two series energized, a cut-off relay and a controlling circuit therefor having branches, each branch including normally open contacts in series of one of said counting relays and the corresponding key, said cut-off relay being adapted to open said main controlling circuit.

20. The combination with a series of relays and means for operating them successively in a definite order, of a series of keys arranged to select for effective operations a variable group of said relays; and an electrically operated device directly responsive to the operation of the last operated relay in the selected group.

21. A selective switching apparatus comprising a set of self-locking relays, a locking wire therefor, an impulse transmitting wire, a controlling relay having a winding continuously connected thereto, front and back contacts on said controlling relay, means for connecting said contacts to alternate relays of said set, each connection passing through contacts on the preceding relay, whereby step by step selection is attained by successive energization of alternate relays by the makes and breaks produced by the impulse transmitting wire.

In witness whereof, I hereunto subscribe my name this first day of September A. D. 1909.

FRANK R. McBERTY.

Witnesses:

IRVING MACDONALD,
EDGAR F. BEAUBIEN.