G. THOMPSON.

DISTRIBUTING SWITCH.

APPLICATION FILED MAY 10, 1919.

1,375,762. **Patented Apr. 26, 1921.**

Fig. 1.

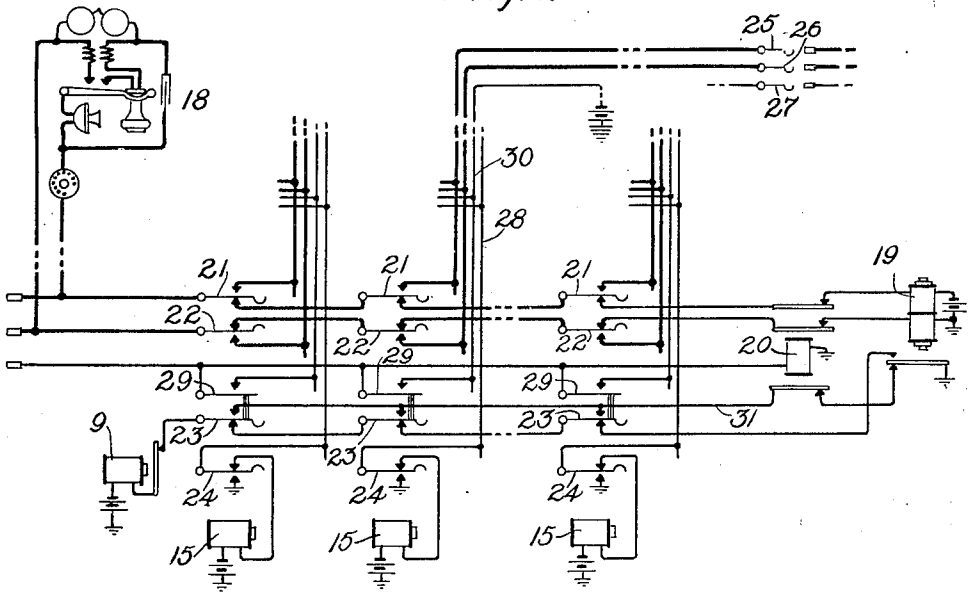
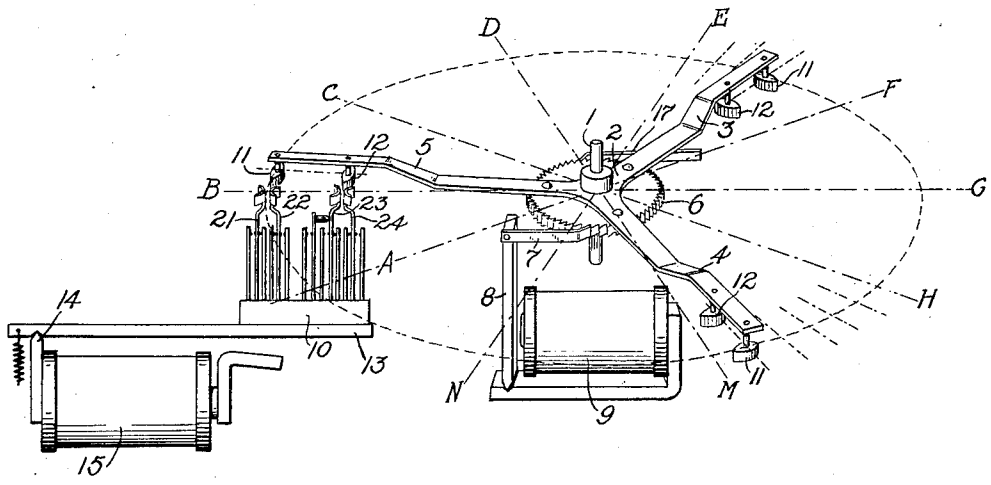


Fig. 2.



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UNITED STATES PATENT OFFICE.

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DISTRIBUTING-SWITCH.

1,375,762. Specification of Letters Patent. Patented Apr. 26, 1921.

Application filed May 10, 1919. Serial No. 296,180.

To all whom it may concern:

Be it known that I, GEORGE THOMPSON, a citizen of the United States, residing at Mount Vernon, in the county of Westchester, State of New York, have invented certain new and useful Improvements in Distributing-Switches, of which the following is a full, clear, concise, and exact description.

This invention relates to automatic telephone exchange systems, and more particularly to the mechanical construction of a switch suitable for use in such systems.

An object of this invention is to provide a switch which shall be simple in construction and rapid in operation.

A feature of the invention is the use of mechanically operable contact sets individual to outgoing lines, the arrangement being such that these contact sets are moved out of the path of a moving contact-operating element when the line with which they are associated is in a non-selectable condition.

An additional feature of the invention is the provision of three movable contact-operating members in fixed relation to one another. The switch is designed primarily for use as a hunting switch, and the peculiar angular relation between these three contact-operating members and the sets of contacts arranged for coöperation with them, is such that whichever contact operating member first reaches a line in the desired condition will operate the contacts of such line. As a result of this arrangement fewer steps are necessary before a line in the desired condition can be seized.

A further advantage which may be obtained from the use of a switch of this type is again due to the peculiar angular relation between the contact sets and the contact-operating members. As a result of this arrangement the outgoing lines will not be tested in a predetermined order, and therefore the apparatus associated with such outgoing lines will receive approximately equal shares of the work which is to be distributed to them by the switch.

The switch, as shown and described, is intended for use primarily as a distributing switch individual to a calling subscriber's line. It is obvious, however, that a switch of this character is adapted to a variety of uses, and the invention is, therefore, to be restricted only by the appended claims.

It is thought that the invention will be best understood from the following detailed description, reference being had to the accompanying drawings.

In the drawings, Figure 1 shows operating circuits for a switch embodying the features of the present invention, and Fig. 2 shows such portions of an operating mechanism as are necessary to an understanding of the operation of the switch.

The mechanical construction of the switch will first be described. Referring now to Fig. 2, a shaft 1 is rotatably mounted on bearings of any suitable character. Secured to said shaft and rotatable therewith is a yoke provided with three arms, 3, 4 and 5. The arms 3, 4 and 5 project radially from the center of rotation and are spaced apart equal angular distances. Since the three arms are spaced equally in the circumference of a circle, it is obvious that the distance between the arms is 120°. Fixedly secured to the yoke 2 is a ratchet wheel 6, which may be rotated in a counter-clockwise direction under the control of a resilient pawl 7, mounted on the armature 8 of a stepping magnet 9.

Ten sets of contacts similar to the sets indicated generally at 10 are spaced equally about the circumference of the circle. The contacts 10 are arranged in pairs and are operated by the action of cams 11 and 12 carried by each of the arms 3, 4 and 5 respectively. Each set of contacts 10 is mounted on an arm 13, pivoted at 14 and arranged for motion in a vertical plane under the control of a magnet 15.

Briefly, the operation of the switch is as follows: When a call is initiated, stepping magnet 9 will function in a self-interrupting circuit to advance the contact operating members carried by the arms 3, 4 and 5 respectively. The contacts sets 10 of all trunks, which are in a busy condition, will be drawn down out of the path of the moving contact-operating elements due to the energization of their associated magnets 15, it being understood that there is a magnet 15 for each trunk at each subscriber's switch. These magnets 15 function in multiple when a line is seized so that the trunk cannot be seized by the switch of any other subscriber,

since the contact set associated with such trunk at the other subscriber's switch will be out of the path of the moving contact-operating element. As soon as a set of contacts is operated, which will occur as soon as the operating elements carried by one of the arms 3, 4 or 5, engage a contact set which is projecting into the path of such elements, the circuit of stepping magnet 9 is opened and the switch is brought to rest. Coincident to the operation of the set 10, the trunk cut-off relays 15 associated with such trunk at other subscribers' switches will function to remove all other contact sets out of possible engagement, thus rendering the trunk non-selectable. The possibility of overthrow or reverse movement of ratchet wheel 6 is eliminated by the action of a holding pawl 17.

Since the contact sets are spaced equally about the circumference of the circle, and are ten in number, it follows that the angular distance between adjacent contact sets is 36°. The ratchet wheel 6 is designed to have 60 teeth so that the contact-operating members will be advanced 6° at each step of the ratchet wheel.

It will now be assumed that the various points about the circumference of the circle, described by the arms 3, 4 and 5 during rotation, at which contact sets are located, are indicated by the letters A, B, C, D, E, F, G, H, M and N, respectively. It will further be assumed that at the time a call is initiated the position of the various arms with respect to these contact sets is as shown in the drawings. By recalling that the contact sets are 36° apart and that the contact-operating arms are spaced 120° apart, it will be obvious that if contact arm 5 must be advanced one step to operate the contacts at B then the contact arm 4 will be one step in advance of position M, and arm 3 will be three steps in advance of position F.

When the subscriber initiates a call the arms 3, 4 and 5 will be advanced. If the trunk, whose associated contact set is located at B, is in a selectable condition, the contacts of such trunk will be operated and the switch brought to rest in this position. However, if the contact set at B is associated with a busy trunk, the switch will continue its advance and the next set of contacts to be tested will be that at E. The trunk associated with the contacts of E will or will not be seized in accordance with the idle or busy condition of such trunk. Provided that the contacts at E are those of a non-selectable trunk, arm 4 will make the next test when it reaches position H. It will, therefore, be seen that each succeeding test is made in a different sector of the circle.

When a contact set associated with an idle trunk is found, the switch is brought to rest and the members 11 and 12 operate the contacts of such set. Upon completion of the conversation the switch is advanced one step. For instance, if upon initiation of a call the subscriber's line is extended to the trunk whose contacts appear at B, this step will bring arm 3 within 2 steps of the contact set at E. The step made upon release will then bring arm 3 within one step of the contact set at E, so that upon initiation of a subsequent call the trunk, whose contact set appears at E, may be seized upon but one step of the switch. An inspection of the drawing will show that whenever the switch is released, regardless of which arm and which contact set was utilized, there will always be an arm within one step of a contact set and therefore only one step will be necessary, upon a subsequent initiation of a call, to seize the trunk associated with such contact set, provided that it be idle.

The operating circuits of the switch will now be described, reference being had to Fig. 1. When the subscriber, whose substation is indicated at 18, removes his receiver from the switchhook, a circuit is completed from the grounded battery, upper winding of the line relay 19, outer upper armature of cutoff relay 20, then in series through the normally closed springs 21 associated with the various outgoing lines at his switch, through the substation apparatus, and thence by way of the normal contacts of springs 22, the inner upper armature of cutoff relay 20 and its back contact and the lower winding of relay 19 to ground. Line relay 19 is energized and completes a circuit from grounded battery, winding of stepping magnet 9, armature and back contact of magnet 9, contacts 23 in their normal position, the armature and front contact of relay 19 to ground. This is a self-interrupting circuit for controlling stepping magnet 9, which causes the contact-operating elements to be advanced until the operating elements 11 and 12 engage and operate a set of contact springs associated with an outgoing line which is in a selectable condition. As soon as this occurs, the springs 21, 22, 23, 24 and 29 associated with such line are thrown into engagement with their working contacts.

If it be assumed that the trunk seized is the one leading to the selector switch, whose brushes are indicated at 25, 26 and 27, it is obvious that as soon as the spring 24 engages its working contact, a circuit is completed from ground through the working contact of spring 24 over conductor 28 and thence by way of multiples at the other subscribers' line switches through the magnets 15 at such line switches to grounded battery. The magnets 15 at such other switches will therefore be energized to draw the contact sets down out of the path of the contact operating elements so that when

the subscribers to which such switches are individual, initiate calls the line cannot be seized.

The engagement of springs 21 and 22 with their working contacts connect the calling subscriber directly to the main conductors of the trunk seized.

As soon as spring 23 opens its normal contact, the driving circuit of stepping magnet 9 is opened and the contact-operating elements are brought to rest in a position to keep the various contact springs in engagement with their working contacts. As soon as the trunk is seized, a circuit is completed from ground through the winding of cutoff relay 20 and thence by way of the spring 29 and its working contact over conductor 30 through apparatus of any well-known type associated with the trunk seized, to grounded battery. Cutoff relay 20 is energized in this circuit and removes the control of line relay 19 from the calling subscriber in the well-known manner. When conversation is completed, the circuit of cutoff relay 20 is broken in any desired, well-known manner and this relay deënergizes. A circuit is then completed from grounded battery, winding of stepping magnet 9, armature and back contact of magnet 9 through springs 23 and their normal contacts at contact sets other than the one associated with the trunk which has been seized, thence by way of the actuated spring 23 and its working contact over conductor 31, lower armature and back contact of cutoff relay 20, also armature and back contact of relay 19 to ground. The contact operating elements are advanced one step in this circuit, thus allowing the contact springs to return to their normal position. As soon as spring 23 leaves its working contact, the circuit of magnet 9 is opened. As previously described, this step, upon completion of conversation, operates to bring another arm and its associated contact operating elements into such a position that one step will bring it into engagement with the contact set of one of the outgoing lines, provided that such outgoing line is idle.

What is claimed is:

1. In an automatic switch, a plurality of circuit closers, a plurality of operating members in fixed relation to one another, a driving mechanism common to said members, and means to bring said members successively into operative relation with said circuit closers.

2. In an automatic switch, a plurality of circuits to be tested, a plurality of testing members, means to cause one of said members to make a test, and means to cause each of the other of said members to make a test of other circuits before said first member makes its second test, regardless of the position of said first member when said test was made.

3. In an automatic switch, a plurality of circuit closers arranged in the arc of a circle, a plurality of rotatable members in fixed angular relation to one another and in operative relation to said circuit closers, step-by-step mechanism to control the advance of said members, means to advance a given one of said members from one of said circuit closers to the next as a result of a plurality of steps by said step-by-step mechanism, and means to bring said members successively into operative relation with said circuit closers.

4. In an automatic switch, a plurality of circuit closers, a plurality of operating members in fixed relation to one another, driving mechanism for said members, means to bring one of said members into operative relation with one of said circuit closers, means to advance said operating member toward the next adjacent circuit closer, and means to bring each of the other operating members into operative relation with others of said circuit closers before said first member is brought into operative relation with said next adjacent circuit closer.

5. In an automatic switch, an incoming line, a plurality of outgoing lines, a mechanically operable contact set individual to each of said outgoing lines, a plurality of contact operating members in fixed relation to one another arranged for rotary motion, means to establish connection between an incoming line and an outgoing line upon operation of one of said contact sets as a result of engagement by one of said movable contact-operating members, and means to remove said contact sets from the path of said operating members when the outgoing lines with which they are associated are in a certain condition.

6. In an automatic switch, an incoming line, a plurality of outgoing lines, a mechanically operable contact set individual to each of said outgoing lines, a plurality of movable contact-operating members in fixed relation to one another, means to establish a connection between an incoming line and an outgoing line upon operation of one of said contact sets as a result of engagement by one of said movable contact-operating members, and means to remove said contact sets from the path of said operating members when the outgoing lines with which they are associated are in a certain condition.

7. In an automatic switch, an incoming line, a plurality of outgoing lines, a plurality of circuit closers arranged in the arc of a circle, a plurality of rotatable members in fixed angular relation to one another and in operative relation to said circuit closers, means to operate a circuit closer when engaged by one

of said members to establish a connection between said incoming line and an outgoing line, means to disengage said operating member from said circuit closer when connection is no longer desired, and means to remove said contact sets from the path of said operating members when the outgoing lines with which they are associated are in a certain condition.

8. In an automatic switch, an incoming line, a plurality of outgoing lines, a circuit closer individual to each of said outgoing lines, said circuit closers being arranged in the arc of a circle, a plurality of rotatable members in fixed angular relation to one another and in operative relation to said circuit closers, means to advance said members in a step-by-step movement, means to remove said circuit closers from operative relation with said members when the lines with which they are associated are in a certain condition, means to operate a circuit closer when engaged by one of said members to establish connection between said incoming line and an outgoing line, means to advance said member one step to release said circuit closer when connection is no longer desired, and means to advance another one of said members as a result of said step into such a position that a single subsequent step will cause it to engage a circuit closer, provided the line with which said circuit closer is associated is in a certain condition.

In witness whereof, I hereunto subscribe my name this 7th day of May, A. D. 1919.

GEORGE THOMPSON.