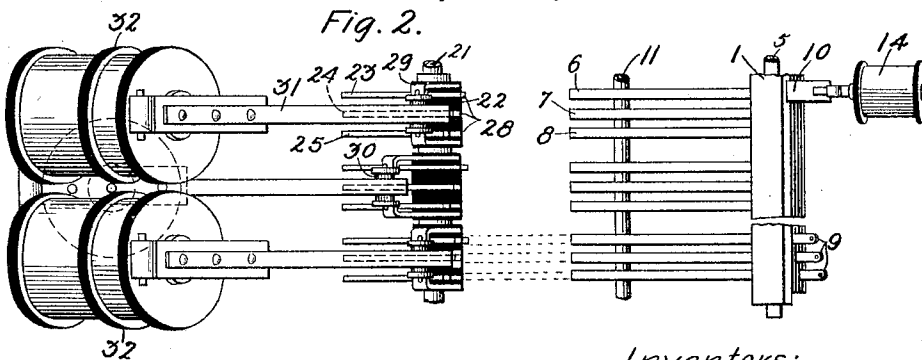
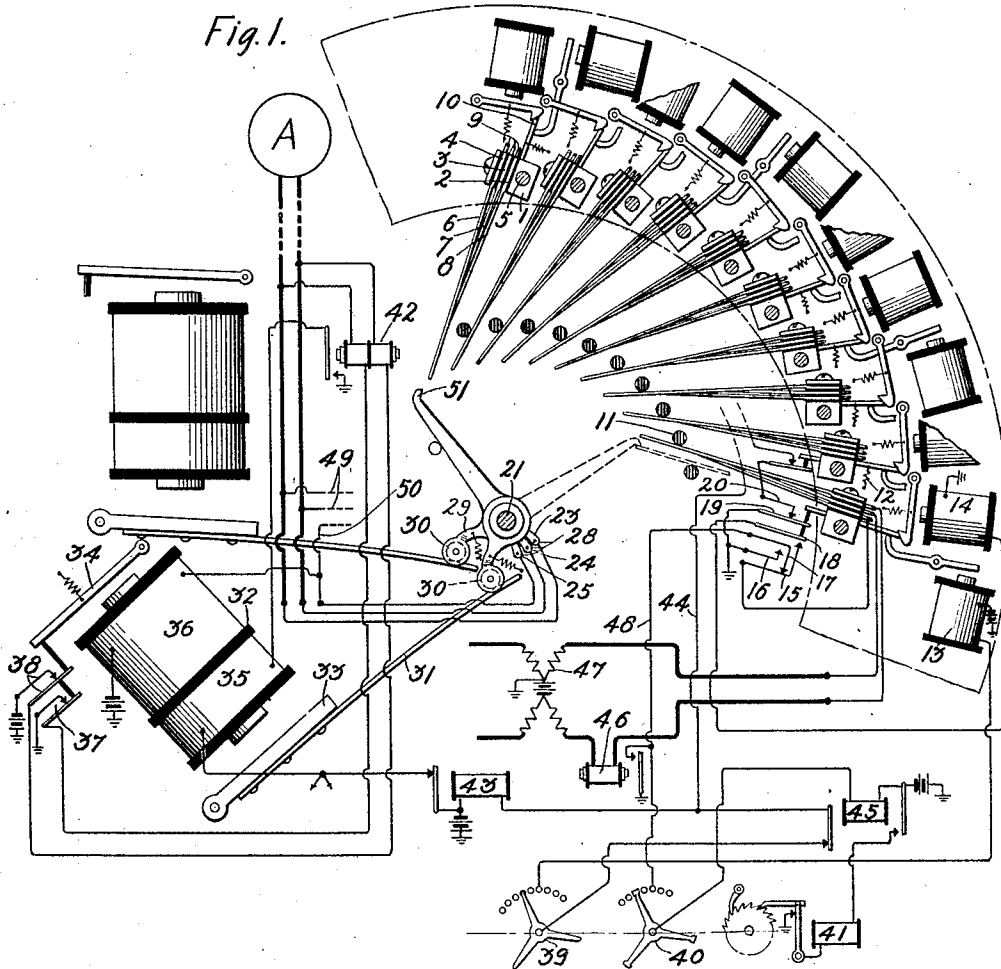


J. N. REYNOLDS AND J. F. HEARN.
 AUTOMATIC SWITCH.
 APPLICATION FILED AUG. 29, 1917.

1,337,794.

Patented Apr. 20, 1920.



Inventors:
 John Newberry Reynolds.
 John F. Hearn.
 by *S. C. Harnes* Att'y.

UNITED STATES PATENT OFFICE.

JOHN NEWBERRY REYNOLDS, OF GREENWICH, CONNECTICUT, AND JOHN F. HEARN, OF PASSAIC, NEW JERSEY, ASSIGNORS TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

AUTOMATIC SWITCH.

1,337,794.

Specification of Letters Patent.

Patented Apr. 20, 1920.

Application filed August 29, 1917. Serial No. 188,760.

To all whom it may concern:

Be it known that we, JOHN NEWBERRY REYNOLDS and JOHN F. HEARN, citizens of the United States, residing at Greenwich, in the county of Fairfield and State of Connecticut, and at Passaic, in the county of Passaic and State of New Jersey, respectively, have invented certain new and useful Improvements in Automatic Switches, of which the following is a full, clear, concise, and exact description.

This invention relates to automatic switches for use in telephone exchange systems, and has for its object the provision of a line switch of new and improved structure.

In former line switches of the cross-bar type, it has been usual to provide a set of terminal bars, arranged parallel to each other, and a second set of parallel bars transverse to said first set, each bar carrying a plurality of sets of contacts, one set on every bar to cooperate with each of the transverse bars. Thus a switch, serving to connect, say one hundred subscribers' lines with ten trunk lines, would require one thousand sets of trunk contacts and one thousand sets of line contacts, or two thousand sets in all.

In accordance with the present invention, one set of bars is arranged in an arcuate bank, while for each transverse bar there is substituted a brush set capable of rotating over the bank and cooperating with contacts on any bar. Thus, in a switch of the capacity mentioned, one thousand sets of trunk contacts would still be required, but only one hundred sets of line contacts, or eleven hundred in all.

At the same time that the saving in the number of contact sets is effected, nothing is lost in rapidity of operation, for means are provided whereby the brush is swept over the bar contacts in a continuous motion until the selected contact is reached.

The contacts may be rendered selectable by a simple rotation of the selected bar, which will swing the ends of the contact springs into the path of any brush which may be actuated. As soon as a set of contacts is taken for use, its bar is rotated back to normal position, rendering non-selectable the other contact sets on the bar. The fact that no longitudinal movement of the bars

is necessary, allows the use of brushes of the simplest construction, such as metal stampings. Neither do the bars themselves require complicated mountings.

Reference will now be had to the accompanying drawings, in which Figure 1 shows a plan view of a switch embodying the features of this invention, with such portions of the circuit therefor as are necessary to an understanding of its operation; and Fig. 2 shows a front elevation of a portion of such a switch.

A plurality of trunk bars 1 are arranged in a circular arc and are pivotally mounted, by means of pins 5, in a frame (not shown). Secured to each trunk bar, but insulated from each other, are conducting strips 2, 3 and 4, which are provided with integral contact springs 6, 7 and 8, one set of said springs being provided to cooperate with each line brush in the structure. At the bottom of each of the strips 2, 3 and 4 there is a set of terminals 9 to which the trunk conductors may be connected. A lever 10 is also provided on each trunk bar for setting the bar. The bars 1 are normally held in position with their springs 6, 7 and 8 pressing against vertical rods 11 by retractile springs 12. A setting magnet 13, individual to each bar, when energized, sets its bar by pressure of its armature against the lever 10. The bars are held in set position by a catch, carried on the armature of the trip magnets 14, one of which is provided for each bar. A set of off-normal springs, individual to each bar, is arranged so that the springs 15, 17 and 19, 20 will be normally closed, but, when the bar is set, these springs will be open and springs 16, 17 and 18, 18 will be closed.

A vertical rod 21, fixed at the center of the arc formed by the trunk bars, carries loose collars 22, one of which is provided for each subscriber's line terminating in the switch. Supported in each collar is a set of brushes 23, 24, 25, which cooperate with trunk springs 6, 7 and 8, respectively, when the brushes are operated. Each brush is provided with a terminal 28 for connection to the incoming line conductors. A yoke 29 on each collar carries a roller 30 to cooperate with armature lever 31 of its operating magnet 32.

These operating magnets 32 are individ-

ual to incoming lines and may be arranged in vertical rows, as shown. By dividing them into two vertical rows, close spacing of the brushes and trunk contacts is attained. Each operating magnet is provided with two armatures 33 and 34, and with two windings, 35 being of low resistance and 36 of high resistance. When the winding 35 is energized both armatures 33 and 34 are attracted, the armature 33 causing its lever 31, by engagement with roller 30, to sweep its brush set into engagement with the first trunk springs which are encountered in set position. Armature 34, when attracted, opens the normally closed contact springs 37 and 38. The energization of winding 36 will hold armature 33 if it has been already attracted, but will not operate said armature. This winding will, however, operate the armature 34.

An auxiliary switch, having wipers 39 and 40, is operated by a magnet 41 to advance the wipers one step upon each retraction of the armature of the magnet 41. The set wiper 39 passes out of engagement with one contact before engaging the next, whereas test wiper 40 engages the next contact before breaking contact with the one on which it rests. As the contact springs 15, 16, 17 and 18 are individual to each trunk bar, it has been considered necessary to show only a single set, but the circuit through contact springs 19 and 20 extends in series through such springs of all trunk bars, so that it will be closed only when every bar is in normal position, and will be broken as soon as any bar is set for selection. Other features of the switch will be more readily understood from a consideration of its operation, which is as follows:

When the subscriber at substation A removes his receiver from its hook, a circuit is closed for line relay 42 from grounded battery, springs 38, right-hand winding of relay 42, through the substation apparatus, left-hand winding of relay 42 and springs 37 to ground. Relay 42, in attracting its armature, closes a circuit from ground, contact and armature of relay 42, winding 35 of magnet 32, back contact and armature of pilot relay 43 to battery and ground. Magnet 32 attracts its armatures, moving the brushes 23, 24 and 25 into engagement with springs 6, 7 and 8, respectively, of a trunk bar which has been set for selection. The armature 34, in operating, opens the circuit of line relay 42, but, as this relay is slow to release, it maintains the circuit for winding 35 until the brushes have engaged a set of contact springs, at which time a circuit is closed from grounded battery, through winding 36, brush 25, contact 8, springs 15 and 18, through the winding of the trip magnet 14 of the seized trunk bar to ground. The winding 36 serves to hold the brushes

in operated position, and the trip magnet 14, in energizing, allows the trunk bar to rotate back to normal position, in which its contact springs will be out of the path of movement of line brushes with the exception of those seized. The seized contact springs are held in operated position by a bent over portion 51 at the end of each brush.

It is to be understood that the wipers 39 and 40 normally rest on contacts of the trunk bar, which has been preselected for use with the next call. As soon as the trip magnet 14 has operated, all the trunk bars will be in normal position, so that a circuit is closed from ground, through springs 19 and 20 of all the trunk bars in series, conductor 44, left-hand armature and back contact of test relay 45, wiper 39, through the winding of the setting magnet 13 of the preselected trunk bar to battery and ground. The magnet 13 is energized in this circuit, and sets its trunk bar. A circuit is also closed in parallel with that just traced through the contact springs 19 and 20 and conductor 44, through the winding of pilot relay 43 to battery and ground. The pilot relay, in attracting its armature, prevents the operation of any line brushes until a trunk bar has been set, since the windings 35 of all the operating magnets are multiplied to the back contact of relay 43.

When the brushes 23 and 24 engage contacts 6 and 7, a circuit is completed from battery, lower winding of repeating coil 47, through the winding of the calling supervisory relay 46, contact 6, brush 23, subscriber's line and substation apparatus, brush 24, contact 7, upper winding of repeating coil 47 to ground. The supervisory relay 46 is operated and places ground on conductor 48, which is substituted for the circuit through trip magnet 14 as soon as the trunk bar has been restored and springs 15, 18 have been opened and 16, 17 have been closed. The ground on conductor 48 also serves as a busy test on the contacts swept by test wiper 40.

As soon as the preselected trunk bar is set, it closes a circuit from ground, through springs 16, 17, its conductor 48, test wiper 40, winding of test relay 45 to battery and ground. Relay 45, in attracting its armatures, closes a circuit from grounded battery, right-hand armature and contact of relay 45, through the winding of auxiliary switch magnet 41, its armature and back contact to ground. Magnet 41 interrupts its own circuit at its armature and back contact, and steps wipers 39 and 40 one step. If the bar associated with these contacts is in use, ground will be found on conductor 48; test relay 45 will be maintained energized and another step will be taken. This operation continues until an idle bar, designated by absence of ground potential on con-

ductor 48, is found, at which time the relay 45 retracts its armatures and opens the circuit of magnet 41. The left-hand armature of test relay 45 prevents the setting of any bar during the travel of the auxiliary switch. At this time one trunk bar is in use with a call, one bar is set for use in the next call, and a third bar has been preselected for use with a subsequent call. The cycle of operations, just traced, may be repeated until every trunk bar is in use, at which time the continued energization of the pilot relay 43 would prevent the operation of any more brushes, so that the connections already set up could not be disturbed. In such a case as this, the auxiliary switch would continue to rotate until one of the trunks was released, at which time it would be set, as described.

At the completion of his conversation, the subscriber, in replacing his receiver on its switchhook, breaks the circuit traced for supervisory relay 46, thus removing ground from conductor 48 and causing deenergization of winding 36 of the operating magnet 32. Magnet 32 now retracts its armatures under the influence of retractile springs, and the removal of the ground from conductor 48 renders the trunk bar, which was in use, selectable for resetting.

When the subscriber's line terminals 49 are seized by a connector switch, ground is placed over conductor 50, through the high resistance winding 36 to battery and ground, causing the operation of armature 34 to break the circuit for line relay 42, so that the line switch brushes will not be operated. Although we have shown the trunk lines as leading to operators' cord circuits, it is to be understood that they might as easily lead to first selector switches in a full automatic system.

What is claimed is:

1. In a switch, a plurality of movable terminal bars arranged in a bank, sets of contacts on said bars, a rotatable brush to co-

operate with contacts on any selected bar, means for actuating said brush, and means for rendering contacts on any bar selectable by a rotation of said bar out of normal position into a selectable position.

2. In a switch, a plurality of rotatable brushes, an arcuate bank comprising a plurality of terminal bars common to said brushes for engagement thereby, means to move any of said bars out of normal position into a selectable position for engagement by said brushes, and means operated on the engagement of a brush with a bar to rotate said bar so that other brushes will not engage therewith.

3. In a switch, a plurality of rotatable bars arranged in an arcuate bank, sets of contacts on said bars, a plurality of rotatable brushes to cooperate with contacts of any of said bars, means for rotating any one of said bars out of normal position into a selectable position to render its contacts selectable, means for rotating said brushes into engagement with selected contacts, and means operable on such engagement for rotating the selected bar to render its contacts non-selectable by another brush.

4. In a switch for telephone exchanges, a plurality of brushes in which lines terminate, a plurality of trunk bars arranged in an arcuate bank, terminals on said bars to cooperate with said brushes, means individual to each trunk bar for rotating it to render its terminals selectable, means individual to each brush to rotate it into engagement with terminals on a selected bar, means operated upon such engagement to restore said selected bar to normal position, and means responsive to said restoration to preselect another bar for use.

In witness whereof, we hereunto subscribe our names this 24th day of August, A. D., 1917.

JOHN NEWBERRY REYNOLDS.
JOHN F. HEARN.