C. W. CLEMMER.

AUTOMATIC SELECTING SWITCH.

APPLICATION FILED JUNE 15, 1912.

1,257,811. Patented Feb. 26, 1918.

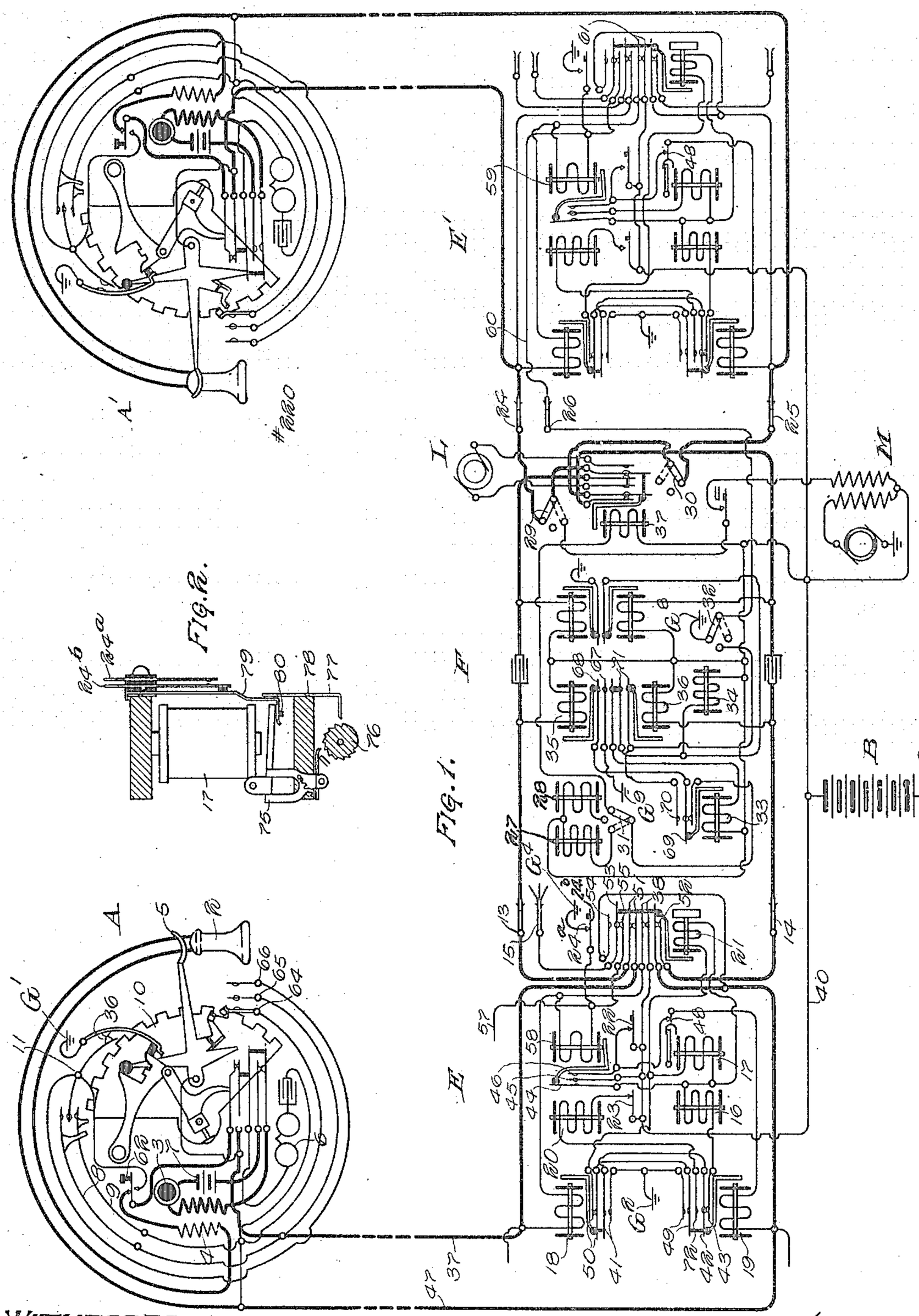

FIG. 1.

FIG. 2.

WITNESSES

Arthur J. Ray.

Albert Andersen.

INVENTOR:

Charles W. Clemmer

By Bulkley & Durand

ATTORNEYS.

UNITED STATES PATENT OFFICE.

CHARLES W. CLEMMER, OF DAYTON, OHIO, ASSIGNOR TO AUTOMATIC ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

AUTOMATIC SELECTING-SWITCH.

1,257,811. Specification of Letters Patent. Patented Feb. 26, 1918.

Application filed June 15, 1912. Serial No. 703,786.

To all whom it may concern:

Be it known that I, CHARLES W. CLEMMER, a citizen of the United States of America, and resident of Dayton, Montgomery county, Ohio, have invented certain new and useful Improvements in Automatic Selecting-Switches, of which the following is a specification.

My invention relates to improvements in selecting switches for automatic telephone systems, and more particularly to switches of the side switchless type—that is, a selecting switch having motion in two intersecting planes, which switch is controlled without the use of the customary and well-known side switch.

The object of my invention is to provide a switch of this type in which the construction and operation are simplified and improved.

Among the novel features I provide improved means for producing the automatic rotation of the switch in selecting an idle trunk, this rotation being directly controlled by the rotary line relay.

A further feature is the novel manner in which the line wipers are disconnected from the switch during the operation of the same.

Another novel feature is the improved manner of operating the rotary off normal springs. Heretofore these springs have been controlled by means of the switch shaft. Such control was objectionable in that the control of these off normal springs tended to retard the movement of this shaft. In my present invention I control these springs by means entirely independent of this switch shaft.

These and other novel features and advantages of my invention will be more readily understood by reference to the accompanying drawings, in which I have illustrated a switch embodying the features of my invention in connection with an automatic system of the well-known Strowger type.

Figure 1 shows a complete connection between a calling substation A and a called substation A′.

Fig. 2 is a detail view of a portion of the central office apparatus.

The system in connection with which I have chosen to illustrate my invention is of the local battery type and of that kind in which first selectors are employed as individual switches for the telephone lines. In Fig. 1 the connection is shown extending through the first selector E, which is individual to the calling substation A, and through a connector switch F to the called substation A′. The selector E′ is the individual selector of the called substation A′. At B there is shown a battery having one terminal grounded at G for the purpose of supplying current for operating the central office apparatus.

The substations shown herein comprise the usual receiver 2, transmitter 3, induction coil 4, switch hook 5, ringer 6 and local battery 7. In addition to the usual telephone apparatus above pointed out, the substation is also provided with an automatic calling device of any suitable character for producing the necessary kind of impulses for operating the central office switches. This calling device, however, may be of any other suitable type. The one shown herein comprises essentially a pair of impulse springs 8 and 9 and a toothed impulse wheel 10, which latter is controlled through the medium of a dial (not shown) in such a manner that upon its operation to call any digit the impulse spring 8 is forced into contact with the ground post 11 a number of times, corresponding to the digit called, after which the impulse spring 9 is forced into contact with said post once. Such a calling device is in general well known in the art and is fully described in United States Letters Patent to E. D. Fales, No. 866,639, issued September 24, 1907, and it is not thought necessary to give a detailed description of the same herein.

The selector E is of the general type of selector switches disclosed in United States Letters Patent No. 815,321, issued March 13, 1906, to Keith, Erickson and Erickson, with the usual side switch omitted and the circuits modified, as will be described hereinafter. This selector includes a bank of contacts arranged in rows or levels and adapted to be engaged by a set of wipers 13, 14 and 15 carried upon a vertically and rotatably movable shaft (not shown) the movement of which is controlled by a so-called vertical magnet 16 and a rotary magnet 17. The operations of the switch are controlled by the calling subscriber through the medium of the usual vertical and rotary line relays 18 and 19. The magnet 20 is the usual re-

lease magnet for restoring the switch to normal position after it has been operated. The wipers 13 and 14 are connected with the line conductors through normally closed contacts of a switching relay 21. This relay is preferably slow acting—that is, slow to deënergize after its energizing circuit has been broken. The desired slow operation of this relay may be obtained by securing a heavy ring of copper or other conducting material around one end of its core. The rotary magnet 17 controls an electrical contact 48 which is opened each time said magnet is energized. The contacts 22 and 23 are adapted to be closed upon the first vertical step of the switch shaft and the contacts 24^a and 24^b are adapted to be closed upon the first movement of the shaft in a rotary direction.

I have provided novel and improved means for operating the said contacts 24^a and 24^b, which means is clearly shown in Fig. 2. Heretofore, such off normal springs have been controlled by a cam on the switch shaft which, as long as the switch shaft was in its normal rotary position, engaged a bushing on one of the springs so as to maintain the contact in its normal position. When the switch shaft was rotated this cam passed out of engagement with the bushing and allowed the contact to assume its operated position. This manner of controlling the rotary off normal contact is objectionable in that the engagement of the cam with the bushing on the spring interferes with the free motion of the switch shaft in a vertical direction. As shown in Fig. 2, these rotary off normal springs are controlled by the armature of the rotary magnet instead of by the switch shaft. Fig. 2 is a more or less diagrammatic view of a section of the switch shown in said Patent No. 815,321, referred to above, said section being taken on a horizontal plane just above the rotary magnet. In this figure, 17 represents the rotary magnet, 75 its armature and 76 the usual switch shaft. 77 is the usual double dog for maintaining the switch shaft in an operated condition. The double dog 77 is pivoted at the point 78. Secured to the back of the switch frame there is a pair of contact springs 24^a and 24^b and an additional flexible spring member 79, which, at its forward free end, is bent over in front of the rotary armature 75. In the bent-over portion of the spring 79 there is an opening which is adapted to be engaged by a short pin 80 in the front of the rotary armature. The rear end of the double dog 77 is also extended back far enough so that when said dog is withdrawn from the shaft it will force the spring 79 inward to the position shown in Fig. 2. Upon the first vertical operation of the switch the double dog drops into the teeth of the shaft in the usual manner, and the rear portion of the double dog therefore moves away from the spring 79. Thus when the rotary magnet is energized the first time and withdraws the pin 80 from the bent-over portion of the spring 79, said spring is released and moves outward under its own tension to force the spring 24^b into contact with the spring 24^a. When the double dog is withdrawn from the switch shaft upon the release of the connection, its rear portion forces the spring 79 back into its normal position, whereupon the pin 80 again engages the opening in the end of the spring 79 so as to lock it in this position until the rotary magnet is again energized.

The connector F is of the general type of connector switches disclosed in United States Letters Patent to Keith, Erickson and Erickson, No. 815,176, issued March 13, 1906. Like the selector, the connector is provided with a set of wipers 24, 25 and 26 which are carried upon a vertically and rotatably movable shaft, the movement of which shaft is controlled by the usual vertical and rotary magnets 27 and 28. The usual side switch comprising the wipers 29, 30, 31 and 32 is controlled by the private magnet 33 in the usual and well-known manner. 34 is the release magnet. The operation of the switch is controlled through the medium of the usual vertical and rotary line relays 35 and 36. 37 is the ringer relay the function of which is to control the application of ringing current to the called line for signaling the called subscriber. At L a ringing current generator is shown and at M there is represented a busy signaling machine for supplying the usual busy signaling current to notify the calling subscriber when the called line is in use.

The selector E′ and the substation A′ are the same as the selector E and the substation A, respectively.

The construction and operation of my improved selector switch will be more readily understood by the following description of the operation of the system described. In order to call the substation A′ the subscriber at the substation A first removes his receiver from the switch hook, then operates his calling dial in accordance with the respective digits of the number of the called substation, which in this case will be assumed to be 220. Upon the initial movement of the subscriber's dial for the first digit 2, the substation ground G′ is connected with the ground post 11 by the closure of the contact 36. As the dial returns to its normal position, the contact between the springs 8 and 11 is closed twice, whereby two impulses of current are transmitted over the circuit extending from the substation ground G′ through the contact 36, springs 11 and 8, line 37, selector line relay 18 and springs 38 to the battery lead 40,

and thence through the battery B to ground G. Each time the relay 18 is energized in response to these impulses, an impulse is transmitted over the circuit extending from ground G^2 through the springs 41, springs 42 and 43, vertical magnet 16 and springs 44 and 45 to the battery lead 40. The vertical magnet 16 operates in response to these impulses to raise the switch shaft two steps to carry the wipers 13, 14 and 15 to a position opposite the second row or level of the bank contacts. The closure of the contact 23 upon the first vertical movement of the switch shaft connects the battery lead 40 with the release magnet 20, while at the same time the closure of the contact 22 connects the rotary line relay 19 to battery, independent of the contact between the springs 45 and 46. After the two impulses are transmitted over the vertical line by the substation impulse spring 8, the rotary impulse spring 9 is forced into contact with the ground post 11, whereby a single impulse is transmitted over the rotary line 47 through the rotary line relay 19, springs 48 and springs 46 and 45 in multiple with the contact 22 to the battery lead 40. The relay 19, upon energizing, closes a circuit extending from ground G^2 through the springs 49 and 50, rotary magnet 17 and the relay 21 in multiple, springs 44 and 45 to the battery lead 40. The rotary magnet, upon energizing, rotates the wipers one step onto the terminal of the first trunk line in the second level, to which level the wipers were raised by the operations of the vertical magnet hereinabove described. The relay 21 is energized in multiple with the rotary magnet and by opening the contacts 51 and 52 disconnects the line wipers 13 and 14 from the line while they are being rotated. If this first trunk line, upon the terminal of which the wipers have been rotated, is not already in use, the relay 21 deënergizes shortly after the impulse is transmitted through the rotary magnet and completes the connection between the calling line and the trunk line. If, however, this first trunk line is already in use, the private wiper 15 finds the contact which it engages provided with a guarding ground potential. This guarding potential is supplied through some other occupying switch in a manner which will be fully described hereinafter. Upon the engagement of the wiper 15 with the grounded contact of a busy line, and while the relay 21 is energized, a circuit is closed from said grounded contact through the wiper 15, springs 53 and 54, rotary line relay 19, springs 48 and contact 22 to the battery lead 40. The rotary line relay 19 thereupon immediately energizes and again closes the circuit of the rotary magnet 17 and the relay 21. The rotary magnet 17, upon energizing, rotates the wipers a second step and breaks the circuit of the relay 19 at the springs 48. The relay 19 thereupon deënergizes, breaking the circuit of the magnet 17, which in turn deënergizes and again closes the circuit of the relay 19. It will thus be seen that as long as the wiper 15 continues to engage grounded contacts, the circuit of the rotary magnet 17 will be periodically interrupted to rotate the wipers 13, 14 and 15 step by step over the contacts of the busy trunks. The relay 21, which is energized in multiple with the rotary magnet 17, being slow acting does not deënergize between the impulses, and therefore remains in its operated position continuously while the wipers are being rotated and thus keeps the line conductors 37 and 47 disconnected from the wipers while they are passing over the contacts of the busy trunks. When the wiper 15 passes off the last grounded contact, the energizing circuit for the rotary relay 19 is destroyed and the wipers come to rest. The relay 21 deënergizes shortly thereafter and completes the connection with the selected trunk line through the contacts 51 and 52. The closure of the contact between the springs 53 and 55 extends a guarding ground potential from the ground G^4 through the contacts 24^a and 24^b, and through said springs 55 and 53 and the private wiper 15 to the selector private bank contacts of the seized trunk. A guarding potential is extended to the connector private bank contacts of the calling line immediately upon the first rotary step of the selector, said potential extending from ground G^4 through the contacts 24^a and 24^b and over the conductor 57 to said contact. Upon the deënergization of the relay 21 after the last rotary step of the selector, a circuit is closed through the battery cut-off relay 58, which circuit extends from ground G^4 through the springs 24^a and 24^b, relay 58 and springs 38 to the battery lead 40. The relay 58, upon energizing, disconnects the battery from the vertical and rotary magnets.

The apparatus is now in position to receive the impulses for the second digit of the called number. These impulses pass through the wipers 13 and 14 of the selector E and thence to the connector F. These impulses operate this connector in the well-known manner to step the same up, first, to the second level and then around to the tenth contact in this level, which contact belongs to the desired called subscriber. When this connection is completed, a guarding potential is placed upon the connector private bank contact of the called line in the well-known manner in order to prevent a second connection being made with this line.

In order to signal the called subscriber the calling subscriber presses the ringing button 62, whereby the vertical line 37 is

grounded to energize the vertical line relay 35 of the connector. Since the side switch wiper 31 is now in third position, the energization of the relay 35 closes the circuit of the ringing relay 37, whereby the connection between the calling and the called lines is temporarily open and the ringing current generator L is connected with the called line.

After the conversation is completed the central office apparatus is released by the hanging up of the receiver at the calling substation. This is accomplished in the following manner: As the switch hook descends, the springs 64, 65 and 66 are all pressed into contact simultaneously, whereby both sides 37 and 47 of the calling line are grounded at the same time. The simultaneous grounding of the conductors 37 and 47 energizes the line relays 18 and 19 and 35 and 36 of both the selector E and the connector F. In the connector F the energization of the relay 36 closes the circuit of the private magnet 33 in the usual manner. The relay 35, upon energizing, at the same time closes a circuit from ground G^9 through the springs 67, 68, 69, 70 and the springs 71 and the release magnet 34 to the battery lead 40. The magnet 34, upon energizing, immediately restores the mechanism of the connector switch to normal position. In the selector E the simultaneous energization of the relays 18 and 19 closes the circuit of the release magnet 20, this circuit extending from ground G^2 through the springs 41, springs 42 and 72, magnet 20 and the contact 23 to the battery lead 40. The magnet 20, upon energizing, attracts its armature and holds it in readiness to release the switch upon its back stroke when the switch hook descends far enough to break the circuit of the line relays 18 and 19 to allow them to deënergize to open the circuit of the release magnet.

It will thus be seen that I have devised a very efficient form of side switchless selector and one in which the positive operation thereof is secured.

While I have illustrated one particular embodiment of my invention, and have shown the same in connection with a particular automatic system, it is, of course, understood that many changes will readily suggest themselves to those skilled in the art and come within the broader scope of my invention. Likewise, my improved selector switch is not limited to use in connection with full automatic systems, but is equally as well adapted for use in semi-automatic systems of any of the well-known types.

What I claim as my invention is:—

1. In a telephone system, a telephone, a central office, a pair of line conductors connecting said telephone with the central office, an automatic switch, trunks accessible to said switch, said trunks divided into groups, said switch having means for electing a group of trunks by one motion and for thereafter finding a line in the group by a second motion, a first relay in one of said line conductors, a second relay in the other of said line conductors, said first relay for controlling said first motion, a motor magnet for moving the switch to find a line, said magnet and said second relay controlling each other's circuits.

2. In a telephone system, a plurality of trunk lines divided into groups, a selecting switch having one motion to select groups and another motion to select an idle line in the selected group, a line relay for controlling the first movement, a second line relay, an operating magnet controlled by said second line relay for controlling the second motion of said switch, a third relay connected in multiple with said operating magnet, and a circuit for said second line relay controlled by said third relay.

3. In a telephone system, a plurality of trunks divided into groups, an automatic selecting switch having one motion to select groups and another motion to select an idle trunk in the predetermined group, a relay for controlling said second motion, manual means for initially energizing said relay over the line circuit to cause said switch to be operated one step, and automatic means for then energizing and deënergizing said relay to operate said switch to select an idle trunk.

4. In a telephone system, a plurality of trunk lines divided into groups, a selecting switch having one motion to select groups and another motion to select an idle trunk in the predetermined group, a line relay, an operating magnet controlled thereby, a second relay controlling an energizing circuit for said line relay, manual means for initially energizing said line relay to operate said switch one step. and a circuit for said line relay controlled by said second relay for automatically energizing said line relay one or more times to operate said switch to select an idle trunk.

5. In a telephone system, a plurality of trunk lines divided into groups, a selecting switch having one motion to select groups and another motion to select an idle trunk in the predetermined group, a line relay, an operating magnet controlled thereby, a second relay connected in multiple with said operating magnet and controlling an energizing circuit for said line relay, manual means for initially energizing said line relay to operate said switch one step, and a circuit for said line relay controlled by said second relay for automatically energizing said line relay one or more times to operate said switch to select an idle trunk.

6. In a telephone system, a plurality of

trunk lines divided into groups, a selecting switch having one motion to select groups and another motion to automatically select an idle trunk in a group, a line relay individual to said switch, line wipers for said switch by which said switch connects with said trunks, an operating magnet for controlling the second movement of said switch in response to the operation of said line relay, and a relay connected in multiple with said operating magnet for disconnecting said line wipers from said switch during said second movement.

7. In a telephone system, a plurality of trunk lines divided into groups, a selecting switch having one motion to select groups and another motion to automatically select an idle trunk in a group, a line relay individual to said switch, line wipers for said switch by which said switch connects with said trunks, an operating magnet for controlling the second movement of said switch in response to the operation of said line relay, and a slow acting relay connected in multiple with said operating magnet for disconnecting said line wipers from said switch during said second movement.

8. In a telephone system, a plurality of trunk lines divided into groups, a selecting switch having one motion to select groups and another motion to automatically select an idle trunk in a group, a line relay, an operating magnet for controlling said second movement controlled by said line relay, an energizing circuit for said line relay controlled by said operating magnet, a second relay connected in multiple with said operating magnet, and means controlled by said second relay for controlling the circuit of said line relay.

9. In a telephone system, a plurality of trunk lines divided into groups, a selecting switch having one motion to select groups and another motion to automatically select an idle trunk in a group, a line relay, an operating magnet for controlling said second movement controlled by said line relay, an energizing circuit for said line relay controlled by said operating magnet, a second relay connected in multiple with said operating magnet, means controlled by said second relay for controlling the circuit of said line relay, a pair of line wipers for said switch, and means controlled by said second relay for disconnecting said line wipers from the switch during said second movement thereof.

10. In a telephone system, a selecting switch comprising a switch shaft, means for moving said shaft first in one direction and again in another direction to find an idle trunk, a pair of contacts normally separated, and means independent of the switch shaft for closing said contacts upon the initiation of the second motion of said shaft for controlling a guarding potential circuit associated with the switch.

11. In a telephone system, a selecting switch comprising a switch shaft, means for moving said shaft first in one direction and again in another direction to find an idle trunk, a magnet for controlling said second motion, a pair of contacts normally separated, and means controlled by said magnet for closing said contacts upon the initiation of the second motion of said shaft for controlling a guarding potential circuit associated with the switch.

12. In a telephone system, a selecting switch comprising a switch shaft, means for moving said shaft in one direction and means, comprising a magnet, for then moving the shaft in another direction to find an idle trunk, a pair of contacts normally separated, and means controlled by said magnet for closing said contacts upon the initiation of the second motion of said shaft by said magnet to control a guarding potential circuit associated with said switch.

13. In a telephone system, a selecting switch comprising a switch shaft, means for moving said shaft first in one direction and again in another direction to find an idle trunk, a pair of contacts normally separated, means independent of the switch shaft for closing said contacts upon the initiation of the second motion of said shaft to control a guarding potential circuit associated with the switch, and means controlled by the release of said switch for again separating said contacts.

14. In a telephone system, a selecting switch comprising a switch shaft, means for moving said switch in one direction and means, comprising a magnet, for then moving the shaft in another direction to find an idle trunk, a pair of contacts normally separated, means controlled by said magnet for closing said contacts upon the initial rotation of said shaft to control a guarding potential circuit associated with said switch, and means controlled by the release of said switch for again separating said contacts.

Signed by me at Dayton, Montgomery county, Ohio, this 6th day of June, 1912.

CHARLES W. CLEMMER.

Witnesses:
JOHN J. MARSH,
BESSIE M. MARSH.