J. L. McQUARRIE.

ELECTRIC SWITCH.

APPLICATION FILED SEPT. 22, 1916.

1,249,154.

Patented Dec. 4, 1917.

2 SHEETS—SHEET 1.

Fig. 1.

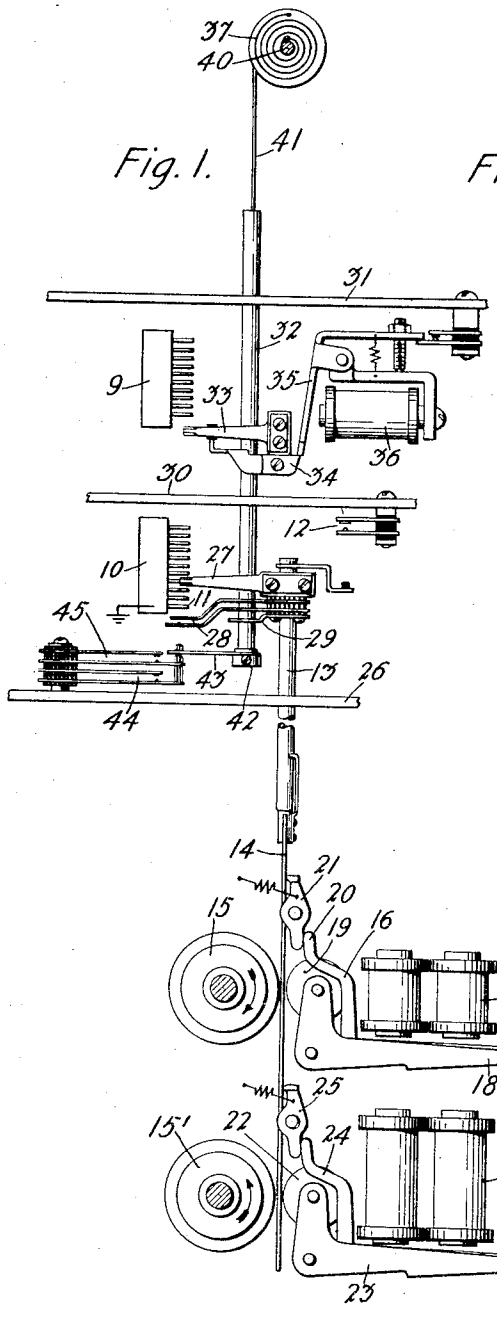
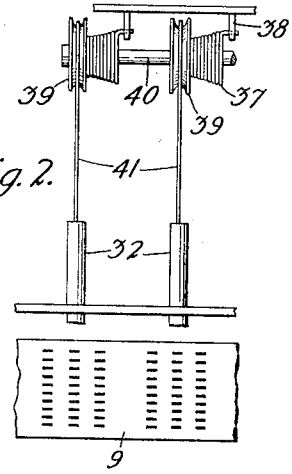


Fig. 2.



Inventor:
James L. McQuarrie.
by J. E. Roberts Att'y

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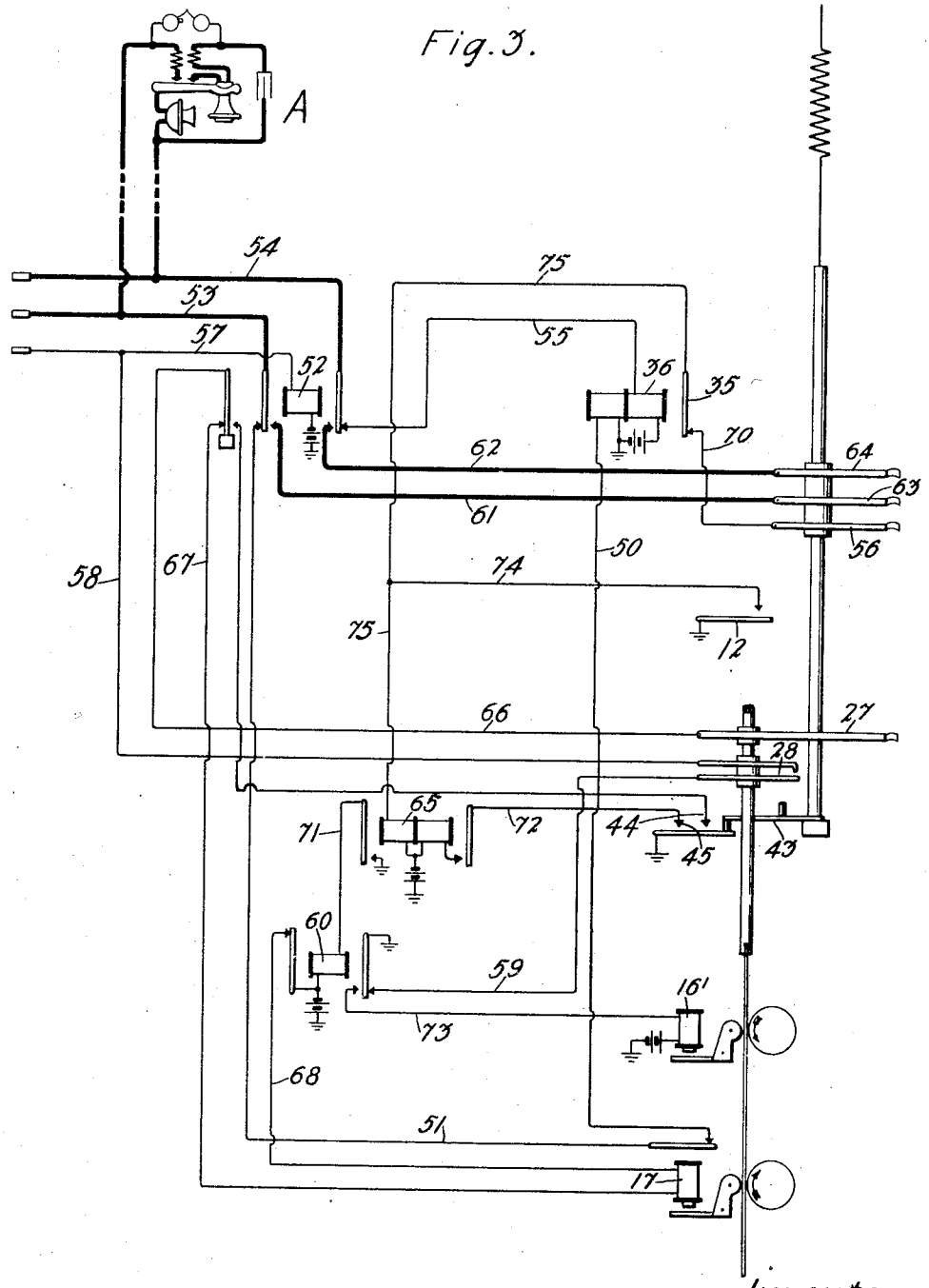
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2 SHEETS—SHEET 2.

Fig. 3.



Inventor:
James L. Mc Quarrie.
J. E. Roberts
Att'y.

UNITED STATES PATENT OFFICE.

JAMES L. McQUARRIE, OF MONTCLAIR, NEW JERSEY, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTRIC SWITCH.

1,249,154. Specification of Letters Patent. Patented Dec. 4, 1917.

Application filed September 22, 1916. Serial No. 121,584.

To all whom it may concern:

Be it known that I, JAMES L. McQUARRIE, a citizen of the United States, residing at Montclair, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Electric Switches, of which the following is a full, clear, concise, and exact description.

This invention relates to electric switches, and especially to switches for use in automatic and semiautomatic telephone systems.

The object of the invention is to effect the association of a movable contact with the terminals of a desired line by the use of a mechanical stop arranged to preselect such line. The switch is shown in use as a line switch to connect a calling line to an idle trunk leading to succeeding apparatus, but it is obviously not restricted to such use and may be used in any place where it is desired to render a plurality of outgoing lines available to one or more incoming lines of any description.

In the embodiment of the invention shown, a test brush having a mechanical stop arranged in fixed relation thereto moves over the terminals of a test bank and stops on a terminal in the desired condition. A movable contact is arranged to move over a line terminal bank and is released when the trunk terminating in said movable contact is seized. On release, it moves until it engages with the stop previously set, in which position the movable contact is located on the terminals of the desired line. The call is extended through the line terminals taken to secure the called party in any desired manner. On taking of the line terminals, the test brushes of other switches resting on the test terminals of that line are moved into contact with the next terminal in the test bank in the desired condition, thus preselecting the terminal set to be taken by the operation of the next movable contact. On completion of conversation, the brush is returned to normal, bringing with it the movable contact. On reaching normal, the contact is engaged against further movement while the brush moves at once to preselect another test terminal in the desired condition.

Referring to drawings, Figure 1 shows a side elevation of a switch embodying the features of the invention. Fig. 2 shows a partial front elevation of the same, and Fig. 3 shows a circuit arrangement for use with the switch when used as a line switch.

The switch bank is of the panel type and comprises an upper section 9 in which the multiple terminal sets of a trunk leading to succeeding apparatus are located, and a lower section 10, containing only test terminals to indicate the condition of the terminal sets in the upper bank to which they are individual. In addition to a multiple test terminal for each of the lines in the upper section 9, section 10 contains a terminal 11, located at the bottom of the bank and connected to ground for a purpose to be later described. The terminal sets of the contact banks 9 and 10 are multipled to provide a number of sets equal to the number of individual switches included within the unit. Each of the switches in the unit has a grounded contact 12 closed in the uppermost position of an elevating rod 13 which carries at its lower end a slotted bar 14. Common to all of the switches is a down-drive friction roll 15 and an up-drive friction roll 15′ with which engagement of the bars 14 is controlled by down-drive magnets 16′ and up-drive magnets 17 individual to each switch in the unit. The down-drive magnet 16′ upon energization pulls up its armature 18 causing an idler 19 to force the bar 14 against the down-drive friction roll 15. An extension 20 on the armature 18 disengages a holding pawl 21 from the slots in the bar 14 to admit of downward movement. The up-drive magnet 17 is of similar construction and, on energization, causes an idler 22 carried on the armature 23 to force the bar 14 against the up-drive roller 15′, while an extension 24 disengages a holding pawl 25 from the slots in the bar 14 to permit upward movement of said bar. The holding pawl 21 is arranged to permit upward movement of the bar, but to normally prevent

downward movement, while the holding pawl 25 permits downward movement but normally prevents upward movement. The rod 13 is slidable through a lower plate 26 of the switch frame and carries on its upper end a contact set 27 slidable over the terminals in section 10. In addition, an off-normal contact 28 and a stop plate 29 are mounted on the rod 13. Slidable through the stop plate 29 and through plates 30 and 31 of the switch frame is a movable contact support 32. Mounted on this support is a contact set 33 comprising brushes to engage the three rows of terminals allotted thereto in the contact bank 9. Extending forwardly from these contacts is a latch-piece 34 with which an armature 35 of a magnet 36 normally engages. Each of the switches is provided with a spring 37 secured at one end to a stationary part 38 of the switch frame and at the other end to a pulley 39 rotatably mounted on a shaft 40. A wire 41 secured to the pulley 39 and the contact support 32 tends to raise the contact set 33 under the influence of spring 37, but is normally prevented from doing so by engagement of the armature 35 with the latch-piece 34. Rigidly secured to the lower end of the contact support 32 is a stop collar 42 for engagement with the stop piece 29 on upward movement of said support. The support 32 also carries an arm 43 which, in the lowermost position of the support 32, opens contacts 44 and 45, closed in the normal position of the movable contact, and which, when the collar 42 engages the stop-piece 29, closes the contact 28.

The operation of the switch, in connection with a suitable circuit arrangement therefor, is as follows: On removal of the receiver of the subscriber's set A, shown in Fig. 3, a circuit is completed to the magnet 36 over a circuit extending from ground, left-hand winding of magnet 36, conductor 50, back contact of the armature 23 of the magnet 17, conductor 51, inner left-hand armature and back contact of cut-off relay 52, conductor 53, subscriber's set A, conductor 54, right-hand armature and back contact of cut-off relay 52, conductor 55, right-hand winding of magnet 36 to grounded battery. The magnet 36 attracts its armature, releasing the support 32, which springs up until the collar 42 engages the stop-piece 29. This brings the contact set 33 on the terminals of the line selected by the brush 27. Energization of the magnet 36 also operates to remove battery supply from the test brush 56 of the contact set 33. On upward movement of the support 32, the off-normal contacts 44, 45 are closed, and when the arm 43 engages the contact 28 to close the same, a circuit is completed for cut-off relay 52, the outer left-hand armature of which is made slow to pull up. This circuit extends from grounded battery, relay 52, conductors 57, 58, contact 28, conductor 59, right-hand armature and back contact of relay 60 to ground. Energization of the cut-off relay extends the lines 53 and 54 over the conductors 61 and 62 to the line brushes 63 and 64, thence over the lines secured to the terminals which they engage to succeeding apparatus. The succeeding apparatus is actuated to secure connection to the called party in any desired manner. On energization of the cut-off relay 52, the armature 35 of magnet 36 falls off. The succeeding apparatus would be arranged so that no ground is placed on brush 56 to energize release relay 65 until disconnection is desired. Upon energization of cut-off relay 52, ground is placed on the test terminals of the seized line in section 10, on which terminals brushes 27 of other switches may be positioned. A circuit is completed for the up-drive magnets 17 of such switches from the grounded terminal in section 10, brushes 27, conductors 66, outer left-hand armatures of cut-off relays 52, conductors 67, up-drive magnets 17, conductors 68, and back contacts and left-hand armatures of release relays 60 of such switches to grounded battery. The up-drive magnets 17 then move the brushes 27 upwardly into engagement with the next ungrounded terminal in section 10, whereupon the circuit is broken at the brushes 27. The brushes 27 are made sufficiently broad to bridge adjacent terminals in section 10 while moving from terminal to terminal. Preselection is thus provided for the other switches in the unit.

On completion of conversation, the restoration of succeeding apparatus places ground upon the brush 56 of the switch in use and completes a circuit to return relay 65; this circuit extending from ground over the contact brush 56, conductor 70, back contact and armature 35 of magnet 36, conductor 75, and left-hand winding of relay 65 to grounded battery. Relay 65 pulls up, energizing relay 60 over a circuit extending from ground, left-hand armature and front contact of relay 65, conductor 71 and relay 60 to grounded battery. The right-hand armature of the relay 65, when attracted, completes a holding circuit extending from ground, off-normal contact 45, conductor 72, right-hand armature and front contact and right-hand winding of relay 65 to grounded battery. This operates to hold the relay 65 up until the arm 43 is returned to normal position. Energization of relay 60 completes a circuit for the down-drive magnet 16′ extending from ground, right-hand armature and front contact of relay 60, conductor 73, magnet 16′ to grounded battery. This draws the bar 14 down to normal posi-

tion and the stop-piece 29 engages the collar 42 to bring the support 32 to its lowermost position whereupon the latch-piece 34 is engaged and held by the armature 35. This movement causes the arm 43 to open the off-normal contacts 44 and 45, breaking the holding circuit of the release relay 65. This in turn deënergizes relay 60 and the down-drive magnet 16′.

In its lowermost position, brush 27 engages grounded terminal 11 in section 10, which completes a circuit for the up-drive magnet 17, extending from ground, brush 27, conductor 66, outer left-hand armature and back contact of cut-off relay 52, conductor 67, up-drive magnet 17, conductor 68, back contact and left-hand armature of relay 60 to grounded battery. Relay 52 is energized at this time, but its outer left-hand armature being slow to pull up, does not interrupt the circuit to the up-drive magnet 17, as the brush moves and opens the contact 28, breaking the circuit to the relay 52 before it can pull up its outer left-hand armature. The test brush 27 thereupon is moved upwardly until the circuit of the up-drive magnet 17 is broken by the test brush 27 encountering an ungrounded terminal. The contact 28 opens on upward movement of the test brush and leaves the switch ready for subsequent operation.

In the event that an idle line should not be found by the brushes 27 before reaching the upper terminal in section 10, it is necessary to insure the return of the brushes to the bottom of the terminal bank. Contact 12 is closed when the brush 27 arrives at its upper limit of movement and completes a circuit for magnet 65, from ground, contact 12, conductor 74, relay 65 to grounded battery. Relay 65 being energized will operate relay 60 and down-drive magnet 16′ to return the switch to its lowermost position in which the contact set 33 is held while the test brush 27 moves up and stops on the first idle terminal found.

What is claimed is:

1. In an electric switching device a bank of line terminals, a set of line brushes therefor, a bank of test terminals, a test brush therefor movable independently of said set of line brushes, means for moving said test brush to a predetermined position in said test bank, stop means controlled by said test brush for predetermining the position of said set of line brushes, and means for subsequently moving said set of line brushes to the position determined by said test brush.

2. In an electric switching device, a bank of line terminals, a set of line brushes therefor, a bank of test terminals, a test brush therefor, a mechanical stop to limit the movement of said set of line brushes, means controlled by the condition of said test terminals to position said stop to preselect a desired line terminal.

3. In an electric switching device, a bank of line terminals, a set of line brushes therefor, a bank of test terminals, a brush for said bank of test terminals, a mechanical stop to limit the movement of said set of line brushes, means to hold said set of line brushes against movement, means to position said stop to preselect a desired line terminal, means to release said holding means, and means for moving said set of line brushes to the position predetermined by the movement of the test brush.

4. In an electric switching device, a bank of line terminals, a set of line brushes therefor, a bank of test terminals, a test brush therefor, a mechanical stop to limit the movement of said set of line brushes, means to move said stop to select an idle test terminal, means to move said set of line brushes to the position determined by said stop, a line terminating in said set of line brushes, and means controlled over said line to normally hold said set of line brushes against movement.

5. In an electric switching device, a bank of line terminals, a set of line brushes therefor, a bank of test terminals, a test brush therefor, a mechanical stop to limit the movement of said set of line brushes, means to position said stop to preselect a desired terminal, means to move said set of line brushes to the position determined by said stop, means normally holding said set of line brushes against movement, and means to release said holding means.

6. In an electric switching device, a bank of line terminals, a set of line brushes therefor, a bank of test terminals, a test brush therefor, a mechanical stop to limit the movement of said set of line brushes, means to position said stop to preselect a desired terminal for said set of line brushes, spring means to move said set of brushes, and means to return said set of brushes to normal position and rewind said spring.

7. In an electric switching device, a bank of line terminals, a set of line brushes therefor, a bank of test terminals, a test brush therefor, means for moving said test brush to a predetermined position in said test bank, stop means controlled by said test brush for predetermining the position of said line brushes, means for subsequently moving said line brushes to their predetermined position, and a common restoring means for said line and test brushes.

8. In an electric switching device, a bank of line terminals, a set of line brushes therefor, a bank of test terminals, a shaft, a test brush carried by said shaft, a stop carried by said shaft for limiting the movement of

said set of line brushes, means for elevating said shaft to select an idle test terminal, a second shaft with said set of line brushes mounted thereon, means for elevating said second shaft until it engages with said stop, electromagnetic means for normally holding said set of line brushes, means for releasing said holding means, and a common power-driven means for returning said shafts to their normal positions.

In witness whereof, I hereunto subscribe my name this 20th day of September, A. D., 1916.

JAMES L. McQUARRIE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."