

June 29, 1926.

1,590,402

C. AALBORG

SWITCHING DEVICE

Filed May 9, 1919

3 Sheets-Sheet 1

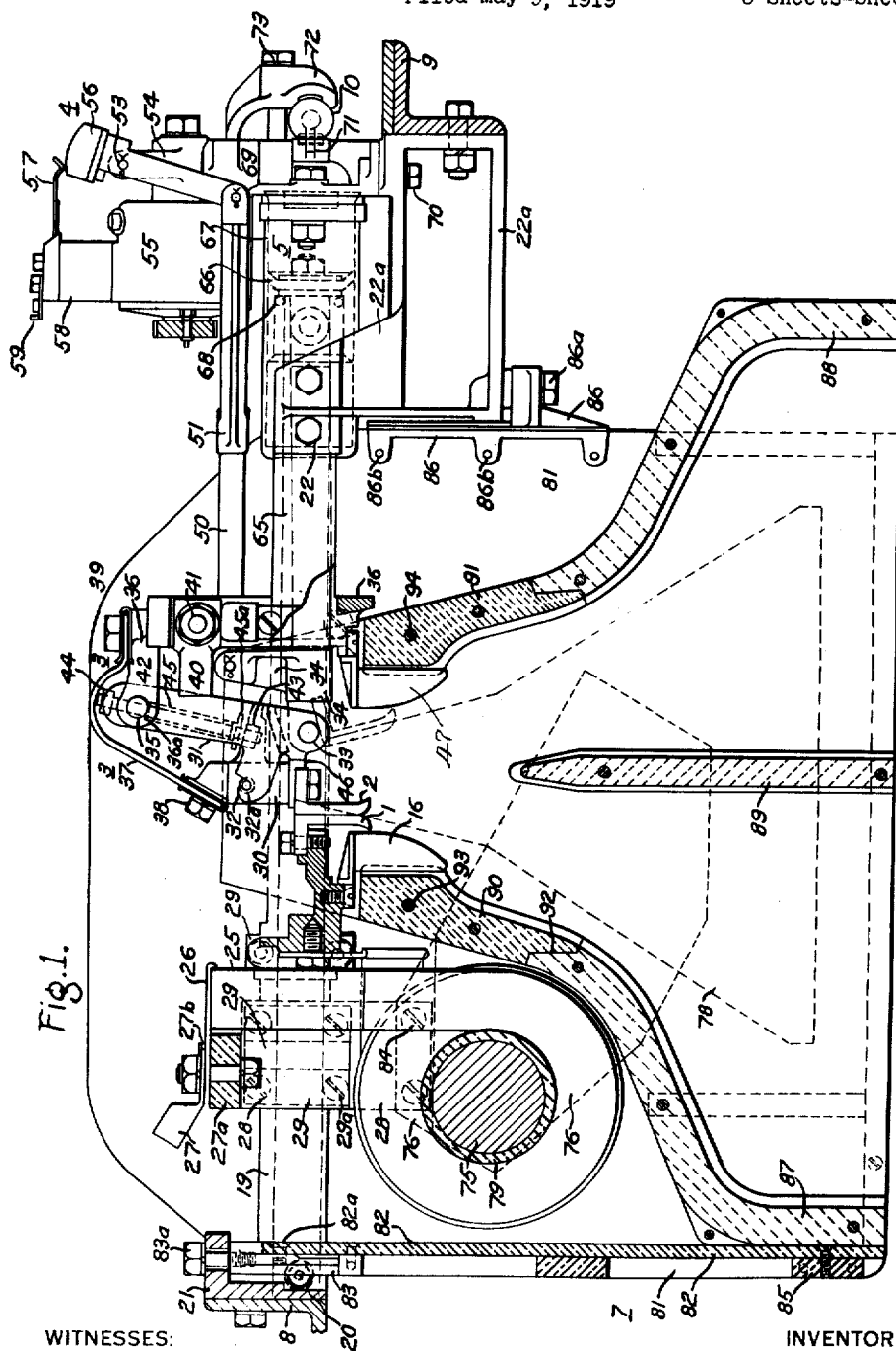


Fig. 1.

WITNESSES:

*R. J. Butler.*

*W. R. Coley*

INVENTOR

*Christian Aalborg.*

BY

*Herbert Barr*

ATTORNEY

June 29, 1926.

C. AALBORG

1,590,402

SWITCHING DEVICE

Filed May 9, 1919

3 Sheets-Sheet 2

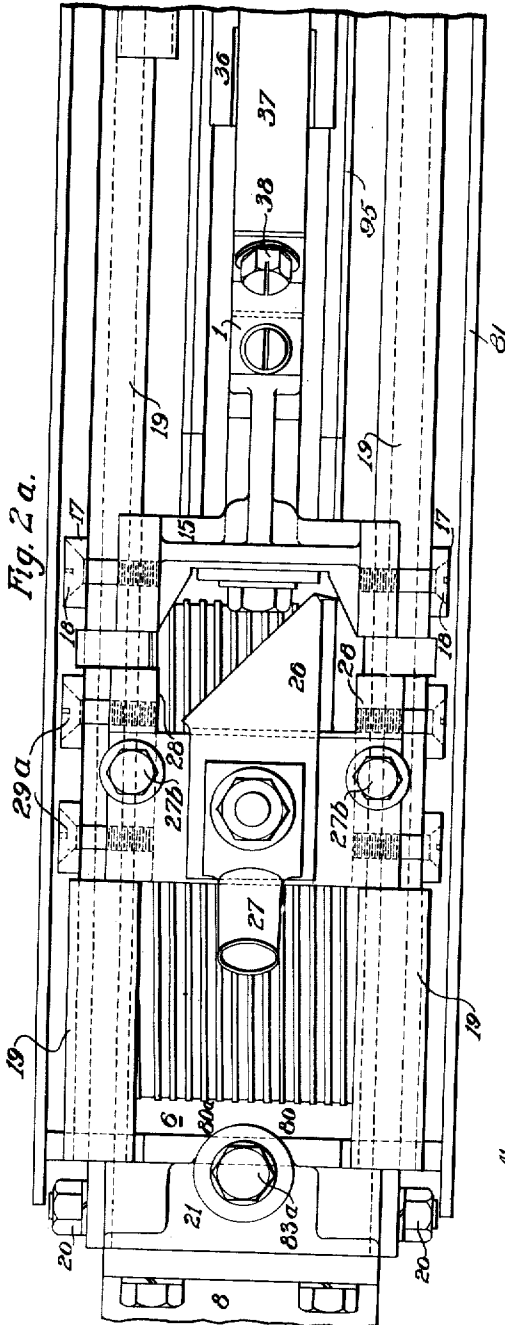


Fig. 2a.

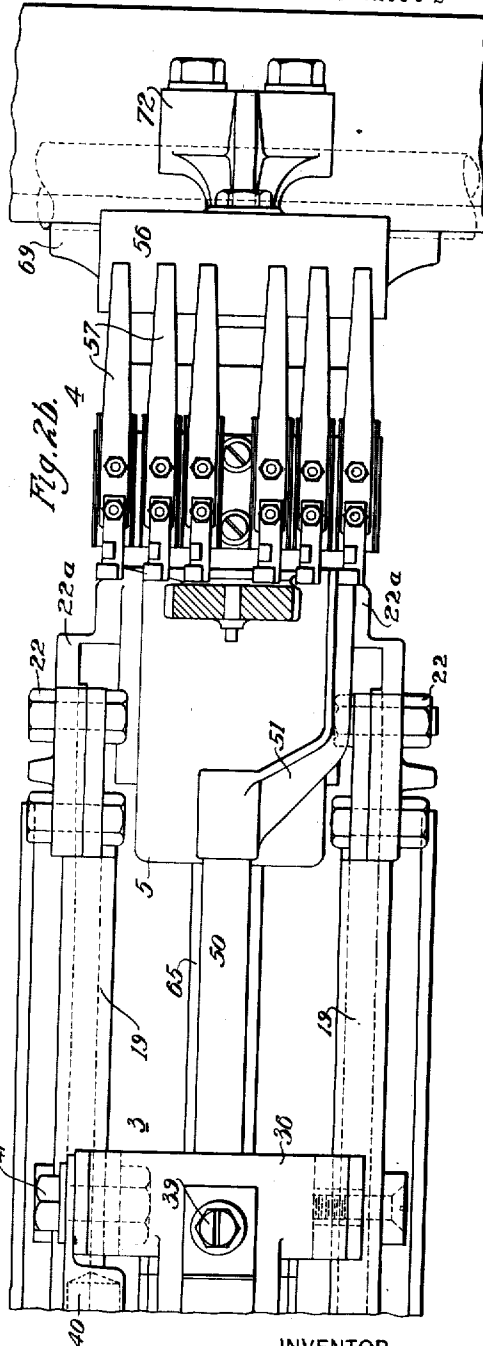


Fig. 2b.

WITNESSES:

*W. H. Barrett*  
*W. H. Coley*

INVENTOR

*Christian Aalborg*

BY

*Wesley S. Barr*  
ATTORNEY

June 29, 1926.

1,590,402

C. AALBORG

SWITCHING DEVICE

Filed May 9, 1919

3 Sheets-Sheet 3

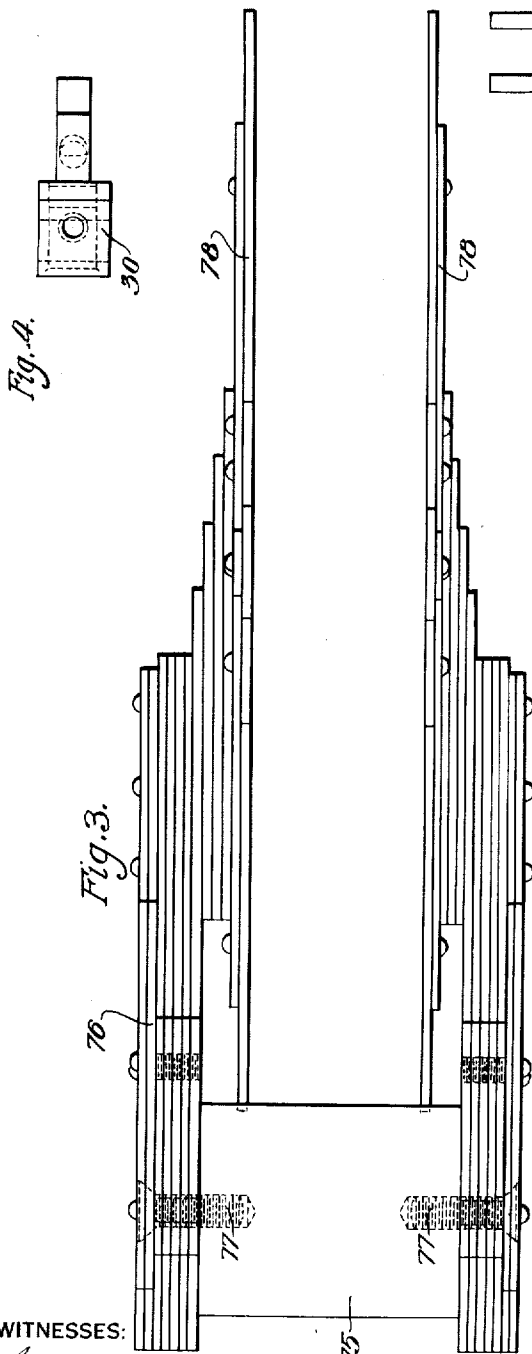


Fig. 4.

Fig. 3.

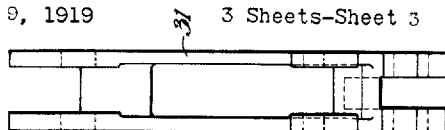


Fig. 7.

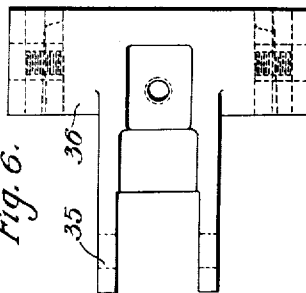


Fig. 6.

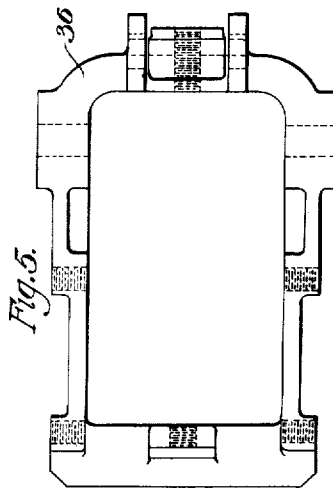


Fig. 5.

WITNESSES:

*Geo. R. Bennett*  
*W. R. Coley*

INVENTOR

*Christian Aalborg*

BY

*Wesley E. Carr*  
ATTORNEY

## UNITED STATES PATENT OFFICE.

CHRISTIAN AALBORG, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

## SWITCHING DEVICE.

Application filed May 6, 1919. Serial No. 295,160.

My invention relates to switching devices of the familiar unit-switch type for railway-motor-control systems, and it has for its object to provide a high-capacity switch of this character which shall be compact in construction and reliable in operation.

Another object of my invention is to provide an arc-chute or guide having removable portions of unglazed porcelain, or the like, located near the contact tips, whereby the worst effects of arcs are expended upon such removable portions, resulting in an arc-chute of relatively long life, and, moreover, the porcelain sections may be readily and inexpensively replaced whenever necessary.

A further object of my invention is to provide an effective arc-chute which may be readily detached from the remainder of the switch by merely removing two bolts.

Still another object of my invention is to provide a novel type of mechanism for the movable contact member whereby the latter may be removed and replaced without requiring the use of any tools.

A further object of my invention is to provide a novel interlocking mechanism between the main and the auxiliary-circuit-contact members in a unit switch.

Further objects and advantages of the present invention will become evident from the following detailed description, taken in conjunction with the accompanying drawings, in which Fig. 1 is a view in side elevation of a switching device constructed in accordance with my present invention. In order to render the description and operation of my switching device clear and the structural details of sufficient size to be intelligible, I have shown a side elevation of the entire switching device upon four sheets, the respective quarters of the figure being designated as 1a, 1b, 1c and 1d. The figures enumerated are to be assembled in a clockwise order to illustrate the complete switching device.

Fig. 1 illustrates the complete switching device on a smaller scale.

Figs. 2<sup>a</sup> and 2<sup>b</sup>, when assembled, constitute a view, in rear elevation, of the switching device, and

Fig. 3 to Fig. 7, inclusive, are detailed elevational views of various parts of the switching-device structure.

Referring to the drawings, the structure

here shown comprises, in general, a stationary contact terminal or tip 1; a co-operating movable contact terminal or tip 2; a combined actuating and supporting mechanism 3 for the movable contact member; an electric interlocking device 4 for governing auxiliary circuits, in accordance with a familiar practice; a power-actuated device 5 of the fluid-pressure type; a magnetic blow-out device 6; an enveloping arc chute 7; and a fluid-pressure-supply pipe 10.

While my present invention, considered as a whole, is particularly adapted for use in 3000-volt direct-current railway systems, I desire it to be understood that the application of the invention is not so restricted, and the structure, either as a whole or in part, may be employed in systems of other types.

For the purpose of supporting the switching device in side-by-side relation with other switches of a like character, a plurality of angle-irons 8 and 9 run along the top and the bottom of the switching device, which may be bolted, or otherwise suitably secured, to such angle-irons.

The stationary contact tip 1 is bolted to a metallic clamp 15 of general T-shape, to which a suitable arcing horn 16 is attached, and which is also bolted to the end 23 of the strap conductor forming a portion of the magnetic blow-out device 6.

The contact clamp 15 is clamped, through the agency of bars or straps 17 and screws 18, upon a plurality of longitudinally-extending insulated rectangular bars 19. One end of each insulated rod 19 is secured, by means of a bolt 20, to a terminal bar 21, while the other ends of the rods 19 are clamped to a base casting 22a through the agency of a plurality of bolts 22.

Following the path taken by current in the switch under operating conditions, starting from the stationary contact terminal 1, such current flows therefrom through the contact clamp 15, strap-conductor terminal 23, a right-angle bend 24 therein, the complete convolutions of strap conductor in the magnetic blow-out device 6, terminal strap 25, a second right-angle bend 26, and thence to the end of the strap conductor, to which is bolted a suitable wire-receiving terminal 27.

The contact terminal 27 is mounted upon

a suitable insulating block 27a that extends transversely of the switch and is secured, by bolts 27b, to metallic clamping and supporting members 28, which, together with clamping bars 29, are fastened to the longitudinally-extending rods 19 by screws 29a. The members 28 are also secured to the metallic portion of the blow-out device 6, as hereinafter described in detail.

10 The movable contact terminal 2 is bolted to a contact-holding piece 30, a bottom-plan view of which is shown in Fig. 4. A contact arm 31, shown in end elevation in Fig. 7, is detachably secured to the contact-holder 30 through the agency of a hook member 32 that engages a pin 32a extending through the contact-holder. The inner end of the contact arm 31 has a pivotal connection 33 with a lug 34 which is adapted to be actuated by the fluid-pressure device 5, as hereinafter described. The outer end of the contact arm 31 has a fixed pivotal connection 35 with a contact clamp 36 (see also Figs. 5 and 6) which is clamped upon the longitudinally-extending insulated rods 19, as previously described in connection with the contact clamp 15.

For the purpose of conducting the major portion of the current away from the illustrated operating mechanism, a flexible braided shunt 37 extends from a bolt 38 in the contact-holder 30 to a bolt 39 in the contact clamp 36. A second wire-receiving terminal 40 is attached, by means of a bolt 41, to the clamp 36.

The current path from the movable contact tip 2, therefore, traverses the contact-holder 30, whence the major portion of the current flows through the shunt 37 and part of the contact clamp 36, and thence through wire-receiving terminal 40.

For the purpose of biasing the movable contact tip 2 towards the illustrated engagement with the stationary contact terminal 1, and also to provide a rolling contact therewith during the closure of the switch, as hereinafter explained in detail, a spring device is adapted to act between the contact-holder 30 and the contact clamp 36. This spring device comprises a guide-rod 42, the inner end of which rests in a recess 43 in a projecting arm of the contact-holder 30 and the outer end of which extends through the pivotal connection 35, a nut 44 being placed upon the threaded outer end of the guide-rod to limit the movement thereof. A coil or finger spring 45 bears upon a flange 45a of the guide-rod near the contact-holder 30, and the other end of the spring bears upon the pivotal connection 35, forming a part of the projecting arm 36a of the contact clamp 36.

In the illustrated closed position of the switch, confronting surfaces 46 of the contact-holder 30 and the contact arm 31 abut,

as shown, whereby the pressure from the power-operated mechanism 5 is directly transmitted to the movable contact terminal 2 after the switch is fully closed.

A second arcing horn 47 is attached to the inner end of the contact clamp 36 in the position relative to the open position of the movable contact terminal 2 (indicated by the corresponding dotted outline) that corresponds to the fixed position of the arcing horn 16 with respect to the stationary contact terminal 1.

The interlocking mechanism 4 is operated by the fluid-pressure device 5 by reason of the fact that a projecting arm of the lug 34 is pivotally attached to one end of an insulating rod 50, the other end of which is swaged into an off-set arm 51. An oscillating contact bar 52 is pivotally secured to the arm 51 to permit rotative movement around an intermediate pivot 53 that extends through a lug 54 upon the encasing member 55 for the familiar electrically-controlled magnet valve that is employed in electro-pneumatic control systems. The outer end of the contact bar 52 is provided with a contact-carrying block 56, whereby a plurality of control fingers 57 may be connected as desired whenever the contact block 56 occupies the position that corresponds to the open condition of the main contact members. The control fingers 57 are mounted upon a suitable insulating block 58, which is secured to the encasing member 55; and suitable contact clips 59 are electrically connected to the several control fingers.

The fluid-pressure mechanism 5 comprises an insulating rod 65, one end of which is inserted within a recess of the lug 34, while the other end of the rod is pivotally associated with a piston 66. The piston 66 travels within a suitable operating cylinder 67 and is biased to the illustrated dotted-line position (corresponding to open condition of the switch) by means of a coil spring 68 extending from the inner end of the operating cylinder 67 substantially to the piston 66.

The operating cylinder 67 is secured, by bolts 70, to a portion 69 of the base casting 22a, which also supports the encasing member 55 for the magnet valve. The fluid-supply pipe 10 communicates with a passage 71 leading to the operating cylinder 67 and is attached to the base-casting portion 69 through the agency of a curved clamp member 72 and bolts 73.

The magnetic blow-out device 6 comprises a central magnetizable core 75 which is shown, in Fig. 3, as secured to a plurality of sets of magnetizable sheets or laminae 76 by means of a plurality of bolts 77. The laminae 76 thus constitute a portion of the magnetic blow-out circuit for the co-operating main contact members, extending downwardly towards the center of the arc-chute

7 and being fastened to a plurality of triangular metallic sheets 78, centrally located with respect to the arc-chute and extending, transversely of the switch, to a zone opposite to the contact terminals.

The magnetic blow-out device 6 further comprises an insulating sleeve 79 around the core 75 and upon which a suitable number of convolutions 80 of the strap conductor are wound, being separated by suitable insulating spacers or disks 80a.

The respective sets of laminæ 76 are secured by screws 84 to the clamping bars 28, whereby the entire blow-out device 6 is supported.

It will be understood that, whenever current traverses the strap-conductor convolutions 80, a magnetic field is set up which traverses the magnetic circuit comprising the core 75 and the laminæ 76 and 78, an air-gap in the magnetic circuit being provided in the path of the main contact terminals 1 and 2, whereby arcs that form upon the separation of the contact terminals, when carrying current, are rapidly and effectively quenched.

The arc-chute 7 comprises a pair of outer confronting slabs 81 of asbestos lumber, or the like, which are separated, at one end, by means of suitably attached bars 82 and blocks 85 of similar material. The bar 82 is secured by screws 82a to a metallic member or bracket 83 which, in turn, is attached to the terminal bar 21 by means of a single bolt 83a. A holding member or bracket 86, located on the opposite side of the arc-chute, is likewise secured, by a single bolt 86a, to the base casting 22a and is also fastened to the asbestos slabs 81 by suitable grommets 86a. Thus, the entire arc-chute may be readily removed and replaced by merely manipulating the two bolts 83a and 86a.

The arc-chute 7 further comprises curved guide-portions 87 and 88 of soap-stone, or similar material, extending from the outer corners of the arc-chute in the general direction of the main contact members 1 and 2; and a pair of arc-guide portions 90 and 91 of unglazed porcelain, or other vitreous material, which have dove-tail joints 92 with the soap-stone guide portions 87 and 88, respectively, and fit within the angle formed by the outer faces of the arcing horns 16 and 47. A barrier 89 of soap-stone, or the like, extends within the arc-chute substantially opposite the main-circuit terminals and is provided with a tapered inner edge for the purpose of splitting the arcs formed by the separation of the contact members, which arcs thus expend their worst effects upon the unglazed porcelain sections 90 and 91 and are then guided along the soap-stone portions 87 and 88 until dissipated.

The several soap-stone and porcelain members mentioned are enclosed in a narrow box

or chute 95 that is suitably held in a central position within the enveloping slabs 81, as shown in Fig. 2<sup>a</sup>. This compound construction has numerous advantages known in the prior art, and is not believed to require further description here. The arc-chute 95 is further positioned by reason of snugly fitting within the sets of triangular laminæ 78.

The various illustrated soap-stone and porcelain members are held in position by means of small screws, as indicated at 93 and 94, that extend from the respective outer slabs of the inner arc-chute 95 into the various arc-guiding members. Consequently, if it is desired to remove the unglazed porcelain sections 90 and 91, such removal may be readily effected by merely withdrawing the associated screws 93 and 94, and new porcelain sections may then be inserted. It should be noted that, in the first place, the porcelain members will possess a much longer operating life than if the arc-guides were entirely composed of soap-stone, as is more or less customary practice, and, in the second place, the expense of replacing the relatively small porcelain sections is materially less, in the long run, than the expense of replacing the entire arc-guide portions, which would be necessary if each curved portion was formed of a single piece of soap-stone.

Assuming that the switch occupies the illustrated closed position, wherein the illustrated magnet valve is energized to admit fluid pressure from the pipe 10 to the operating cylinder 67, in accordance with a familiar practice, the opening of the switch, upon de-energization of the magnet valve, occurs as follows: The spring 68 within the operating cylinder 67 rapidly returns the piston 66 to the illustrated dotted-line position, and the contact arm 31 is, consequently, rotatively moved about the pivotal point 35 to a corresponding position, such movement being freely effected, without any binding of parts, by reason of the pivotal connection that is provided within the operating cylinder. At the same time, the finger spring 45 exerts pressure upon the contact-holder 30 to rotate it around the pivot 32a and thus effect a clockwise rolling action of the movable contact terminal 2 over the surface of the stationary contact terminal 1. When the spring 68 in the cylinder and the finger spring 45 reach their limiting positions, the movable contact terminal 2 occupies the open position indicated by the corresponding dotted outline near the arcing horn 47. At the same time, the operating rods 50 and 51 for the interlocking mechanism 4 have been retracted to a position wherein the auxiliary contact arm 52 swings inwardly to engage the desired combination of control fingers-57,

It is believed that the closing movement of the switch will be understood without further description by reason of its analogy to the opening operation just recited and, consequently, further description of the actuation of the various parts to the illustrated positions is not deemed necessary.

In addition to the previously described ready removal of the entire arc-chute 7 by merely withdrawing the two bolts 83a and 86a when it is desired to inspect or repair the corresponding portion of the apparatus, it should be noted that the illustrated construction of the actuating mechanism for the movable contact member permits the ready removal of the movable contact terminal 2, for the purpose of replacement through the rear of the switch. It is evident also that the stationary contact terminal 1 may be removed in a similar manner by merely withdrawing the illustrated single bolt that attaches the contact tip to the clamp 15.

To remove the movable contact member 2 without the use of any tools, the contact-holder 30 is grasped and pulled towards the rear of the switch in initial opposition to the action of the finger spring 45. The guide-rod 42 is concurrently lifted out of the recess 43 in the contact-holder 30, whereby the contact-holder may be withdrawn from within the hook extension 32 of the contact arm 31. Thus, the contact-holder 30 and the movable contact tip 2 may be withdrawn entirely outside of the switch, such movement being limited only by the length of the flexible shunt 37. The finger spring 45 does not fall from the guide-rod 42, by reason of the provision of the flange 45a near the inner end of the rod. In this way, all parts are in readiness for the return of the contact-holder 30 and contact terminal 2 whenever desired, and it is evident that such replacement may again be readily effected without the use of any tools.

I do not wish to be restricted to the specific structural details or arrangement of parts herein set forth, as various modifications thereof may be effected without departing from the spirit and scope of my invention. I desire, therefore, that only such limitations shall be imposed as are indicated in the appended claims.

I claim as my invention:

1. In a switching device, the combination with a plurality of relatively movable contact members, of an arc-guide associated therewith and having portions of vitreous material.
2. An arc-guide for switching devices having removable portions of vitreous material.
3. In a switching device, the combination with a plurality of relatively movable contact members, of an arc guide having the

portions nearest said contact members formed of vitreous material.

4. In a switching device, the combination with a plurality of relatively movable contact members, of a plurality of arcing horns attached to said contact members, and a plurality of members formed of vitreous material and fitted to said horns to extend the arc-guiding action thereof.

5. In a switching device, the combination with a plurality of relatively movable contact members, of a plurality of arcing horns attached to said contact members, a plurality of arc-guiding members formed of unglazed porcelain and fitted to said horns, and further arc-guiding members formed of non-conducting material and fitted to the porcelain members.

6. In a switching device, the combination with a plurality of relatively movable contact members, of an enveloping arc-chute for the device having a plurality of supporting members on opposite faces, and single means associated with each supporting member and constituting the sole supporting means for said arc-chute.

7. In a switching device, the combination with a plurality of relatively movable contact members, of an enveloping arc-chute for the device of non-conducting material and having a single metallic supporting member on each of two opposite faces, and a single securing member detachably associated with each supporting member and constituting the sole supporting means for said arc-chute.

8. In a switching device, in combination, a plurality of relatively movable contact members, means operable to effect relative movement of the contact members toward and away from one another, one of said contact members being pivotally and removably disposed on said contact-moving means and resilient means carried by the switching device for retaining the contact member in position on said contact moving means, said resilient means being disposed for manual operation to permit manual detachment of the contact member.

9. In a switching device, in combination, a plurality of relatively movable contact members, means operable to effect relative movement of the contact members toward and away from one another, one of said contact members being pivotally disposed on said contact-moving means and resilient means pivotally mounted on the switching device adapted to retain the contact member in position on the contact-moving means during the angular movement of the contact member about its pivot point, said retaining means being adapted for manual operation to permit the removal of the contact member.

10. In a switching device, in combination,

a plurality of relatively movable contact members, means operable to effect relative movement of the contact members toward and away from one another, one of said contact members being pivotally disposed on said contact-moving means and resilient means adapted to retain the contact member in position on the contact-moving means during the angular movement of the contact member about its pivot point, said resilient means being adapted for manual withdrawal from an active position to permit the removal of said contact member.

11. In a switching device, the combination with a plurality of relatively movable contact tips, of a contact-holder for the movable tip, an operating rod, and an oscillatable contact-arm having its movable end pivotally secured to said rod and having a lateral hook connection with said contact-holder.

12. In a switching device, the combination with a movable contact tip, of a contact-holder, an operating rod, an oscillatable contact-arm having one end pivotally secured to said rod and having a lateral hook connection with said contact-holder, and a spring extending approximately parallel with said contact-arm and bearing upon it and upon the contact-holder.

13. In a switching device, the combination with a movable contact member, of an operating member having a hook connection for the contact member, a support for said operating member, and a flexible shunt joining said contact member and said support, whereby the contact member may be removed without the use of tools as far as the length of the shunt permits.

14. In a switching device, the combina-

tion with a movable contact tip, of a contact-holder, an operating rod, an oscillatable contact arm having one end pivotally secured to said rod and having a hook connection with said contact-holder, a stationary support for said contact arm, and a flexible shunt extending from said contact-holder to said support, whereby the contact-holder and tip may be removed by purely manual manipulation as far as the length of said shunt permits.

15. In a switching device, the combination with a movable main-circuit contact member, of an operating member therefor, a remotely located oscillatable auxiliary-circuit contact member, and a rod for mechanically joining said operating member and said auxiliary contact member.

16. In a switching device, the combination with a movable main-circuit contact member, of a longitudinally movable operating rod therefor, an auxiliary-circuit contact member, and a second rod extending substantially parallel to said operating rod and longitudinally movable therewith and connected to said auxiliary contact member.

17. In a switching device, the combination with a movable main-circuit contact member, of an operating rod therefor, an auxiliary-circuit contact arm pivotally mounted at an intermediate point, a second rod extending substantially parallel to said operating rod and pivotally connected to one end of said contact-arm, and a single member for pivotally joining the two rods.

In testimony whereof, I have hereunto subscribed my name this 23d day of April 1919.

CHRISTIAN AALBORG.

### Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,590,402, granted June 29, 1926, upon the application of Christian Aalborg, of Pittsburgh, Pennsylvania, for an improvement in "Switching Devices," an error appears in the printed specification requiring correction as follows: Page 1, line 35, beginning with the word "In" strike out all to and including "scale" in line 47; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 10th day of August, A. D. 1926.

[SEAL.]

M. J. MOORE,  
*Acting Commissioner of Patents.*