

Aug. 26, 1958

M. BINGENHEIMER

2,849,581

FRONT-OPERATED CIRCUIT INTERRUPTERS

Filed Jan. 28, 1955

3 Sheets-Sheet 1

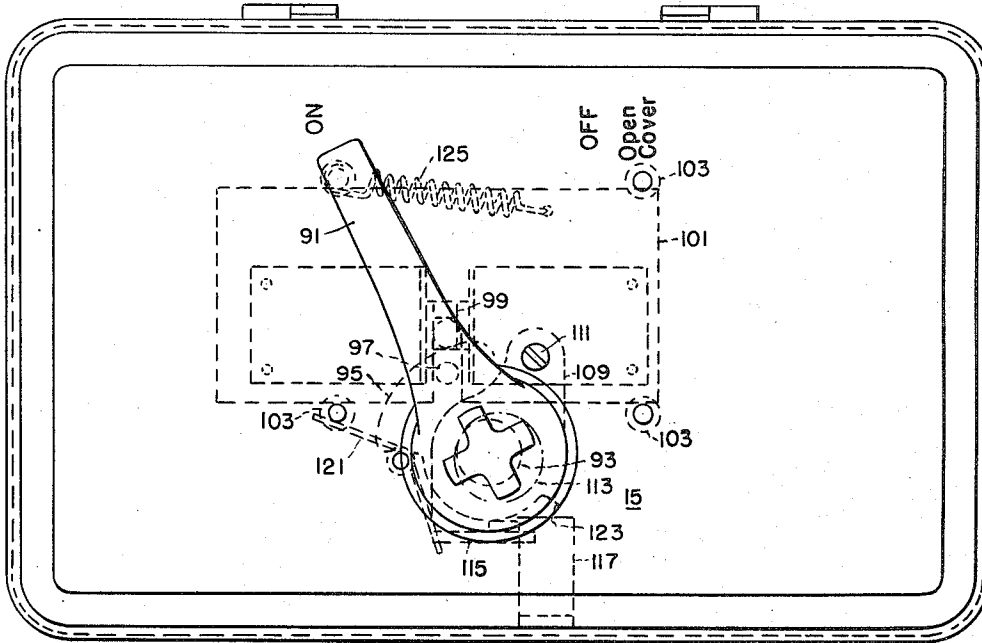


Fig. 1.

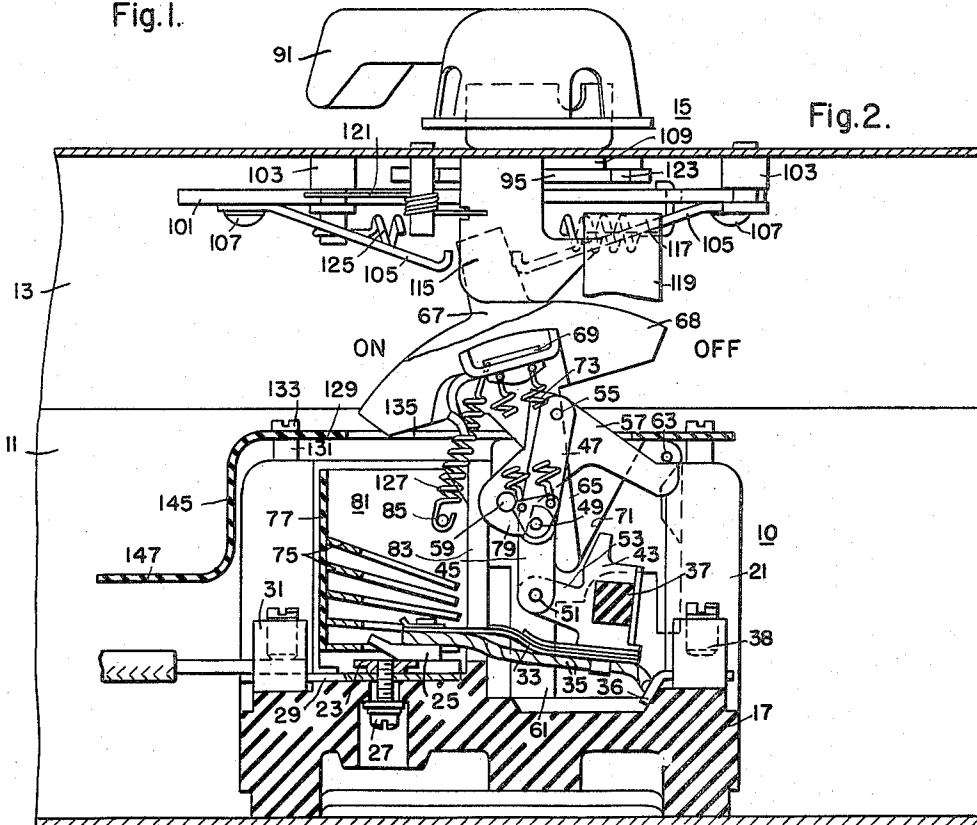


Fig. 2.

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Fig.3.

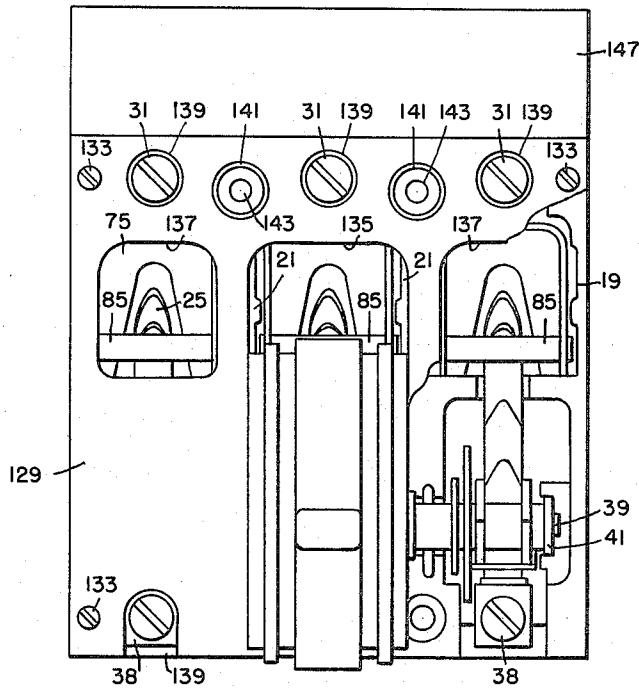
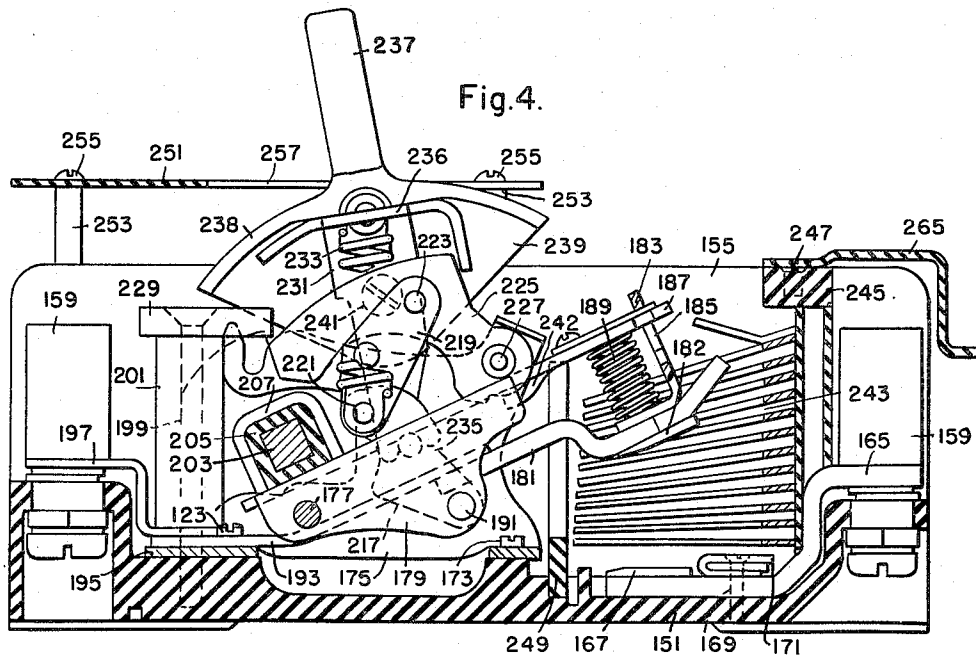


Fig.4.



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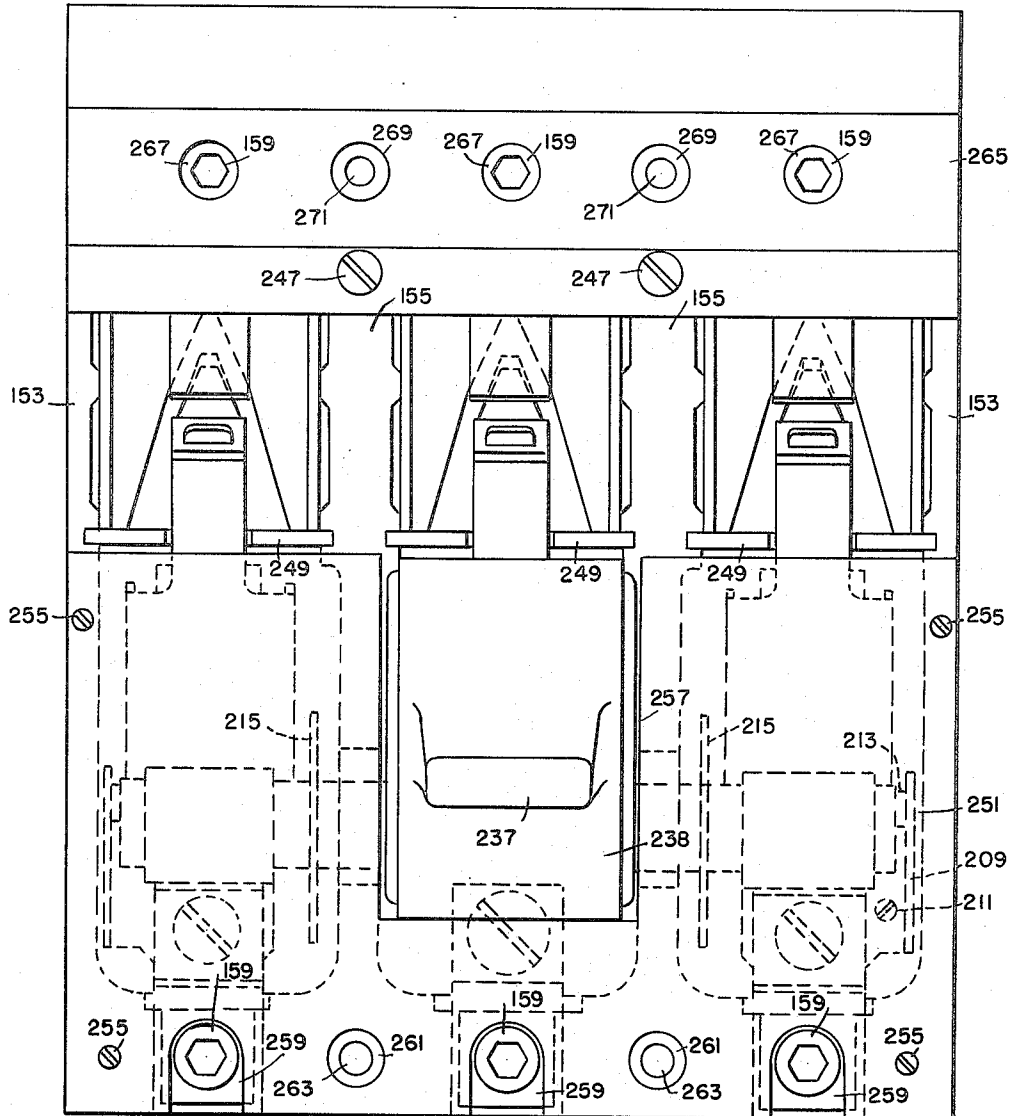
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Fig. 5.



WITNESSES:

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2,849,581

FRONT-OPERATED CIRCUIT INTERRUPTERS

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Application January 28, 1955, Serial No. 484,614

14 Claims. (Cl. 200—168)

This invention relates to front-operated switches, and, more particularly to visible-blade arc-extinguishing disconnecting switches.

An object of the invention is to provide an improved front-operated arc-extinguishing switch in which the movable contact is visible in the open position of the switch.

Another object of the invention is to provide an improved front-operated arc-extinguishing switch in which the movable contact is visible in the open position of the switch and having a cover on a portion of the front of the switch so as not to obscure the movable contact.

Another object of the invention is to provide a front-operated disconnect switch having barriers forming spaces in which the poles of the switch are mounted, the switch having arc-extinguishing means in said spaces and terminals in said spaces at each end and cover means covering said spaces including the terminals but excepting the arc-extinguishing means.

Another object of the invention is to provide a front-operated disconnect switch having barriers forming spaces in which the poles of the switch are mounted and an operating mechanism disposed in the center space.

Another object of the invention is to provide a front-operated disconnect switch according to the preceding paragraph in which means is provided to return the operating mechanism to the "on" position in the event the contacts fail to open when the operating mechanism is moved to the "off" position.

Another object of the invention is to provide an improved front-operated arc-extinguishing switch having line terminals at one end and load terminals at the other end in which the movable contacts are visible in the open position of the switch and having a cover on a portion of the front of the switch, said cover covering the load terminals and a portion of the switch so as not to obscure the movable contacts, and having a second cover on a portion of the front of the switch covering the line terminals.

The invention, both as to structure and operation, together with additional objects and advantages thereof, will be best understood from the following detailed description of several embodiments thereof when read in conjunction with the accompanying drawings.

In said drawings:

Figure 1 is a plan view of an enclosing cabinet and operating device for an arc-extinguishing disconnect switch, constructed in accordance with principles of the invention, the switch operating handle being shown in the "on" position;

Fig. 2 is an enlarged vertical sectional view of a portion of the enclosing cabinet taken inside the cabinet showing the handle mechanism on the cover in elevation and showing an elevational sectional view taken through the center pole of the switch;

Fig. 3 is a top plan view of the switch shown in Fig. 2;

Fig. 4 is an elevational sectional view of a switch of a somewhat different type; and

Fig. 5 is a top plan view of the switch shown in Fig. 4.

Referring to Figs. 1 and 2 of the drawings an arc-extinguishing switch, indicated generally at 10, is mounted in a metal enclosure comprising a base portion 11 and a cover 13 hinged thereto, and is operated, with the cover 13 closed, by an operating mechanism indicated generally at 15 which is mounted solely on the cover 13.

The switch 10 comprises a base 17 of one-piece insulating material having outer barriers 19 and inner barriers 21 molded integral therewith. The barriers between them form three recesses or compartments extending the length of the base. The switch 10 comprises stationary butt contacts 23 and movable butt contacts 25 for each pole of the switch. The stationary contacts are secured to the base 17 by means of screws 27 which also secures a conducting strip 29 to the base. The conducting strip 29 is provided at its outer end with a terminal connector 31.

The moving contact 25 is mounted on the free end of a resilient switch arm 33 with one end of a flexible conductor 35 between the contact 25 and the switch arm 33, the parts being brazed for good electrical contact. The other end of the flexible conductor 35 is brazed to a conducting strip 36 which at its outer end is provided with a terminal 38. The resilient switch arms 33 for the three poles of the switch are arranged for simultaneous operation by means of a pivoted insulating tie bar 37 which is suitably pivotally mounted by means of pivot pins 39 (only one being shown) which extend through openings in bearing brackets 41 (Fig. 3) mounted on the base 17. Each of the switch arms 33 is mounted on a bracket 43 which is rigidly secured to the tie bar 37.

The tie bar 37 is operated to open and close the contacts by means of a toggle mechanism comprising a pair of toggle links 45 and 47 pivotally connected together by a knee pivot pin 49. The toggle link 45 is pivotally connected by means of a pivot pin 51 to an arm 53 on the bracket 43 of the center pole, and the toggle link 47 is pivoted by means of a pin 55 to a fixed support member 57. The support member 57 is mounted at one end on a pin 59 supported in a pair of spaced frame members 61 (only one being shown) and is restrained at the other end by a pin 63 also supported in the frame member 61. A U-shaped operating lever 65 having an insulating handle 67 mounted on the bight portion 69 thereof, is pivotally supported in V-shaped recesses 71 in the frame member 61. Overcenter springs 73 are connected under tension between the bight 69 of the operating lever 65 and the knee pivot pin 49 of the toggle 45—47.

The switch is operated to open the contacts by clockwise movement of the handle 67 from the position shown in Fig. 2. This moves the line of action of the overcenter springs 73 across to the right of the pivot 55 whereupon the force exerted by the overcenter springs causes collapse of the toggle 45—47 and opening movement of the switch arms 33 to open the contacts with a snap action.

The contacts are closed by reverse movement of the handle 67, that is, in a counterclockwise direction back to the Fig. 2 position. This moves the line of action of the springs 73 over to the left of the pivot 55 whereupon the force of the springs 73 exerted on the toggle 45—47 extends the toggle to an overset position (Fig. 2) in which the knee pivot pin 49 is in engagement with a projection 79 on the support member 57. The action of extending the toggle 45—47 rotates the tie bar 37 and simultaneously moves all of the switch arms to the closed position to close the contacts with a snap action.

Arc-extinguishers 81 (Figs. 2 and 3) are provided to extinguish the arcs drawn by the separation of the contacts. The arc-extinguishers are of the spaced-plate type

and comprise a stack of slotted plates 75 of magnetic material which are insulated from each other by an insulating and supporting housing 77 and positioned adjacent the path of movement of the moving contacts. Following the initiation of an arc incident to the separation of the contacts, the presence of the plates produces a magnetic reaction which causes the arc to move in a direction toward the slots. This movement results in the breaking up of the arc into a plurality of serially connected short arcs as soon as the single arc reaches the ends of the slots, and then causes the extinguishment of the several small arcs. The barriers 19 and 21 have a height greater than the stack of slotted plates to isolate them. The arc extinguishers, there being one for each pole of the switch, are held in place by the screws 27.

Adjacent the arc extinguishers 81 are cross barriers 83 molded integral with the base 17 and slotted to accommodate the switch arms 33. Rods 85 are supported in the sides of the arc extinguisher housings 77 and are provided to stop the opening movement of the switch arms.

As set forth previously the switch 10 (Fig. 2) is mounted in an enclosing housing having an openable cover 13. In order to manually operate the switch 10 while the cover is closed, the external handle mechanism 15 is provided. The handle mechanism 15 is of the type fully described and claimed in Patent No. 2,550,125, issued April 24, 1951, to Alfred E. Schueler and Howard T. Walton, and assigned to the assignee of the instant invention. The handle mechanism comprises a handle 91 attached to a short shaft 93 which may be made integral with the handle and which is rotatably supported in a suitable opening in the cover 13. Rigidly mounted on the inner end of the shaft 93 for rotation therewith is a cam-shaped plate which forms an actuating member 95. The actuating member 95 carries a pin or an anti-friction roller 97 which engages in a slot 99 formed in a sliding plate 101. The plate 101 is slidably supported in grooved studs 103 mounted on the inside of the cover 13. Carried by the sliding plate 101 are two resilient or spring arms 105, the outer end of each arm being secured by means of screws 107 to the plate 101, the other end of each arm being free and bent away from the sliding plate with a space between the opposing arms 105 as shown in Fig. 2. The handle 67 of the switch 10 is normally disposed between the free ends of the arms 105 in the operative position by the handle 91 when the cover 13 is in the closed position.

As viewed in Fig. 1, clockwise rotation of the handle 91 from the "on" to the "off" position rotates the actuating member 95 in the same direction. This movement of the actuating member 95, acting through the pin and slot connection 97—99, moves the plate 101 toward the right (Figs. 1 and 2). During this movement of the plate 101 the left arm 105 engages and moves the switch handle 67 in a clockwise direction from the switch "on" to the switch "off" position to effect opening of the switch contacts.

Movement of the handle 91 (Fig. 1) counterclockwise from the "off" to the "on" position reverses the direction of movement of the parts just described and moves the plate 101 toward the left to the "on" position. This causes the right arm 105 to engage and move the switch handle counterclockwise to the "on" position to close the switch contacts.

Locking means is provided to prevent opening the cover 13 in all positions of the handle 91 except when the handle is moved beyond the "off" position to the "open cover" position. The locking means comprises a locking member 109 pivotally supported on the cover by means of a screw 111. The locking member 109 is disposed between the actuating member 95 and the inner surface of the cover 13 and is held in place by the actuating member. The locking member 109 is provided

with a clearance opening 113 to permit movement thereof relative to the short shaft 93. The locking member 109 is provided with a downwardly extending latch portion 115 which is adapted to engage under a formed over-portion 117 of a locking bracket 119 which extends downwardly and is rigidly secured to the side wall of the casing 11. A spring 121 biases the locking member 109 to locking position.

The actuating member 95, which is secured to and moves with the handle 91, has a shoulder 123 thereon which engages and moves the locking member 109 to unlocking position when the handle 91 is moved beyond the "off" position to the "open cover" position. When the cover 13 is opened, the spring arms 105 separate from the switch handle 67 and, upon release of the handle 91, the plate 101 together with the spring arms 105 is returned to the "on" position by a spring 125. The spring 125 has one end hooked in an opening in the plate 101 and the other end thereof is attached to one of the studs 103 so as to bias the plate toward the left (Figs. 1 and 2), that is, to the "on" position. Movement of the plate 101 to the "on" position by the spring 125 acts through the pin and slot connection 97—99 to rotate the actuating member 95 and the handle 91 from the "open cover" position to the "on" position. In this manner the outer handle 91 never indicates "off" when the switch is in the "on" position thus serving as a warning should the cover 13 be closed with the handle 91 in a different position from the switch handle 67.

Should the outer handle 91 be moved to the "off" position in order to open the switch without opening the cover 13, the toggle 45—47 would collapse to open the contacts. In this condition the spring 125 does not have sufficient force to straighten the toggle and close the contacts, hence the switch will remain in the open position and the handle 91 will remain in the "off" position until moved to another position.

The resilience of the spring arms 105 permits the cover 13 to be closed regardless of the respective positions of the handle 91 and the switch handle, without damage thereto even if the cover is slammed shut, because the spring arms 105 yield upon engaging the end of the switch handle 67 if the handles are not in corresponding operative positions. The spring arms 105 will automatically ride over and engage the switch handle in the space between them as soon as the handle 91 is moved sufficiently.

Should an excessive overcurrent or a short-circuit current occur while the switch is standing closed the contacts may stick or weld closed. In this situation movement of the outer handle 91 to the "open cover" position will move the switch handle 67 and the toggle mechanism to the "off" position. If the cover 13 is then opened, separating the spring arms 105 from the switch handle 67, the latter will remain in the "off" position giving a false indication of the position of the switch contacts which are then stuck closed. In this condition the pivot 51 joining the toggle link 45 to the arm 53 cannot move any substantial distance in opening direction, consequently, movement of the handle 67 to the "off" position will cause the springs 73 to move the toggle 45—47 only slightly overcenter in opening direction but collapse of the toggle is prevented by the pin 51 being held in substantially the position by the welded contacts. In this condition it requires the application of a very small force to the handle 67 in closing direction to move the handle back to the "on" position. This force is provided by a spring 127 (Fig. 2) having one end attached to the free end of the operating lever 65 and the other end hooked over the rod 85 in the arc extinguisher for the center pole of the switch.

With the switch in the fully open position and the toggle 45—57 collapsed, the spring 127 does not have sufficient force to move the handle 67 to the "on" position against the force of the overcenter springs 73. How-

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ever, if the cover 13 is opened with the contacts sticking or welded closed, the spring 127 has sufficient force to move the switch handle 67 back to the "on" position as soon as the spring arms 105 disengage the handle 67, thus warning that the switch contacts are closed. If the handle 91 should be moved from the "on" position to the "off" position in order to open the switch but not the cover 13 and the contacts should stick or weld and fail to open, then, upon release of the handle 91, the springs 125 and 127 would cooperate to move the handles 91 and 67 back to the "on" position.

In order to prevent accidental contact with the live parts of the switch, such as the terminals 38, the clamps 43 for the center poles, etc., a cover 129 (Figs. 2 and 3) formed from a flat piece of sheet insulating material is provided. The cover 129 is mounted on the barriers 19 and 21 by means of spacers 131 and screws 133. The cover has a large opening 135 therein for accommodating the handle 67 and for providing a sight opening through which the center pole movable contact is visible at least in the open position of the switch. The handle 67 has an extended base portion 68 of insulation which substantially covers the opening 135 below the arc extinguisher for the center pole of the switch in all positions of the handle to guard against contact with the live parts of the switch mechanism. Smaller openings 137 which substantially register with the outer pole arc extinguishers are provided, through which the movable contacts of the outer poles are visible. The cover 129 also has openings 139 and 141 providing access to the screw of terminals 31—38 and to mounting holes 143 respectively. As seen in Fig. 3, the moving contacts are clearly visible with the cover 129 in place.

At the left end (Fig. 2) on the top (Fig. 3), the cover 129 has a portion 145 formed downwardly along the end of the base and a portion 147 formed outwardly therefrom to prevent accidental contact with the line terminals 31 which are live even when the switch is open. By having the portion 147 extend out beyond the end of the switch, it also prevents accidental contact with the portion of the wire from which more insulation may have been stripped than is necessary to make electrical contact with the terminal 31.

Referring now to Figs. 4 and 5 of the drawings, there is illustrated a somewhat different form of a disconnect switch for higher currents. The switch comprises a base 151 of molded insulating material having outer barriers or side walls 153 and inner barriers 155 extend integral therewith. The barriers 153 and 155 extend the length of the base 151 and between them form closely-spaced recesses or compartments which also extend the length of the base. The ends of the recesses are open and have terminals 159 mounted therein on the base 151. Disposed at the right-hand end (Fig. 4) of each of the recesses or compartments is an angular conducting strap 165 on the outer end of which is mounted the terminal 159. At its inner end the strap 165 has brazed thereto a stationary butt contact 167 and the strap 165 is secured to the base 151 by means of screws 169 which also serve to mount an arc runner 171 on the strap 165 adjacent the contact 167.

Mounted in the center recess or compartment and secured to the base 151 by means of screws 173 is a U-shaped frame 175 which supports the operating mechanism of the switch. Pivottally mounted on the frame 175 by means of a pivot 177 supported in the side members of the frame is a channel-shaped switch member 179 upon which is mounted the moving contact structure of the switch. The moving contact structure comprises a contact bar 181 to which is brazed the moving butt contact 182. Also secured to the contact bar 181 is an angle bracket 183 the upper portion of which has as opening 185 therein through which extends the reduced free end 187 of the switch member 179. A coil spring 189 compressed between the switch member 179

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and the portion of the bracket 183 which is secured to the contact bar 181 provides contact pressure in the closed position of the switch. In the open position of the switch the spring 189 biases the upper end of the opening 185 in the bracket 183 against the switch member and biases the left-hand end of the contact bar against a rod 191 carried in the side portions of the channel-shaped switch member 179.

One end of a flexible conductor 193 is brazed to one end of the contact arm or bar 181 and the other end of the flexible conductor is mounted on the left-hand end of the yoke portion 195 of the frame 175. Also mounted on the yoke portion 195 in good electrical contact with the flexible conductor 193 is one end of an angular conducting strap 197 having its other end connected to the adjacent terminal 159. The flexible conductor 193 and the strap 197 are secured together and to the base 151 by means of a screw 199 and a post 201. The purpose of the post 201, which is provided in the center pole only of the switch, will be described later. In the outer poles of the switch the flexible conductors 193 and the conducting straps 197 are secured together and to the base by means of screws (not shown).

A metal tie bar 203 encased in an insulating tube 205 is clamped to the channel-shaped switch member 179 by means of a clamp 207. The tie bar 203 extends across all of the poles of the switch and the switch members 179 for the center poles are similarly clamped thereto for unitary movement to open and closed position. Brackets 209 (Fig. 5) disposed in the outer compartments adjacent the outer barriers 153 of the base 151 are secured by means of screws 211 to the base and have pivot pins 213 mounted thereon pivotally supporting the channel-shaped switch members 179 for the outer poles. In order to provide a greater creepage path and reduce the danger of flashover between the poles, insulating creepage discs 215 are mounted on the tie bar in the two outer poles adjacent the inner barriers 155.

The operating mechanism for operating the switch members to open and close the contacts for all of the poles of the switch is supported between the side members of the U-shaped frame 175 in the center compartment comprising the recess between the inner barriers 155. The barriers 155 extend the length of the base and their height is almost as great as that of the operating mechanism. The operating mechanism comprises a pair of toggle links 217 and 219 pivotally connected together by a knee pivot pin 221. The toggle link 217 is pivotally connected to the center pole switch member 179 by means of the pin or rod 191 and the toggle link 219 is pivotally supported at a fixed point at its upper end by a pin 223 on a fixed toggle support member 225. The toggle support member 225 is mounted at one end on a pin 227 supported in the frame members 175 and at the other end by means of a block 229 mounted on top of the previously described post 201 and rigidly secured thereto by the screw 199.

The toggle 217—219 is operated to effect opening and closing movement of the switch members 179 by means of a U-shaped operating lever 231 and overcenter springs 233 (only one being shown). The legs of the operating lever 231 are pivotally mounted on pins 235 in the side members of the frame 175. The overcenter springs 233 are connected under tension between the knee pivot pin 221 of the toggle 217—219 and the yoke portion 236 of the U-shaped operating lever 231. An insulating operating handle 237 has side portions 239 which are attached to the legs of the operating lever 231 by screws 241.

The switch is shown in Fig. 4 in the open position in which the toggle 217—219 is in the collapsed condition with the line of action of the overcenter springs 233 to the left of the pivot pin 223 which supports the toggle link 219 on the toggle support member 225. In the open position of the switch, the switch member 179 for the center pole rests against the toggle support 225 ad-

jacent the support pin 227 therefor, there being a formed portion 242 on the switch member for this purpose. In order to close the contacts the handle 237, together with the operating lever 231, is moved clockwise about the pivot 235 from the position in which it is shown in Fig. 4. This movement of the operating lever carries the line of action of the springs 233 over to the right of the pivot 223 whereupon the force of the springs 233 straightens the toggle 217—219 and move the switch members 179 for all of the poles to the closed position to close the contacts with a snap action.

In the closed position of the switch the toggle 217—219 is overset thus locking the switch members in the closed position against magnetic blow-off action in response to short-circuit currents.

The switch is opened by counterclockwise movement of the handle back to the position in which it is shown in Fig. 4. This moves the line of action of the over-center springs 233 across to the left of the pivot 223 whereupon the force of the springs 233 causes collapse of the toggle 217—219 and simultaneous opening movement of the switch members 179 to open the contacts with a snap action.

Arc extinguishers 243 (Figs. 4 and 5) are provided to extinguish the arc drawn by the separating contacts and are held in place by an insulating bar 245 secured to the base 151 by means of screws 247. The arc extinguishers are of the spaced-plate type and comprise generally a stack of slotted plates of magnetic material which are insulated from each other and which are positioned adjacent the path of movement of the moving contacts. Following the initiation of an arc incident to the separation of the contacts, the presence of the plates produces a magnetic reaction which causes the arc to move in a direction toward the slots. This results in the breaking up of the arc into a plurality of serially connected short arcs as soon as the arc reaches the ends of the slots in the plates, and then causes extinguishment of the several small arcs. It will be noted that the barriers 155 have a height greater than the stack of slotted plates to isolate them from each other.

Slotted cross barriers 249 (Figs. 4 and 5) are provided adjacent the arc extinguishers 243 to aid in preventing the hot gases in the arc extinguishers from flowing toward the operating mechanism. The cross barriers 249 are made of insulating material and are inserted in slots molded in the barriers 153 and 155.

In order to prevent accidental contact with the live parts of the switch such as the terminals 159, clamps 207 for the outer poles, the block 229 in the center pole, etc., a two-piece cover 251, 265 (Figs. 4 and 5) formed from flat insulating material is provided. The cover portion 251 is mounted on the outer barriers 153 by means of spacers 253 and screws 255. The cover 251 covers the lower portion (Fig. 5) of the base 151 from approximately the lower ends of the arc extinguishers 243 on the cross barriers 249 and has an opening 257 therein for accommodating the handle 237. The handle portion 237 has an extended base-portion 238 of insulating material which extends under the opening 257 and substantially closes the opening in both the open and closed positions of the switch against accidental contact with live parts of the switch. The cover 251 also is provided with openings 259 and 261 giving access respectively to the terminals 159 at the bottom of the switch and mounting holes 263.

In order to guard against accidental contact with the live or line terminals 159 adjacent the arc extinguishers and contacts a separate terminal cover portion 265 (Figs. 4 and 5) is provided. The cover portion 265 is mounted by means of the screws 247 on the cross bar 245 and extends beyond the end of the base 151 where it is formed downwardly along the end of the barriers 153—155 and then outwardly therefrom. The terminal cover 265 has openings 267 and 269 respectively providing access to the line terminals 159 and mounting holes 271

in the inner barriers 155. As seen in Figs. 4 and 5, the moving contacts are clearly visible with the cover 251 and the terminal cover 265 in place while the covers provide protection against accidental contact with the operating mechanism, the line terminals and conductors fastened thereto, and other live parts of the switch.

The invention provides a front-operated, visible-blade, arc-extinguishing disconnecting switch of compact arrangement and high current-interrupting capacity. The operating mechanism is in the center space of these spaces or compartments provided by insulating barriers and cross barriers which are provided in each space at the arc extinguishers. The switch has no rotating or sliding current-carrying joints, a solid current path being provided by brazing one end of a flexible conductor to a terminal and the other end to the arms on which the moving butt contact is brazed. Another advantage of the switch is the provision of butt contacts, the moving contact being visible in the open position to give a visible break. The snap-acting operating mechanism has an overset toggle which in the closed position of the switch, locks the contacts closed against being blown open by a short-circuit current. Means is also provided to move the operating handle back to the "on" position should it be moved to the "off" position with the contacts stuck or welded in the closed position to give a warning of the condition of the switch. Inexpensive covers are provided for protection against contact with live parts of the switch and the terminals at both ends of the switch without interfering with the visibility of the moving contacts.

Having described the invention in accordance with the provisions of the patent statutes, it is to be understood that various changes and modifications may be made therein without departing from the spirit of the invention.

I claim as my invention:

1. A switch for controlling an electric circuit comprising stationary and movable butt contacts, a movable switch arm having the movable butt contact thereon, operating mechanism for said switch arm comprising an operating lever and a handle thereon for manually moving said operating lever, an overset toggle operable by said operating lever to effect movement of said switch arm to open and closed positions, and spring means having one end attached to said operating lever to move said operating lever and said handle from said open position to said closed position upon release of said handle when said operating lever is moved to said open position to effect opening of said butt contacts and said butt contacts fail to open.

2. A switch for controlling an electric circuit comprising a base of one-piece molded insulating material, insulating barriers on said base forming compartments, stationary and movable butt contacts in each of said compartments, a movable switch arm in each compartment having the movable butt contact thereon, operating mechanism for said switch arms in one of said compartments comprising an operating lever and a handle thereon for moving said switch arms to open and closed positions, and spring means having one end attached to said operating lever to move said handle from said open position to said closed position upon release of said handle when said handle is moved to said open position and said contacts fail to open.

3. A switch for controlling an electric circuit comprising a base of molded insulating material, insulating barriers on said base forming compartments extending the length of the base, stationary and movable butt contacts in each compartment, a movable switch arm in each compartment having the movable butt contact thereon, an operating mechanism for said switch arms disposed in the center compartment comprising a handle movable to open and closed positions to effect opening and closing movements of said switch arms, a cover formed from a flat sheet of insulating material mounted on said barriers and leaving said movable butt contacts exposed so that said contacts are visible from the front of the switch at least

in the open position of the switch arms, a portion of said cover extending beyond said barriers at the end of said base adjacent said contacts.

4. A switch for controlling an electric circuit comprising a base of molded insulating material, insulating barriers on said base forming compartments extending the length of the base, stationary and movable butt contacts in each compartment, a movable switch arm in each compartment having the movable butt contact thereon, an operating mechanism for said switch arms disposed in the center compartment, cover means formed from a flat sheet of insulating material covering said compartments but leaving said movable butt contacts exposed so that said movable butt contacts are visible from the front of said switch at least in the open position of said switch arms, and a portion of said cover extending beyond said barriers at the end of said base adjacent said contacts and formed downwardly to cover part of the ends of said base adjacent said contacts and formed downwardly to cover part of the ends of said compartments.

5. A switch for controlling an electric circuit comprising a base of molded insulating material, insulating barriers on said base forming compartments, stationary and movable butt contacts in each compartment, a movable switch arm in each compartment having the movable butt contacts thereon, an operating mechanism for said switch arms disposed in the center compartment comprising a handle movable to open and closed positions to effect movement of said switch arms to open and closed positions, cover means of insulating material covering said compartments but leaving said movable butt contacts exposed so that said movable butt contacts are visible from the front of the switch at least in the open position of said switch arms, and spring means connected to said switch handle to move said handle from said open position to said closed position upon release thereof when said handle is moved to said open position to effect opening movement of said switch arms and said butt contacts fail to open.

6. A switch for controlling an electric circuit comprising a base of one-piece molded insulating material, barriers molded integral with said base forming compartments, said barriers being open at the top, stationary and movable butt contacts in each of said compartments, a movable switch arm in each compartment having the movable butt contacts thereon, a cover plate mounted on said barriers over said compartments, said cover plate having sight openings therein over said contacts so that said movable contacts are visible from the front of said switch at least in the open position thereof, operating mechanism in one of said compartments comprising a handle movable to open and closed positions to effect movement of said switch arms to open and closed positions, and spring means connected to the handle of said switch to move said handle from said open position to said closed position upon release thereof when said handle has been moved to said open position to effect opening movement of said switch arms and said butt contacts fail to separate.

7. A switch for controlling an electric circuit comprising a base of one-piece molded insulating material, barriers molded integral with said base forming compartments, a pair of stationary and movable butt contacts in each compartment, a movable switch arm in each compartment having the movable butt contacts thereon, an operating mechanism for said switch arms disposed in the center compartment, terminals in each compartment at the ends of said base, a cover portion of insulating material mounted on said barriers and covering the portions of said compartments beside the operating mechanism and the terminals at one end of said base, and a second cover portion covering the terminals at the other end of said base, said covers being disposed and arranged to have exposed the movable contacts so that they are visible from the front of the switch at least in the open position of said switch arms.

8. In a switch for controlling an electric circuit comprising a base of one-piece molded insulating material, insulating barriers on said base forming compartments, stationary and movable butt contacts in each compartment, a movable switch arm in each compartment having the movable butt contacts thereon, an operating mechanism for said switch arms disposed in the center compartment, an arc extinguisher in each compartment, a cover portion formed from a flat sheet of insulating material mounted on said barriers and covering the portions of said compartments below said arc extinguisher, and a second cover portion formed from a flat sheet of insulating material covering the portions of said compartments above said arc extinguishers, one of said covers having a portion extending beyond said barriers, said covers exposing the movable contacts so that they are visible from the front of the switch at least in the open position of said switch arms.

9. In a switch for controlling an electric circuit comprising a base of one-piece molded insulating material, insulating barriers on said base forming compartments, stationary and movable butt contacts in each compartment, a movable switch arm in each compartment having the movable butt contact thereon, an operating mechanism for said switch arms comprising a handle for moving said switch arms, an arc extinguisher in each compartment, a cover portion formed from a flat sheet of insulating material mounted on said barriers and covering the portions of said compartments below said arc extinguishers and beside the operating mechanism, said cover having an opening therein through which the handle of the operating mechanism extends, and a second cover portion mounted on said barriers and covering the portions of said compartments above said arc extinguishers, said second cover having a portion extending beyond said barriers, said cover portions being spaced apart to expose the movable contacts so that they are visible from the front of the switch at least in the open position of said switch arms.

10. An enclosed switch having a member movable to "on" and "off" positions to operate said switch, a casing in which said switch is mounted, an openable cover for said casing, a movable operating member having means thereon engaging and operating said movable member of the switch, said means disengaging said movable member when said cover is opened, a handle on said cover having means engaging and operating said movable operating member to open and close said switch, said handle being movable to an "on," an "off" and an "open cover" position, said handle when moved to said "open cover" position moving said movable member to said "off" position, and spring means connected to the movable member of said switch to move said movable member from said "off" position to said "on" position if said switch fails to open when said cover is opened.

11. An enclosed switch comprising separable contact means, operating mechanism comprising an operating lever and a handle thereon movable to "on" and "off" positions to open and close said contact means, a casing in which said switch is mounted, an openable cover for said casing, a slidable operating member mounted on said cover and having means thereon resiliently engaging and operating said handle of said switch, a movable member on said cover having means thereon engaging and operating said slidable operating member to effect opening and closing of said contacts, spring means connected to return said movable member to the "on" position when said cover is opened and said movable member is released, and other spring means attached to the operating lever of said switch to return said switch handle to the "on" position in the event said contact means fails to open when the cover is opened and said switch handle is released after being moved to effect opening of said contacts.

12. An enclosed switch for controlling an electric circuit comprising a base of insulating material, insulating barriers on said base forming compartments, stationary

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and movable butt contacts in each compartment, a movable switch arm in each compartment having said movable butt contacts thereon, an operating mechanism for said switch arms disposed in the center compartment comprising a handle movable to "on" and "off" positions to move said switch arms, a casing in which said switch is mounted, an openable cover for said casing, a slidable operating member mounted on said cover and having resilient means thereon engaging and operating said handle of said switch, said resilient means disengaging said handle when said cover is opened, a movable member on said openable cover movable to "on," "off," and "open cover" positions and having means engaging and operating said slidable operating member, said movable member when moved to said "open cover" position to effect opening of said contacts, spring means connected to return said handle to the "on" position if said contacts fail to open when said movable member is moved to the "open cover" position and said cover is opened, and cover means mounted on said barriers covering said compartments and having openings therein over said contacts so that said contacts are visible from the front of said switch, said cover means preventing contact with the live parts of said switch when said openable cover is open.

13. A switch for controlling an electric circuit comprising a base of molded insulating material, insulating barriers extending upwardly on said base providing a plurality of pole spaces therebetween, stationary and movable butt contacts in each of a plurality of the spaces between the barriers, a movable switch arm in each of a plurality of the spaces and each having one of the movable butt contacts thereon, an operating mechanism for said switch arms, said operating mechanism being mounted on said base and including a movable operating member extending upwardly from the base, wire-receiving terminal members on said base adjacent one end thereof, cover means of insulating material mounted over said barriers and leaving said movable contacts exposed so as to be visible from the front of the switch at least in the open position of the switch arms, a portion of said cover means extending over

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and beyond said wire-receiving terminal members, and a plurality of openings in said cover means one of which is over each of said terminal members to give access thereto.

14. A switch for controlling an electric circuit comprising a base of molded insulating material, insulating barriers extending upwardly on said base providing a plurality of pole spaces therebetween, stationary and movable contacts in each of a plurality of the spaces between the barriers, a movable switch arm in each of a plurality of the spaces and each having one of the movable contacts thereon, an operating mechanism for said switch arms, said operating mechanism being mounted on said base and including a movable operating member extending upwardly from the base, wire-receiving terminal members on said base adjacent one end thereof, cover means formed from a flat sheet of insulating material mounted over said barriers and leaving said movable contacts exposed so as to be visible from the front of the switch at least in the open position of the switch arms, an opening in said cover means through which the upwardly-extending operating member is movable, a portion of said cover means extending over and beyond said wire-receiving terminal members, and a plurality of openings in said cover means one of which is over each of said terminal members to give access thereto.

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