Feb. 17, 1948. H. W. GRAYBILL ET AL 2,436,296

SWITCH

Filed Dec. 11, 1943 2 Sheets-Sheet 1

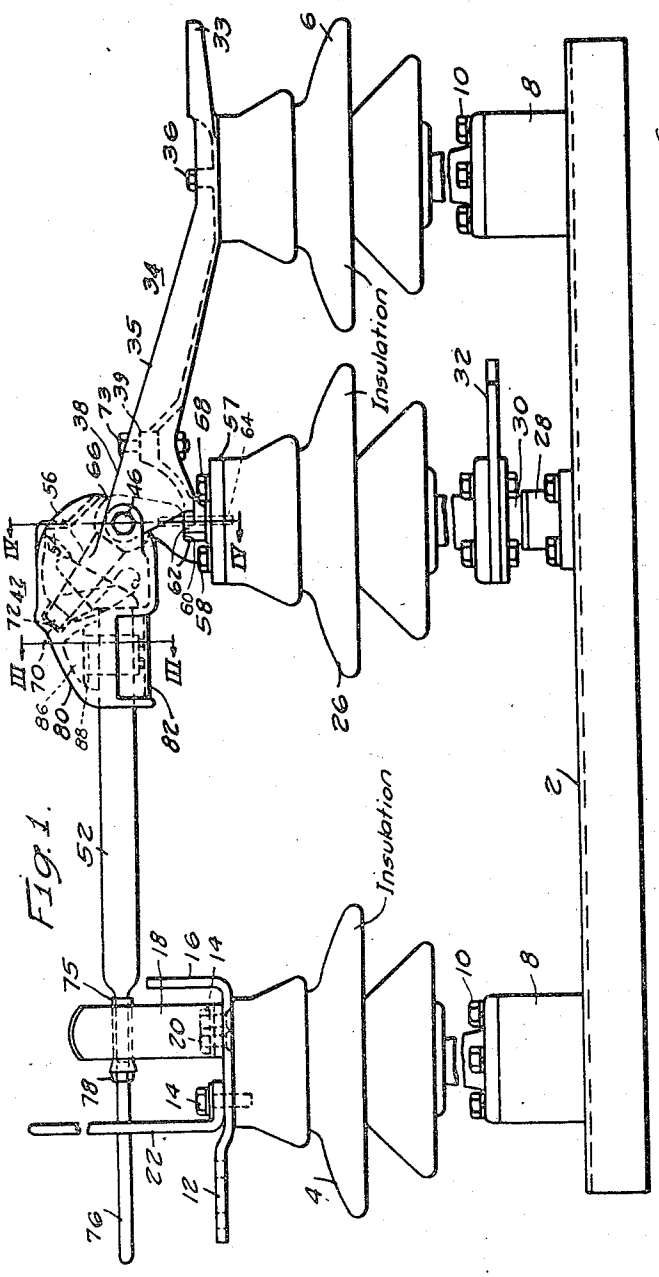


FIG. 1.

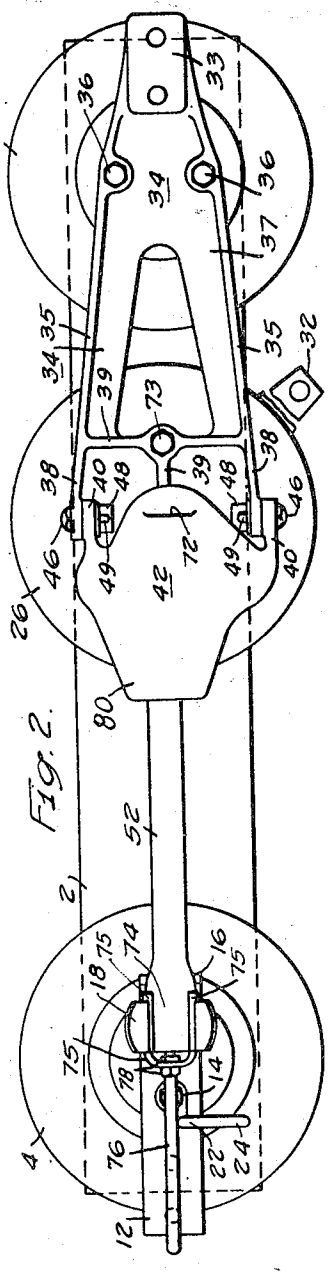


FIG. 2.

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Fig. 3.

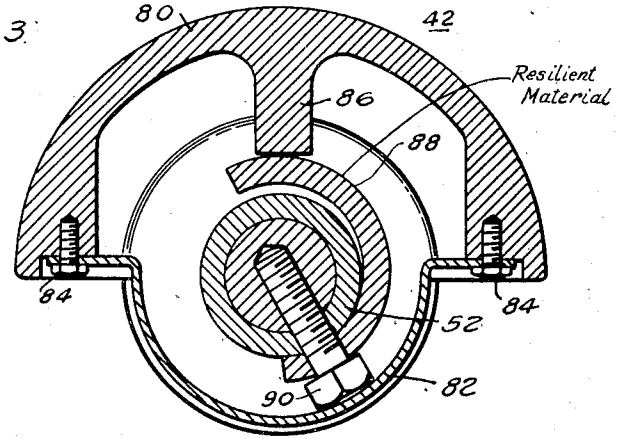
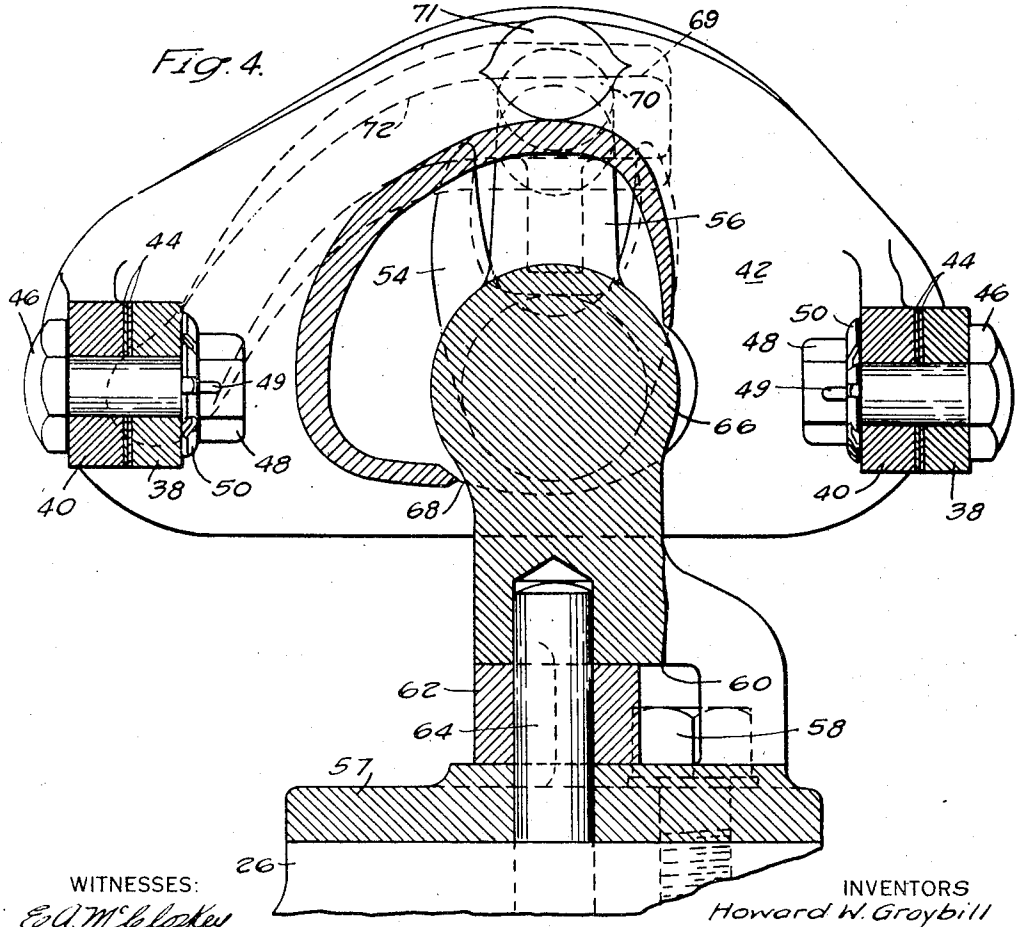


Fig. 4.



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2,436,296

SWITCH

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7 Claims. (Cl. 200—48)

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This invention relates generally to electric switches, and more particularly to high-voltage disconnect switches, and to switches having high-pressure contact engagement.

The particular embodiment of the invention disclosed herein constitutes certain improvements in the switch disclosed and claimed in the copending application of H. L. Rawlins, Serial No. 443,586, filed May 19, 1942, now Patent No. 2,363,360, issued November 21, 1944, to the same assignee as this invention. The switch disclosed in the Rawlins application is of the general type wherein a switch blade is mounted for pivotal movement about a transverse axis to and away from a position where it is disposed in proximity to one or more line contacts, and the blade is also mounted for rotation about its longitudinal axis when in proximity to the line contacts, to move into and out of high-pressure engagement with the contacts. It has been customary to conduct current from the switch blade to the line terminal adjacent the blade pivot, by means of flexible shunt. One method of avoiding this is disclosed in the aforesaid Rawlins application, and comprises the provision of a second set of high-pressure contact jaws on the line terminal adjacent the blade pivot to be engaged with high pressure by the same movement of the blade which causes high-pressure engagement with the other line contact remote from the blade pivot.

One object of this invention is to provide novel means for conducting current in a switch of the type described, from the switch blade to the line terminal located adjacent the blade pivot.

More specifically, it is an object of this invention to provide a novel high-pressure-contact current path in a switch of the type described, between the switch blade and line terminal located adjacent the blade pivot, wherein the high-pressure contacting surfaces are entirely enclosed or covered at all positions of the blade, together with provisions for relieving at least a part of the contact pressure during pivotal movement of the switch blade.

Another object of this invention is simply to provide a novel form of high-pressure contact for electric switches.

Still another object of this invention is to provide a simplified bearing support for one end of a rotatable blade-actuating insulator.

A more particular object of this invention is to provide certain improvements in high-pressure contacts per se to render them more efficient in operation and to have a longer life.

These and other objects of this invention will

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become more apparent upon consideration of the following detailed description of a preferred embodiment thereof, when taken in connection with the attached drawings, in which:

Figure 1 is a side elevational view of a disconnecting switch constructed in accordance with this invention;

Fig. 2 is a top plan view of the switch shown in Fig. 1;

Fig. 3 is an enlarged transverse section through the switch shown in Fig. 1, taken substantially on the line III—III thereof; and

Fig. 4 is also an enlarged transverse section through the switch shown in Fig. 1, but taken substantially on the line IV—IV thereof.

The particular switch illustrated may be mounted on a supporting base 2, such as a channel iron or the like, and includes spaced insulators 4 and 6 rigidly secured to mountings 8 on support 2, for example as by bolts 10. The insulator 4 has secured to the free end thereof a terminal strap 12 of copper or other good electrical conducting material, for example as by bolts 14. The terminal strap 12 has one end thereof angularly directed as at 16 in a direction outwardly of insulator 4, to form a stop flange, for a purpose to be described. A generally U-shaped line contact 18, preferably of some wear resistant good electrical conducting material, such as a copper alloy, for example a beryllium-cobalt-copper alloy, is adapted to be secured on terminal strap 12 in electrical conducting relation therewith, by bolts 14 and 20 extending through apertures provided in the bight portion of the contact. One of the securing bolts 14 also acts to secure an arcing horn 22 in conducting relation to terminal strap 12. The outer end of arcing horn 22 is bent at an angle as shown at 24. As clearly shown in Figs. 1 and 2, terminal strap 12, at the end opposite stop flange 16, extends outwardly of insulator 4 for the connection of a line conductor thereto.

An operating insulator 26 is provided at one end with a short stub shaft 30, adapted to be rotatably mounted in a bearing 28 mounted on support 2. An operating crank 32, which may be connected to suitable operating mechanism, or directly actuated manually, if desired, is secured to stub shaft 30 and insulator 26 for actuating the insulator. A supporting or bracing frame 34 is adapted to be secured to the outer end of insulator 6, as by screws 26, and has at one end thereof an integrally formed terminal pad 33 for the connection of a line conductor thereto. Frame 34 may be of any desired metallic material and is preferably cast to provide

opposite side plates 35, and integral open webbing 37 joining the side plates at selected points, with reinforcing flanges 39 positioned adjacent the end of frame 34 nearest to rotatable insulator 26. The ends 38 of the sides of frame 34 are extended to be substantially in alignment with the axis of rotation of insulator 26, and are transversely apertured for cooperation with integral apertured lugs 40 provided on a rigid member comprising a hollow blade supporting housing 42. It will be seen by reference to Figs. 2 and 4, that the lugs 40 on blade supporting housing 42 are each positioned at the same side of extensions 38 on frame 34, or, as shown in Fig. 2, lugs 40 on the blade supporting housing are each positioned below one extension 38 on the sides of frame 34. The reason for positioning lugs 40 offset to one side of extensions 38 of the supporting frame, is that since both the frame and blade supporting housing are preferably cast in form, the lugs 40 and extensions 38 will be relatively rigid and, therefore, in order to obtain good contact between the contact portion of at least one of lugs 40 and contact means comprising the confronting face of its adjacent extension 38, it is necessary that a force exerted on these parts, which tends to move the parts in opposite directions, will force both lugs 40 into engagement with their respective frame extensions 38. Contact pressure between lugs 40 and frame extensions 38 is obtained by mounting generally cup-shaped spring washers 50, on the pivot bolts 46 for each lug and frame extension, so that when the nut 48 of the pivot bolt is drawn tightly and locked in position by a cotter pin 49, each spring washer will exert a force tending to move the housing 42 and frame 34 in opposite directions, to thereby cause engagement of lugs 40 and frame extensions 38 with a high pressure. If desired, the confronting faces of lugs 40 and frame extensions 38 may be coated, for example by electro-deposition, with a layer of a good electrical conducting material 44, such for example as silver, to thereby provide a low resistance current path between the frame 34 and blade supporting housing 42. It will be observed that even though the spacing of lugs 40 does not exactly correspond to the spacing of frame extensions 38, at least one lug and frame extension will be urged into good high-pressure contact, and it has been found that this is sufficient to carry the current from frame 34 to blade housing 42.

The switch blade 52 proper, is preferably tubular in form and the inner end thereof extends through an opening provided in hollow blade support 42, and is provided within the blade support with an actuating fork 54 secured to the inner end of the blade. Switch blade 52 is rotatably mounted in one wall of blade housing 42 and in an outer wall defining the outer end of a hood portion 80 integral with the blade housing 42, so that the blade may be rotated substantially about its own longitudinal axis. An angularly extending drive crank 56 is provided for the purpose of actuating blade 52 both in a rotatable fashion about its longitudinal axis, and in a pivotal manner about pivot bolts 46 for blade support housing 42. The drive crank 56 is integral with a cap plate 57 secured to the free end of rotatable insulator 26, for example as by bolts 58. The portion of the actuating crank structure adjacent plate 57 is provided with a slot 60 for receiving an integral projection 62 on frame 34. A pivot pin 64 is adapted to be freely positioned

through apertures provided in the drive crank structure including its cap plate 57, and through an aperture provided in frame extension 62. Frame 34 thus provides a bearing for the free end of rotatable insulator 26 which also acts to brace the insulator at its outer end.

Rotatable drive crank structure 56 is provided with a substantially spherical portion 66 adapted to be positioned at the point where the drive crank structure passes through an opening 68 provided in the blade supporting housing 42. The outer end of drive crank 56 is provided with a roller 70 adapted to be received in a groove 72 formed on the inner wall of blade supporting housing 42, as in the aforementioned Rawlins application.

The outer end of switch blade 52 is flattened at 74 to form a portion having a width somewhat greater than the space between the sides of contact 18, so that when positioned transversely of contact 18, side-edge portions of blade part 74 will be in high-pressure wedging engagement with contact 18. Preferably, an arc and wear resistant U-shaped contact piece 75 is provided for the end 74 of the blade, with the contact piece having the leg portions thereof telescoped over the side edges of part 74 of the blade, and preferably being channel-shaped in section so as to receive such edges within the leg portions of the contact strip 75. The contact strip 75 may be secured to the outer end of the blade in any desired manner, such for example as by soldering the leg portions thereof to the side edges of the blade. Preferably, U-shaped contact strip 75 is secured to blade end 74 with the bight portion thereof spaced from the free end of the blade, and provided with an aperture for receiving the inner end of a rod-like arcing horn 76. The inner end of horn 76 may be threaded, and secured to contact strip 75, for example, as by the nuts 78.

The hood portion 80 of contact supporting housing 42 is provided with a cover 82 for the open side thereof, to completely enclose the space beneath hood portion 80 and the portion of switch blade 52 which lies therein. Cover 82 may be secured in position by any desired means, such for example as by machine screws 84. Hood portion 80 is provided beneath the same with an integral longitudinally-extending contact portion 86 (Fig. 3), adapted to be engaged by contact means comprising a substantially spiral-shaped contact spring 88, suitably secured at one end to switch blade 52, for example as by bolts 90. Contact spring 88 may be of any desired resilient material which is also a good conductor of electricity, such as, for example, a copper alloy similar to that used for line contact 18.

In the closed circuit position of the switch, the parts occupy the positions shown in the drawing, that is, blade portion 74 is positioned substantially transversely of the sides of line contact 18 so as to be in high-pressure engagement therewith. Similarly, the spiral contact spring 88 on the blade beneath hood 80, is in pressure engagement with contact portion 86 integral with blade supporting housing 42. The electrical circuit through the switch may then be traced from terminal strip 12 to line contact 18, and to switch blade 52 by the high-pressure engagement of the line contact with contact strip 75 on the blade; the circuit proceeds through the switch blade to its spring contact 88 and to contact portion 86 by virtue of the high-pressure engagement of these two parts; then through blade supporting

housing 42 and its lugs 40 to extensions 38 of frame 34, by virtue of the high-pressure engagement of lugs 40 and frame extensions 38; thence through the frame to the other line terminal 33.

In the operation of the switch described above, when it is desired to open the switch, insulator 26 is rotated in a counterclockwise direction as viewed in Fig. 2. The initial movement of the rotatable insulator causes drive crank 56 to carry actuating fork 54 of the blade with it, and thereby cause rotation of the blade about its longitudinal axis to position portion 74 of the blade at an acute angle with respect to contact 18. This rotation of the blade in a counterclockwise direction as viewed in Fig. 3, will also at least partially release contact spring 88 from pressure engagement with contact portion 86. During this initial rotation of the blade, there will be no pivotal movement about pivot bolts 46, because the roller 70 on the actuating crank travels in the straight end portion 69 of slot 72 which is disposed in the plane of this initial movement of roller 70. However, after contact pressure has been released at line contact 18, the roller will enter the inclined portion of slot 72 and thereby cause movement of blade-supporting housing 42 and with it the blade 52, in a clockwise direction as viewed in Fig. 1, to move the blade to a position spaced away from line contact 18. The open position of the switch blade may be defined by an adjustable stop bolt 73 mounted in frame 34, in a position to be engageable with an indentation 71 provided in blade-supporting housing 42. During pivotal movement of blade 52 away from contact 18, actuating crank 56 has but a small component of motion transversely to fork 54, and hence very little rotation of the blade about its longitudinal axis will occur. When it is desired to close the circuit, insulator 26 is rotated in the opposite direction. This first causes pivotal movement of the blade and its blade support about pivot bolts 46, until the outer end of the blade reenters contact 18. At this time the roller 70 on the actuating crank will be just entering the straight end portion of slot 72 in the housing, so that continued rotation of insulator 26 in the same direction will not cause any pivotal movement of the blade and its housing about pivot bolts 46, but will cause only rotation of blade 52 about its longitudinal axis to cause the portion 74 and contact spring 88 to be rotated into high-pressure contact with line contact 18 and contact projection 86 of the housing, respectively. During pivotal movement of blade 52 adjacent line contact 18, arcing horn 76 thereon will remain in engagement with fixed arcing horn 22. Stop flange 16 prevents excessive movement of blade 52 when the closing operation takes place very rapidly.

From the foregoing, it is believed apparent that this invention provides a novel arrangement for conducting current from one line terminal 33 to switch blade 52. It will be observed that this current path includes high-pressure contact between lugs 40 and frame extensions 38 which are always in engagement at all positions of the switch. This current path also includes high-pressure contacts 86 and 88 which are engaged under high-pressure only at the final closed position of the switch. However, high-pressure contacts 86 and 88 are totally enclosed so that the current path from terminal 33 to the switch blade is entirely protected at all times. The particular means for obtaining high-pressure contact between the blade and its supporting housing 42 in response to rotation of the blade, while especially adapted for the particular application illustrated, may find certain desirable cooperation in other types of switches, as well. There is also disclosed herein a novel method of obtaining high-pressure contact between a pair of rigid members pivoted at spaced points, that is, between the supporting frame 34 and blade support 42 illustrated, which assures high-pressure contact at least at one of these points. The particular manner of supporting the outer end of rotatable insulator 36 from frame 34, adds to the simplicity of the switch constituting this invention, and especially to more economical manufacture thereof. The particular manner of securing an arcing horn to a switch blade illustrated, may also find certain novel features of cooperation or utility with switches other than the particular switch disclosed herein.

Having described a preferred embodiment of the invention in accordance with the patent statutes, it is desired that the invention be not limited to this particular embodiment, inasmuch as it will be obvious, particularly to persons skilled in the art that many changes and modifications may be made in this particular structure without departing from the broad spirit and scope of this invention as set forth in the following claims.

We claim as our invention:

1. In a switch of the type having a switch blade rotatably mounted on substantially its longitudinal axis on a blade support which in turn is pivotally mounted on a line terminal for movement of said blade to and away from a position, said pivotal mounting of said blade support including a pair of rigid ears on said support and a pair of rigid ears on said one terminal, pivot means extending through said ears with the ears on said support being positioned in proximity to and on corresponding sides of the ears on said one terminal, respectively, and resilient means biasing one pair of ears laterally in one direction into high-pressure engagement with said other pair of ears.

2. In a switch, a terminal support, a switch blade structure, a plurality of spaced rigid ears on said support, a plurality of correspondingly spaced rigid ears on said blade structure, pivot means extending through said ears for pivotally mounting said blade structure on said support, the ears on said support being positioned in proximity to and on corresponding sides of the ears on said blade structure, and resilient means biasing said members laterally in a direction to cause engagement under pressure of said ears.

3. In a switch, a terminal support, a switch blade structure, a plurality of spaced rigid ears on said support, a plurality of correspondingly spaced rigid ears on said blade structure, pivot means extending through said ears for pivotally mounting said blade structure on said support, the ears on said support being positioned in proximity to and on corresponding sides of the ears on said blade structure, said pivot means comprising a separate pivot pin for each pair of ears on said support and blade structure which are in proximity to each other, and spring washers on each of said pivot pins for biasing the ears on each member laterally in opposite directions into high-pressure engagement.

4. In a switch of the type having a switch blade rotatably mounted on substantially its longitudinal axis on a blade support, which in turn is pivotally mounted on a line terminal for movement of said blade to and away from a position wherein an end portion of said blade lies between the jaws

of a line contact, with said end portion of said blade having one transverse dimension greater than another and slightly greater than the distance between said contact jaws so as to be rotatable upon rotation of said blade to and away from a position where said greatest transverse dimension is presented transversely of said jaws to effect high-pressure engagement therewith, the combination of a substantially U-shaped contact strip telescoped over said end portion of said blade with the leg portions thereof extending longitudinally of the blade and being secured in overlying relation to the edges of said blade at said greatest transverse dimension and with the bight portion of said strip spaced, from the outer end of said blade and an arc horn secured to said bight portion of said contact strip.

5. In a switch, spaced line terminals, a switch blade mounted on one of said line terminals for rotative movement substantially about its longitudinal axis into and out of high pressure engagement with a contact on the other of said terminals, and for pivotal movement to and away from a position adjacent said contact, separate bearing means supporting said blade for the aforesaid movements, respectively, a rigid member of conducting material mounted solely for pivotal movement with said blade, said member having one contact portion positioned to engage contact means on said blade at least at the closed circuit position of said switch, said member having a spaced contact portion positioned to engage contact means on said one line terminal, at least at the closed circuit position of said switch, means causing each of said contact portions to engage its respective contact means under pressure at least at the closed circuit position of said switch, and said rigid member having housing means movable therewith and with said blade and entirely enclosing said one contact portion and said blade contact means at all positions of said blade, so that none of said contacts are ever exposed to the weather.

6. A switch, comprising a switch blade rotatably mounted on substantially its longitudinal axis in bearing means mounted in a blade supporting housing, separate bearing means pivotally mounting said housing on a line terminal for movement of said blade to and away from a position in proximity with another line terminal spaced from the first-mentioned terminal, actuating means operable in a circuit-opening operation to first rotate said blade about said longitudinal axis out of high-pressure engagement with said other line terminal and to thereafter pivotally move said blade to a position spaced away from said other line terminal, means for conducting current from said one terminal through at least a part of said housing to said blade at least in the closed circuit

position of said switch, comprising, contacting portions on said blade and on one portion of said pivotally mounted housing, respectively, said contacting portions being located in said housing so that the latter completely encloses said contacting portions at all positions of said switch, cooperating contact surfaces of relatively small area on said one terminal and on another portion of said housing arranged so as to be in engagement at all positions of said switch, and means for urging said contact surfaces and contacting portions into engagement under pressure, whereby said current conducting means has no current carrying contact parts exposed to the weather at any position of said switch.

7. A switch, comprising, a switch blade rotatably mounted on substantially its longitudinal axis in bearing means mounted in a blade supporting housing, separate bearing means pivotally mounting said housing on a line terminal for movement of said blade to and away from a position in proximity with another line terminal spaced from the first-mentioned terminal, actuating means operable in a circuit-opening operation to first rotate said blade about said longitudinal axis out of high-pressure engagement with said other line terminal and to thereafter pivotally move said blade to a position spaced away from said other line terminal, means for conducting current from said one terminal to said blade at least in the closed circuit position of said switch, comprising separable contacts on said blade and on said pivotally mounted housing, respectively, positioned to be moved into and out of high-pressure engagement by rotation of said blade relative to said support into and out of high-pressure engagement with said other line terminal, said contacts being located in said housing so as to be completely enclosed at all positions of said switch, and contacting portions on said one terminal and said housing, respectively, arranged so as to be in engagement at all positions of said switch, whereby said current conducting means has no current carrying contact parts exposed to the weather at any position of said switch.

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