Sept. 26, 1944. A. C. SCHWAGER ET AL. 2,359,055

ROLLER CONTACT FOR HINGED CONDUCTORS

Filed Oct. 11, 1941 2 Sheets-Sheet 1

Fig. 1.

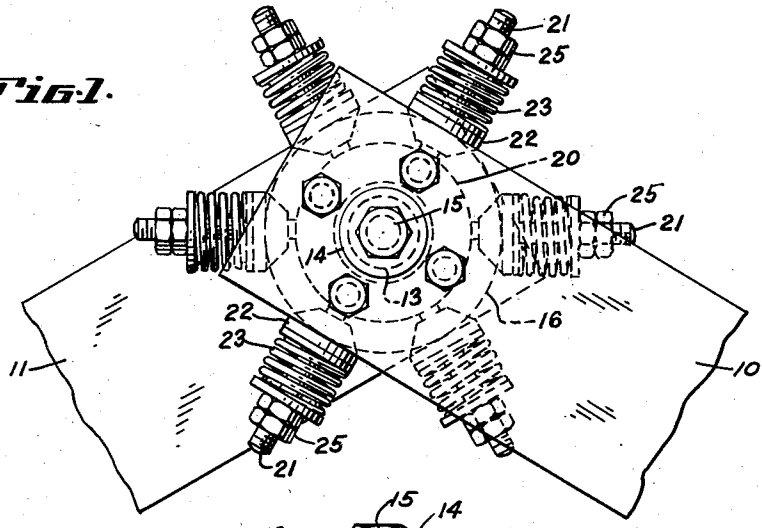


Fig. 2.

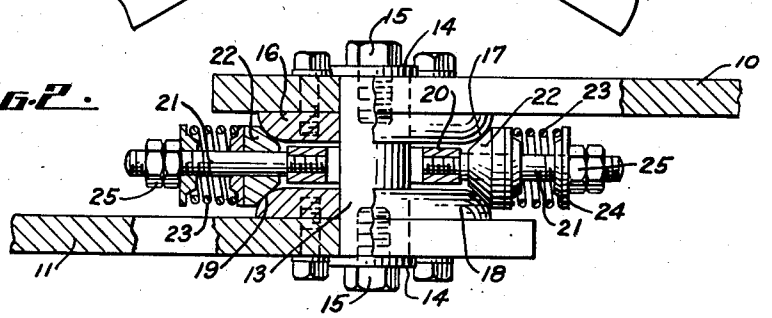


Fig. 3.

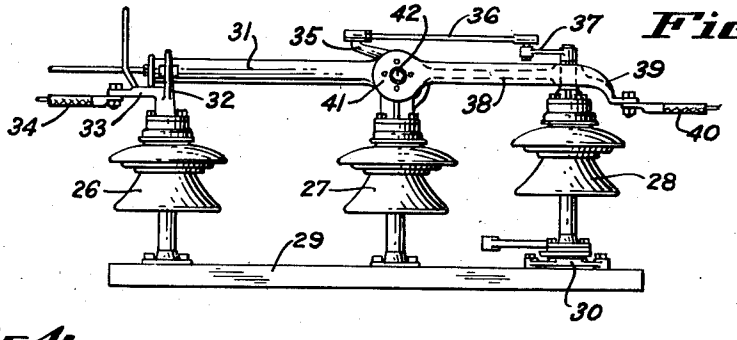
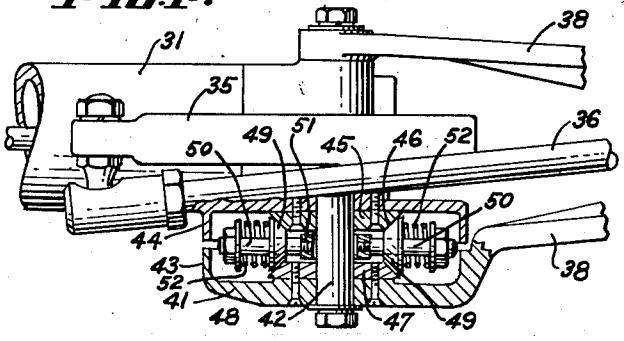


Fig. 4.



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ROLLER CONTACT FOR HINGED CONDUCTORS

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Fig. 5.

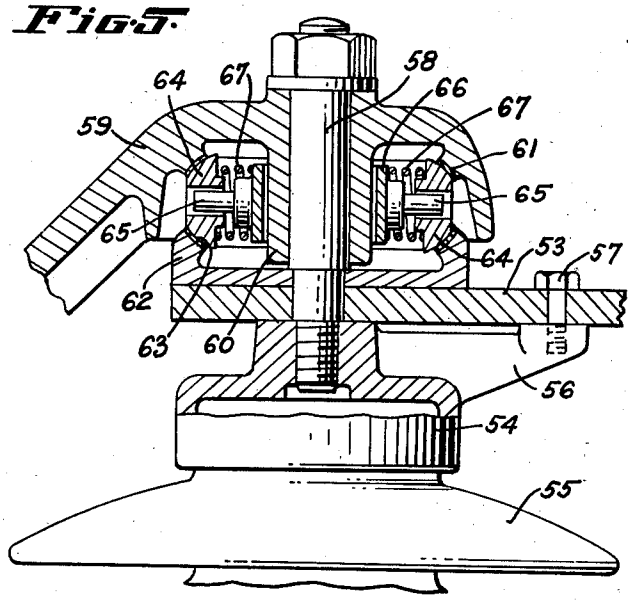


Fig. 6.

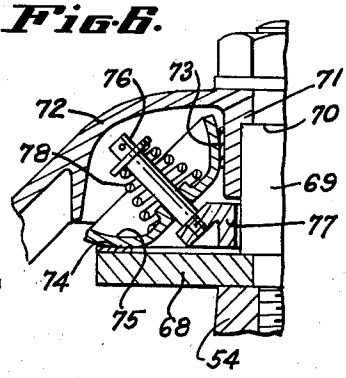


Fig. 7.

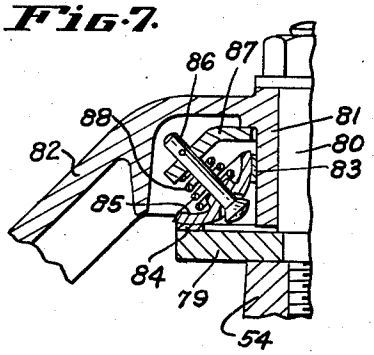


Fig. 8.

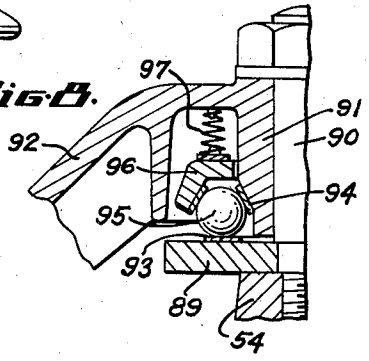


Fig. 10.

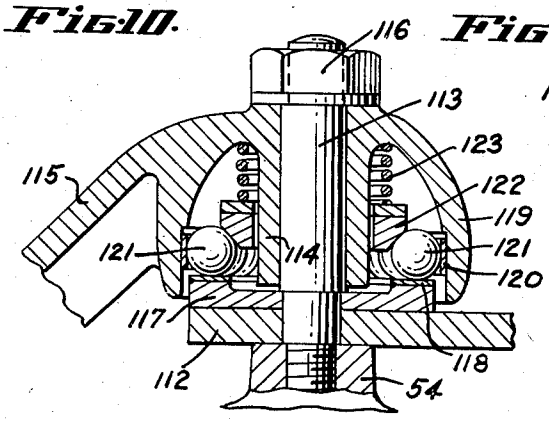
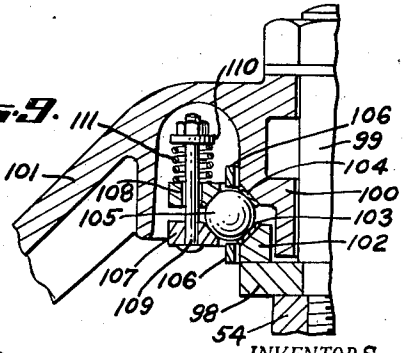


Fig. 9.



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UNITED STATES PATENT OFFICE

2,359,055

ROLLER CONTACT FOR HINGED CONDUCTORS

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Application October 11, 1941, Serial No. 414,650

10 Claims. (Cl. 200—162)

The present invention relates to electrical apparatus, and more particularly to an improved device for establishing a current carrying connection between articulately connected current carrying members.

An object of the invention is to provide a new and novel means for maintaining a good electrical connection between relatively movable current conducting members which are hinged together upon a common axis.

Another object of the invention is to provide a current conducting path between two hinged current carrying members which will eliminate the use of flexible current carrying jumpers.

In the past, where two electrical current conducting members have been hinged together upon a common axis, and particularly on high potential switches, it has been the custom, in order to avoid the passage of current through the pivotal support of the switch blade, to provide a current conducting shunt or jumper from the switch blade to the pivot and terminal supporting standard. These shunts or jumpers must of necessity be made of good current conducting material and in practice they are formed of copper ribbon or small wires. While these expedients provide a good electrical connection between the stationary terminal supporting means and the movable switch blade, they are open to the objection that the copper conductors become corroded and eventually break, due to the frequent flexing thereof. It is, therefore, a further object of the invention to provide a means for establishing and maintaining a good electrical connection between the stationary terminal and the movable blade of a circuit controlling switch which will overcome the above difficulty.

Another object of the invention is to provide a circuit completing connection between relatively hinged current conducting members which can be concealed and enclosed to thus protect it against damage or the accumulation of ice and snow, which might interfere with its efficient operation.

Other objects and advantages of the invention will be in part evident to those skilled in the art and in part pointed out hereinafter in the following description taken in connection with the accompanying drawings, wherein there is shown by way of illustration and not of limitation, a number of embodiments thereof.

In the drawings:

Figure 1 is a side elevation of a modification of the invention adapted for use with two flat current conducting members,

Figure 2 is a plan view partially in section of the device illustrated in Figure 1,

Figure 3 is a side elevation of a high potential disconnecting switch with the device of Figure 1 embodied therein,

Figure 4 is a fragmentary plan view with parts broken away and partially in section showing details of the switch of Figure 3,

Figure 5 is a fragmentary side elevation in section showing the invention as applied to a horizontally swinging switch blade, and

Figures 6, 7, 8, 9 and 10 show the modifications of the invention as applied to a switch of the character illustrated in Figure 5.

In Figures 1 and 2 of the drawings the invention is shown as applied to two copper current conducting members 10 and 11 which are pivotally secured together side by side upon a shaft 13 that forms a hinged connection therebetween. As shown in Figure 2, the shaft 13 is provided at its ends with washers 14 that are secured thereupon by means of studs 15. These washers 14 serve to hold the two current conducting members 10 and 11 in a uniformly spaced manner upon the shaft 13. The copper conducting member 10 carries a contact forming member 16 that is rounded off at its outer edge so as to provide a rounded annular contact surface 17 which is concentric to the axis of the shaft 13. Likewise, the current conducting member 11 carries a contact forming member 18 which is rounded off at its outer edge so as to provide an annular contact surface 19 which is also concentric to the axis of the shaft 13. Disposed between these contact forming members 16 and 18 and surrounding the shaft 13, there is an annular ring-like supporting member 20 which carries a plurality of radially extending spindles 21, upon each of which there is both slidably and rotatably mounted a conical contact engaging roller 22. These contact engaging rollers 22 are held in peripheral engagement with the concentric contact surfaces 17 and 19 of the contact members 16 and 18 by means of compression springs 23 which are held in a compressed manner between complementary spring seats 24 by means of a nut and check nut 25 which are adjustably threaded upon the outer ends of the spindles 21.

With the above arrangement it will be seen that when the compression springs 23 are adjusted to exert a substantially uniform pressure upon the several conical contact engaging rollers 22, the entire assembly, including the annular ring-like supporting member 20 with its spindles 21 and the rollers 22, will freely float about the

shaft 13 and, as a result, when the current conducting members 10 and 11 are moved with relation to each other about the shaft 13, the contact engaging rollers 22 will roll in peripheral engagement over both of the concentric contact surfaces 17 and 19 upon the contact forming members 16 and 18 and thus maintain a good electrical contact therewith through which current may pass from one to the other of the current conducting members 10 and 11. If the device is to be used where it will be exposed to corrosion, it will be understood that the contact members 16 and 18 and the contact engaging rollers 22 may be made of a non-corrosive metal. Or, as an alternative, the concentric contact surfaces 17 and 19 and the contact engaging rollers 22 may be provided with a silver plating upon their engaging surfaces.

In Figures 3 and 4 of the drawings the invention is shown as applied to a high potential disconnecting switch. This type of switch is generally installed outdoors, as upon a transmission line supporting tower, or upon the structure of an outdoor sub-station. The switch is here shown as mounted upon two insulators 26 and 27 and is adapted to be operated through the medium of a third and rotatable insulator 28. The insulators 26 and 27 are secured in spaced relation upon a support 29, and the insulator 28 is journaled upon the support 29 by a bearing 30. Pivotally mounted at the upper end of the insulator 27 there is a switch blade 31 that cooperates with and engages a stationary contact 32 at the upper end of the insulator 26. The stationary contact 32 has a terminal boss 33 to which a line conductor 34 is connected. At its pivotal end the switch blade 31 also has an operating lever 35 that is connected by means of a link 36 to a crank arm 37 secured to the upper end of the rotatable insulator 28, and extending from the pivotal point of the switch blade 31 to the upper end of the rotatable insulator 28 there is a spacing strut 38 which carries a terminal boss 29 to which a power line conductor 40 is connected. This spacing strut 38 also serves to provide a bearing for the upper end of the insulator 28 and holds it in proper operating relation with the axis of the switch blade 31. As is more clearly shown in Figure 4 of the drawings, the spacing strut 38 is provided with an enlarged annular portion 41 at its inner end through which a switch blade supporting shaft 42 extends. This enlarged portion 41 of the spacing strut 38 carries an annular flange 43 which, in conjunction with a cooperating flange 44 carried by the switch blade 31, forms an enclosing housing at one side of the switch blade. Arranged within the housing provided by the flanges 43 and 44, as described above, the switch blade 31 carries an annular contact member 45 that is chamfered at its outer edge to form a substantially conical contact surface 46 which is concentric to the axis of the switch blade 31. Arranged opposite the contact member 45, the enlarged portion 41 of the spacing strut 38 carries a second contact member 47 which is likewise chamfered at its outer edge to provide a substantially conical contact surface 48 which is concentric to the axis of the shaft 42. Cooperating with and engaging the annular contact surfaces 46 and 48 there is shown a plurality of contact engaging rollers 49 which, like the rollers 22 above described, are rotatably mounted upon spindles 50 carried by a floating annular supporting member or ring 51. These contact engaging rollers 49 are here shown as held at their peripheries in good contact making engagement with each of the contact members 45 and 47 by means of compression springs 52.

In connection with the above described embodiments of the invention, it will be understood that while the contact members 16 and 18 are illustrated in Figure 2 of the drawings as having rounded contact surfaces 17 and 19 at their outer edges, and the contact members 45 and 47 are illustrated in Figure 4 as being chamfered to provide substantially conical contact surfaces 46 and 48, these contact surfaces may take other shapes. It is also conceivable that one of these contact members may be provided with a substantially conical contact surface, while the other or cooperating contact member is provided with a rounded contact surface. In either event, it will be readily seen that, because of the free floating characteristic of the supports 20 and 51 and the fact that the contact surface engaging rollers 22 and 49 are each individually held in peripheral engagement with their adjacent concentric contact surfaces, they will individually adjust themselves in wedging relation between the contact surfaces so as to provide a good electrical connection between the hinged relatively movable current conducting members.

Reference is now made to Figure 5 and to the remaining figures of the drawings for a detailed description of other variations or embodiments of the invention. As illustrated by Figure 5, the invention is applied to a disconnecting switch of the type having a circuit controlling blade that moves in a horizontal plane. Switches of this character are less expensive than the one above described and are generally mounted upon a pole or transmission tower which supports the high potential transmission power line. This switch comprises a blade 53 that cooperates with a stationary contact (not shown) which is mounted upon a suitable and properly spaced insulating support. The switch blade 53 is secured upon an insulator cap 54 that is carried by an insulator 55 which is adapted to be rotated about its vertical axis by any of the operating means now commonly used for this purpose. Extending outwardly from the cap 54 there is an arm 56 that is secured to the switch blade 53 by means of a screw 57. This insures that the switch blade 53 will turn with the insulator 55 when it is rotated as above indicated. The insulator cap 54 also carries an upwardly extending shaft 58 about which a relatively stationary terminal supporting member 59 is journaled. This terminal supporting member is generally held at its outer end (not shown) by a fixed support where it connects with the terminal of the power line at one side of the switch. On its under side this terminal supporting member 59 is shown as having a central bearing forming hub 60 and also a raised and concaved annular contact surface 61 which is concentric to the axis of the shaft 58. Arranged opposite to this raised contact surface 61 upon the terminal supporting member 59, the switch blade 53 is shown as provided with a contact forming member 62 that has a similar raised and concaved annular contact surface 63 which is also concentric to the axis of the shaft 58. Cooperating with the raised concentric contact surfaces 61 and 63, there is a plurality of contact engaging rollers 64 which, in this instance, have semi-spherical outer surfaces. These contact engaging rollers 64 are shown as positioned in

operative peripheral engaging relation with the concaved contact surfaces 61 and 63 by means of radially extending spindles 65 that are carried by an annular supporting member 66, and surrounding each of these spindles 65, there is a suitable compression spring 67 for each of the contact engaging rollers 64. It will be noted that the annular supporting member 66 is out of contact with the hub 60 so that it may float with respect thereto and thus insure a substantially uniform wedge-like engagement of all of the contact engaging rollers 64 with the cooperating raised contact surfaces 61 and 63. With this last above described arrangement it will be readily seen that when the switch blade 53 is rotated about its pivotal axis, the contact engaging rollers 64 will roll over the concentric contact surfaces 61 and 63 and thus at all times maintain a good electrical connection between the switch blade 53 and the relatively stationary terminal supporting member 59.

In connection with the remaining figures of the drawings it will be understood that the general configuration of the several stationary terminal supporting members and the character of the switch blades and their supporting and operating insulators will be substantially identical to that described above in connection with Figure 5 of the drawings.

In Figure 6 of the drawings the switch blade, designated by the numeral 68, is shown as pivotally mounted upon a vertically disposed shaft 69 that is carried by the insulator cap 54. This shaft 69 has a shouldered portion 70 which cooperates with a suitably shouldered hub 71 formed upon a stationary terminal supporting member 72. In this embodiment the hub 71 is shown as provided with a plated or raised contact surface 73, and the switch blade 68 has a similar raised or plated contact surface 74. Cooperating with these plated contact surfaces 73 and 74 there is a plurality of radially spaced and dished or cupped roller forming discs 75 that are journaled upon spindles 76 that extend radially outward and upwardly from a suitable annular supporting member 77 that is adapted to float both axially and radially about the shaft 69. In this embodiment the roller forming discs 75 are also each shown as biased into good contact making peripheral engagement with the contact surfaces 73 and 74 by means of helical springs 78 which are secured upon the spindles 76 by suitable means.

In Figure 7 of the drawings the switch blade, designated by the numeral 79, is shown as mounted upon its supporting insulator cap 54 with an upwardly extending shaft 80 that turns freely within a depending hub 81 carried by a stationary contact supporting member 82. In this embodiment, like that illustrated in Figure 6 of the drawings, the hub 81 is provided with a raised or plated contact surface 83 and the switch blade 79 has a similar raised or plated contact surface 84 that is concentric to the shaft 80. Cooperating with these raised contact surfaces 83 and 84 there is a plurality of cupped discs 85 which are held in radially spaced relation about the axis of the shaft 80 by means of cooperating spindles 86 that are carried by a free floating annular support 87, and surrounding each of these spindles 86 there is a helical spring 88 that serves to bias the cupper discs 85 into good contact making peripheral engagement with the concentric contact surfaces 83 and 84 as the switch blade is moved about its pivotal axis.

In Figure 8 of the drawings the switch blade, designated by the numeral 89, is shown as mounted upon its supporting insulator cap 54 with an upwardly extending shaft 90 that is freely rotatable within a depending hub portion 91 formed upon a stationary terminal supporting member 92. In this embodiment the switch blade 89 is shown as provided with a raised or plated contact surface 93 that is disposed concentric to the axis about which the switch blade pivots, and the hub 91 is shown as provided with a conical or diagonally disposed cooperating annular contact surface 94. Disposed between and in engagement with the raised annular surfaces 93 and 94 there is a plurality of radially spaced balls or contact rollers 95 which are held in peripheral engagement with the contact surfaces 93 and 94 and through which current may flow from the switch blade 89 to the stationary terminal supporting member 92. It will be understood that these balls or contact rollers 95 may be provided in sufficient number to completely surround the circumference of the hub 91, or they may be held in spaced relation by a ball retainer, as is common practice with ball bearings. Engaging the outer surface of these balls or contact rollers 95 there is a free floating annular ring 96 that is held into pressure exerting relation therewith by means of a plurality of axially extending compression springs 97 that are carried by the stationary terminal supporting memebr 92.

In the embodiment of the invention illustrated in Figure 9 of the drawings the switch blade, designated by the numeral 98, pivots with its supporting insulator cap 54 about the axis of an upwardly extending shaft 99 that is freely rotatable within a depending hub 100 carried by a stationary terminal supporting member 101. As here shown, the switch blade 98 carries an annular and upwardly extending contact member 102 that is chamfered so as to provide a substantially conical contact surface 103, and arranged axially opposite to this raised annular contact member 102, the hub 100 is provided with an oppositely disposed substantially conical contact surface 104. Mounted also in peripheral engagement with the contact surfaces 103 and 104 there is a plurality of balls or roller contacts 105 which are held in equally spaced relation about the axis of the shaft 99 by means of a ball retainer 106. Cooperating with these balls or roller contacts 105 there is also shown a free floating pressure exerting means which comprises two spaced rings 107 and 108. These rings 107 and 108 are chamfered at their inner edges to provide opposed conical surfaces that engage the balls or roller contacts 105 in a manner similar to the latters' engagement with the conical contact surfaces 103 and 104. The ring 108 is slidably mounted upon a plurality of spaced studs 109 that are carried by the ring 107, and surrounding these studs 109 and disposed between the ring 108 and washers and nuts 110 at the outer ends thereof, there are suitable compression springs 111. With this arrangement the springs 111 will bias the rings 107 and 108 toward each other and thus the balls or roller contacts 105 will be wedged between and caused to maintain a good current conducting contact with the conical contact surfaces 103 and 104 carried respectively by the switch blade 98 and the stationary terminal supporting member 101.

In Figure 10 of the drawings the switch blade, designated by the numeral 112, is shown as mounted upon a rotatable pedestal-type insulator

having a cap 54 similar to that above described. The cap 54 also carries an upwardly extending stub shaft 113 that extends through a hub 114 of a stationary terminal supporting member 115 which is secured at its outer end where the line conductor is connected thereto. The stub shaft 113 is shown as having a threaded nut 116 at its outer end which serves to hold the stationary terminal supporting member 115 thereupon. In this embodiment the switch blade 112 carries a contact forming member 117 that turns therewith and upon which there is formed a raised annular contact surface 118. Arranged outwardly from the annular contact surface 118 the stationary terminal supporting member 115 has a depending skirt-like portion 119 upon which there is formed a raised contact surface 120 that is disposed at a right angle to the raised contact surface 118 carried by the switch blade 112. Positioned in engaging relation with the raised contact surfaces 118 and 120 there is a plurality of balls or roller contacts 121 that are adapted to maintain a current conducting circuit between the switch blade 112 and the stationary terminal supporting member 115. For the purpose of maintaining the roller contacts 121 in good peripheral contact making engagement with the raised contact surfaces 118 and 120, there is an anuular pressure exerting ring 122 that is chamfered at its lower outer edge so that it will become centered between the roller contacts 121. A spring 123 is provided for exerting a downward pressure upon the ring 122.

In connection with all of the above described embodiments of the invention, it will be noted that the contact establishing rollers are either carried by a free floating support, or are biased into engagement with their cooperating annular contact surfaces by a free floating pressure exerting means and, as a result, the individual roller contacts will each exert an independent and substantially uniform contact making peripheral engagement with their cooperating relatively movable contact surfaces. In connection with the annular and concentrically arranged contact surfaces which have been described above as formed upon the two relatively movable current conducting members, it will be understood that these surfaces may be plated with silver or other good conducting metal, or if desired, they may be formed entirely of such a metal by soldering or welding same to their respective supporting surfaces.

While we have, for the sake of clearness and in order to disclose the invention so that the same can be readily understood, described and illustrated specific devices and arrangements, we desire to have it understood that this invention is not limited to the specific means disclosed, but may be embodied in other ways that will suggest themselves to persons skilled in the art. It is believed that this invention is new and all such changes as come within the scope of the appended claims are to be considered as part of this invention.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. In an articulated current conducting device, the combination of a shaft, a pair of current conducting members mounted upon said shaft and adapted to rotate relative to each other, means carried by each of said current conducting members forming opposed conical contact surfaces thereupon concentric to the axis of said shaft, conical contact making rollers arranged radially about said shaft and constrained to roll on the conical contact surfaces of said first means, and radial pressure exerting means for forcing said conical contact making rollers into good contact making engagement with the conical contact surfaces of said first means.

2. In an articulated current conducting device, the combination of a shaft, a pair of current conducting members mounted in fixed axially spaced relation upon said shaft, means forming a raised contact surface upon the adjacent inside surfaces of said current conducting members, a free floating annular support disposed about said shaft between said current conducting members having radially extending spindles, a substantially conical contact making roller mounted upon each of said spindles and adapted to engage the raised contact surfaces upon said current conducting members, and spring means associated with each of said contact making rollers for holding them in good current conducting contact with the raised contact surfaces upon said current conducting members.

3. In a circuit controlling switch, the combination of a supporting shaft, a switch blade pivotally mounted upon said shaft, means carried by said switch blade forming a contact surface concentric to the axis of said shaft, a current conducting member disposed in axially spaced relation to said switch blade, means carried by said current conducting member forming a second contact surface concentric to the axis of said shaft, a free floating annular support having a plurality of spindles extending radial to the axis of said shaft, a contact making roller mounted upon each of said spindles and engaging the annular contact surface forming means upon said switch blade and upon said current conducting member, and spring means associated with each of said rollers for holding them in good electrical contact with said annular contact surfaces.

4. In a circuit controlling switch, the combination of a supporting shaft, a switch blade pivotally mounted upon said shaft, means upon one side of said switch blade forming a contact surface concentric to the axis of said shaft, a current conducting member disposed in axially spaced relation to said switch blade, means carried by said current conducting member forming a second contact surface concentric to the axis of said shaft, a free floating support disposed between said first and second annular contact surfaces having a plurality of spindles extending radial to the axis of said shaft, contact making rollers mounted upon said spindles between the annular contact surfaces upon said switch blade and upon said current conducting member, and spring means associated with each of said rollers for holding them in wedging engagement with the annular contact surfaces upon said switch blade and said current conducting member.

5. In a circuit controlling switch, the combination of a pivotally mounted switch blade, a relatively stationary terminal carrying member mounted in axially spaced relation along the pivotal axis of said switch blade, means upon the switch blade forming an annular current carrying contact surface concentric to its pivotal axis, means carried by said relatively stationary terminal carrying member forming a second and axially spaced annular current carrying contact surface concentric to the pivotal axis of the switch blade, said first and second annular cur-

rent carrying contact surfaces being developed along lines disposed at an angle to each other, a plurality of radially spaced current conducting rollers positioned in peripheral engagement with and between said annular current carrying contact surfaces, spring means for exerting a contact producing pressure upon said current conducting rollers, and means for retaining said spring means in an operative position where the direction of the pressure exerted upon said conducting rollers will be along a line substantially bisecting the angles along which said current carrying contact surfaces are developed.

6. In a circuit controlling switch, the combination of a pivotally mounted switch blade, a relatively stationary terminal carrying member mounted in axially spaced relation along the pivotal axis of said switch blade, means upon the switch blade forming an annular current carrying contact surface concentric to its pivotal axis, means carried by said relatively stationary terminal carrying member forming a second annular current carrying contact surface concentric to the pivotal axis of the switch blade, said first and second annular contact surfaces being developed along intersecting angles and disposed in opposed spaced relation to each other, circuit completing means between said annular current carrying contact surfaces comprising a plurality of radially spaced current conducting conical rollers, and spring means for retaining said current conducting rollers in high pressure contact with each of said annular contact surfaces as said switch blade moves about its pivotal axis.

7. In a circuit controlling switch, the combination of a pivotally mounted switch blade, a relatively stationary terminal carrying member mounted in axially spaced relation along the pivotal axis of said switch blade, means upon the switch blade forming an annular current carrying contact surface concentric to its pivotal axis, means carried by said relatively stationary terminal carrying member forming a second annular current carrying contact surface concentric to the pivotal axis of the switch blade, said first and second annular contact surfaces being developed along intersecting angles and disposed in opposed spaced relation to each other, circuit completing means between said annular current carrying contact surfaces comprising a plurality of radially spaced current conducting balls, and spring means for retaining said current conducting balls in high pressure contact with each of said annular contact surfaces as said switch blade moves about its pivotal axis.

8. In a circuit controlling switch, the combination of a supporting shaft, a switch blade pivotally mounted upon said shaft, means carried by said switch blade forming a contact surface disposed in a plane transverse to the axis of said shaft, a current conducting member disposed upon said shaft in axially spaced relation to said switch blade having an angularly disposed contact surface concentric to the axis of said shaft, a free floating support disposed between said contact surfaces, a plurality of contact surface engaging rollers carried by said support, and spring means exerting a pressure upon said rollers along a line substantially bisecting the angle between said annular contact surfaces for holding said contact surface engaging rollers in good electrical contact with the contact making surfaces upon said switch blade and said current conducting member.

9. In an articulated current conducting device, the combination of two relatively hinged current conducting members, means carried by each of said members forming annular current carrying contact surfaces concentric to the axis about which said members are hinged, said annular current carrying contact surfaces being developed along intersecting angles and disposed in opposed relation to each other, a plurality of rollable current conducting contact members disposed between and in peripheral engagement with each of the annular current carrying contact surfaces carried by said means, spring means operating to exert a contact producing pressure upon said rollable current conducting members, and a support for said spring means, whereby the pressure exerted thereby upon said rollable members will be along a line substantially bisecting the angles along which said annular contact surfaces are developed.

10. In an articulated current conducting device, the combination of two relatively hinged current conducting members, means carried by each of said members forming annular current carrying contact surfaces concentric to the axis about which said members are hinged, said annular current carrying contact surfaces being in the form of conic sections disposed in opposed relation to each other, rollable contact members having a spherical surface disposed between and in peripheral engagement with each of the annular current carrying contact surfaces, an annular spring retaining device disposed adjacent said contact surfaces, and spring means carried by said annular retaining device for exerting a pressure upon said rollable contact members along a line substantially bisecting the angle between the surfaces of the means forming said annular contact surfaces.

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