Sept. 7, 1954 W. H. GILLILAND ET AL 2,688,666

TWIST BLADE SWITCH

Filed June 1, 1950 3 Sheets-Sheet 1

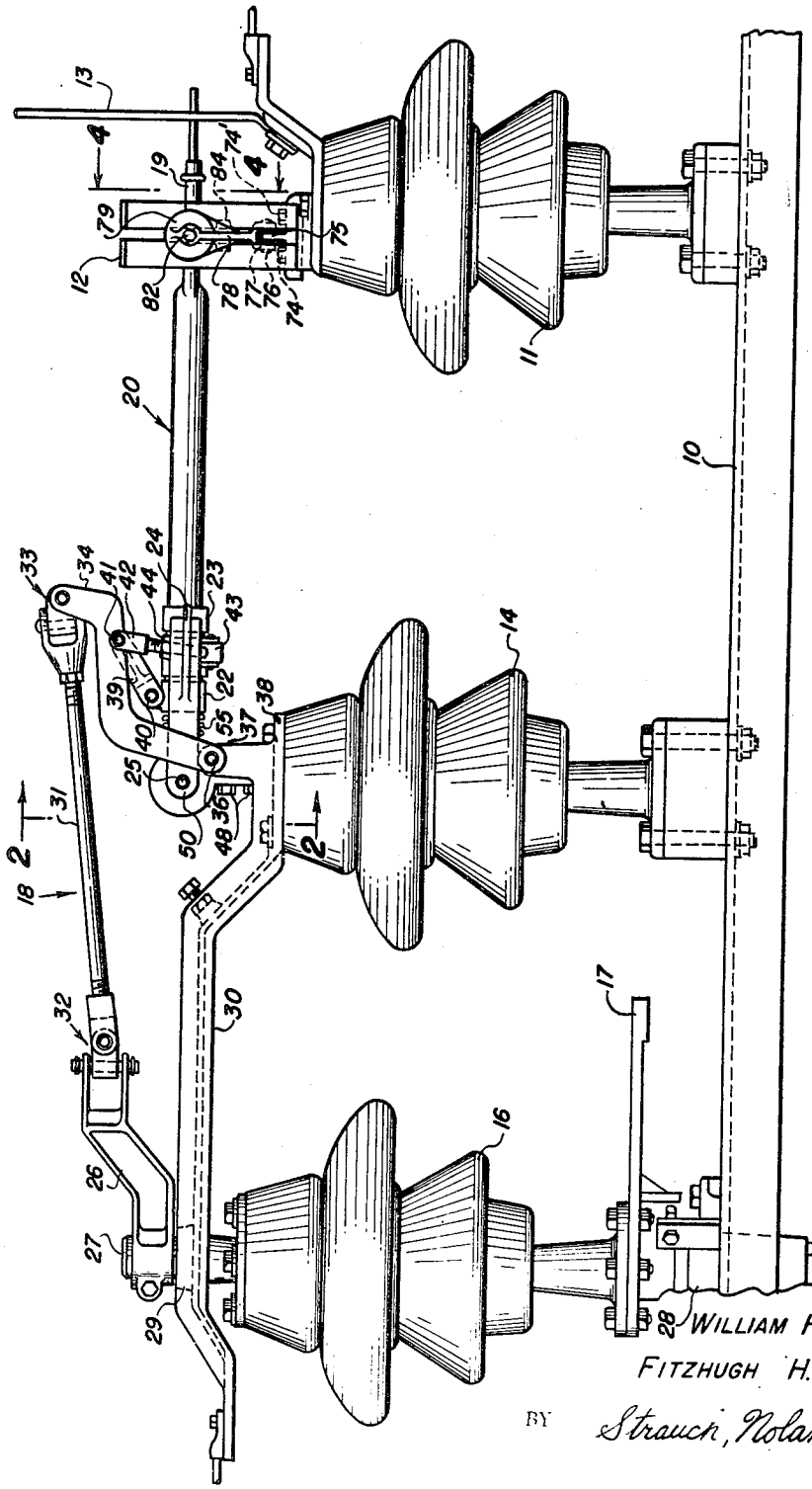


Fig. 1

INVENTORS
WILLIAM H. GILLILAND
FITZHUGH H. TURNHAM

BY Strauch, Nolan & Diggins
ATTORNEYS

Sept. 7, 1954 W. H. GILLILAND ET AL 2,688,666

TWIST BLADE SWITCH

Filed June 1, 1950 3 Sheets-Sheet 2

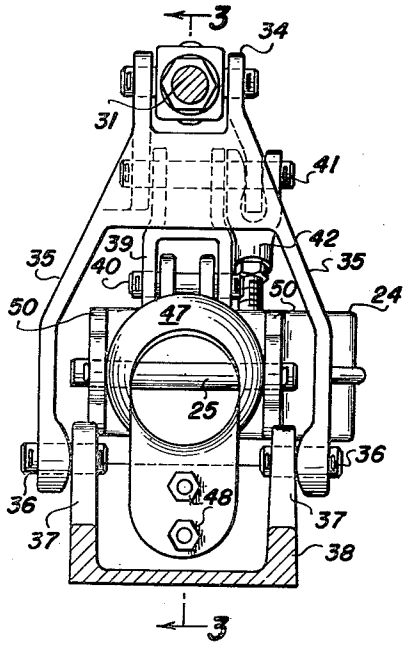


Fig. 2

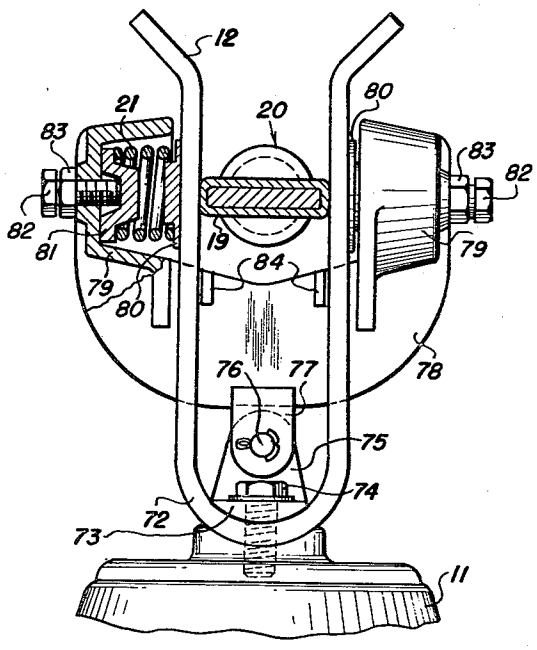
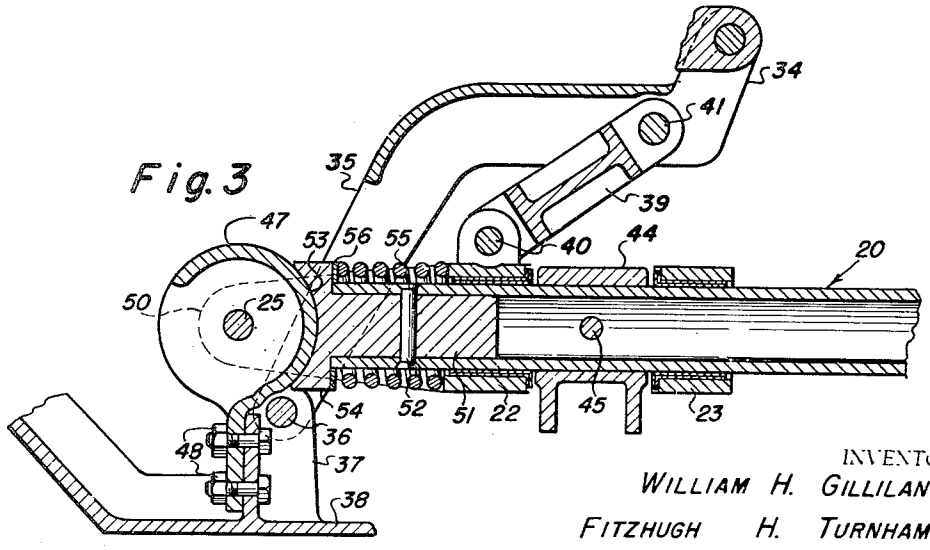


Fig. 4

Fig. 3



INVENTORS
WILLIAM H. GILLILAND
FITZHUGH H. TURNHAM
BY Strauch, Nolan + Diggins
ATTORNEYS

Sept. 7, 1954 W. H. GILLILAND ET AL 2,688,666

TWIST BLADE SWITCH

Filed June 1, 1950 3 Sheets-Sheet 3

Fig. 6

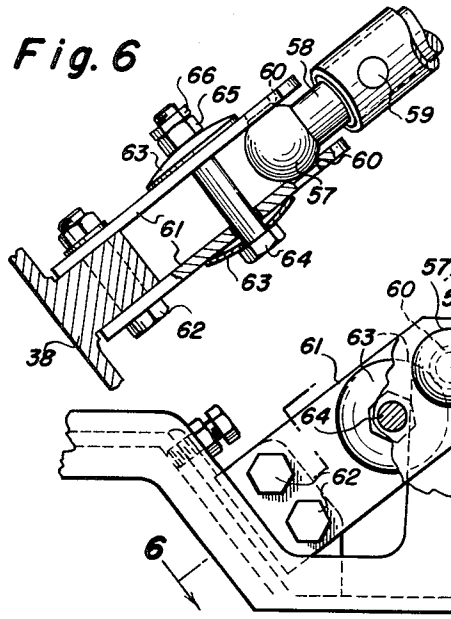


Fig. 5

Fig. 8

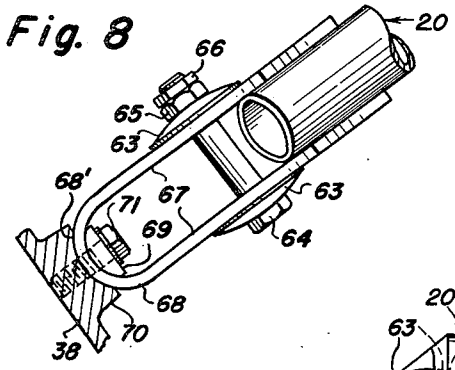


Fig. 7

INVENTORS
WILLIAM H. GILLILAND
FITZHUGH H. TURNHAM
BY Strauch, Nolan & Diggins
ATTORNEYS

Patented Sept. 7, 1954

2,688,666

UNITED STATES PATENT OFFICE

2,688,666

TWIST BLADE SWITCH

William H. Gilliland and Fitzhugh H. Turnham, Birmingham, Ala., assignors to USCO Power Equipment Corp., Birmingham, Ala., a corporation of Alabama

Application June 1, 1950, Serial No. 165,546

10 Claims. (Cl. 200—48)

1

This invention relates to high voltage switches of the twist blade type in which the switch blade is first moved to a circuit closing position between opposed jaw contacts and then twisted or rotated about its longitudinal axis to develop a heavy frictional pressure between the blade and the jaw contacts. More particularly the present invention is directed to contact assemblies designed to improve the operation of such switches and to facilitate the use of such switches in the transmission of high amperage current.

In prior switches of this kind used to control high amperages, it has been the practice to employ a heavy shunt at the hinged end of the switch to accommodate the very high amperage currents and a relatively heavy, stiff, fixed jaw contact structure. As an alternative construction, it has also been proposed to replace the heavy shunt with a jaw-type hinge contact assembly similar in construction to the contact assembly employed at the outer or swinging end of the blade. In either case, substantial resistance to blade twist is developed necessitating high applied operating forces and uneven pressure contact often results due to misalignment between the blade and jaw contacts. Where severe icing conditions are present, this added resistance may be of sufficient magnitude to prevent effective operation of the switch.

Accordingly, it is a general object and purpose of the present invention to provide novel blade contact assemblies comprising a cylindrical or spherical contact at the hinge end of the blade which is at all times resiliently engaged with a mating stationary contact which offers a minimum resistance to rotation of the blade and yet provides ample contact area and mass for transmission of the heavy current in the desired manner and a self aligning jaw contact assembly for engagement by the swing end of the blade.

It is a further object of the invention to provide a novel hinge contact assembly which assures positive contact between the switch blade and the hinge base at all times so that the contact has full capacity in all positions of the switch blade even during periods of extensive arcing in opening and closing the switch.

It is a further object to provide a novel hinge contact assembly which is simple in design, comprises a minimum number of structurally rugged parts, and is inexpensive to manufacture and assemble.

In the conventional jaw-type stationary contact for the outer end of the switch blade, particularly after a period of use, accurate alignment between the switch blade and the stationary contact often cannot be maintained. This is particularly true where the switch blade is of substantial length. As a result there may be considerable variation in the pressure with which the blade engages the opposing jaws of the contact and consequently uneven wear on one contact surface. In the conventional jaw contact construction this situation can be remedied only by mechanical bending of the jaws or complete resetting of the contact, neither of which has proved to be wholly satisfactory in practice.

2

Accordingly, it is a further object to provide an improved jaw-type outer contact assembly for a switch blade switch which is self-aligning.

It is a further object to provide an improved outer contact assembly in which the engaging pressure may be easily and accurately adjusted.

It is a further object to provide an improved contact assembly in which the pressure of the opposing contact jaws is automatically maintained in substantial equality.

Other objects and advantages will appear as the description proceeds in connection with the accompanying drawings in which:

Figure 1 is a side elevation of a switch illustrating one embodiment of the improved hinge contact construction of this invention;

Figure 2 is an enlarged sectional view taken along line 2—2 of Figure 1;

Figure 3 is a sectional view taken along line 3—3 of Figure 2;

Figure 4 is a sectional end view of the outer contact assembly taken along line 4—4 of Figure 1;

Figure 5 is a side elevation partly in section of a modified embodiment of the hinge contact assembly of this invention;

Figure 6 is a fragmentary plan view taken along line 6—6 of Figure 5;

Figure 7 is a fragmentary side elevation of still another hinge contact assembly embodying the present invention; and

Figure 8 is a fragmentary plan view taken along line 8—8 of Figure 7.

The present invention is concerned only with contact assemblies. The general arrangement of the components of the switch and the operating mechanism therefor are disclosed and claimed in the copending application of William H. Gilliland and Fitzhugh H. Turnham, Serial No. 137,618, filed January 9, 1950, and entitled High Voltage Switch Assemblies. The switch is here described

only in so far as it is necessary for a complete understanding of the construction and operation of the improved hinge contact assembly.

Referring now to Figures 1–4 of the drawing, 10 indicates a base on which are mounted a fixed insulator 11 carrying jaw-type contact 12 and arcing horns 13, a fixed insulator 14 supporting the hinge assembly 15, and a rotatable insulator 16 carrying operating arm 17 at its lower end and operating linkage, indicated generally at 18, at its upper end. As best seen in Figure 4, extension 19 of switch blade 20, is formed into rectangular shape provided with a reinforcing insert, and is resiliently and frictionally clamped between opposed contacts 12. While any suitable construction may be employed for contacts 12, the self aligning contact of this invention to be hereinafter described is preferred. Blade 20 is journalled at its end opposite contacts 12 in sockets 22 and 23 which are integral parts of bracket 24 (Figures 1 and 2) which is pivotally mounted on pin 25 for vertical rotation thereabout.

The mechanism for twisting and lifting switch blade 20 includes operating arm 17 and crank 26 mounted for co-movement on shaft 27 which is journalled in bearings 28 and 29 respectively mounted in base 10 and a conductor arm 30 interconnecting insulators 14 and 16. Pull rod 31 is connected by universal joints 32 and 33 to crank 26 and rocker arm 34 respectively. Legs 35 of rocker arm 34 are pivotally mounted on stub pins 36 mounted in ears 37 of fixed base 38. Lifting link 39 is pivotally mounted on pin 40 on bearing 22 and pivotally mounted at its opposite end on pin 41 in rocker arm 34. Also pivotally mounted on pin 41 is blade twisting link 42 which is connected through universal joint 43 to the free end of crank arm 44 which is rigidly secured to switch blade 20.

The operation of the blade twisting and lifting mechanism thus far described is as follows.

When operating arm 17 is rotated to open the switch, rocker arm 34 together with pin 41 will be rotated in a counterclockwise direction about pin 36. Since both lifting link 39 and twisting link 42 are pivotally secured to pin 41 at their upper ends and as their opposite ends are respectively disposed substantially radially inwardly of and substantially directly below pin 41, link 39 will initially rotate about pin 40 without imparting any appreciable lifting movement to pin 40 or its supporting bracket 24 because of the substantial coincidence of the arcs of rotation of pin 41 around pins 36 and 40. Link 42 meanwhile since it extends substantially directly downwardly from pin 41 will initially be raised bodily upwardly due to the axial application of force through pin 41. As a consequence, the angular relationship of links 39 and 42 will be decreased while link 39 is maintained in tension and link 42 imparts an upward force to universal joint 43. Since downward movement of pin 40 is also prevented by the closed condition of switch blade 20 and contacts 12, the force resulting from the folding of links 39 and 42 is effective to rotate blade 20 in sockets 22 and 23 twisting switch blade 20 through substantially 90 degrees to disrupt the frictional bearing pressure of the blade contacts 12 and position the blade in a substantially vertical plane between the contacts. In the further upward swinging movement of the rocker arm the arcs of rotation of pin 41 around pins 36 and 40 separate imparting a lifting movement to link 39. The angular relationship of the links at this time is maintained and the bracket 24 with its journals 22 and 23 is swung upwardly through an arc of approximately 90 degrees about the axis of pin 25 to dispose the switch blade in the open position.

The above described operation is reversed when the switch is closed by rotation of the operating arm 17 in the opposite direction.

It will be apparent from the foregoing that the ease of operation of the switch during initial twisting movement of the switch arm is dependent wholly upon the resistance to twist offered by the contacts at the inner and outer ends of switch blade 20. As aforementioned the present invention is concerned with minimizing the resistance to twist offered by the inner or hinge contact without impairment of the effectiveness of the contact at this point.

Referring now to Figures 2 and 3, which illustrate a preferred embodiment of the improved hinged contact assembly, 47 indicates a hollow spherical stationary contact element rigidly attached to base 38 by bolts 48. Pin 25, on which ears 50 of bracket 24 are mounted, passes through a diameter of contact 47. Bearings 22 and 23 carried in bracket 24 are thus maintained in spaced relationship to contact 47 and are rotatable about the axis of pin 25. A female contact 51 is disposed within the hollow journalled end of blade 20 and rigidly secured thereto as by pin 52. A press fit is preferably maintained between contact 51 and blade 20 to assure positive contact between the members over a large surface. A spherical recess 53 having a radius equal to that of the outer surface of contact 47 is provided in an enlarged portion 54 of contact 51 protruding beyond the end of blade 20. To assure positive engagement of the mating surfaces of contacts 47 and 51, a spring 55 is compressed between shoulder 56 of contact 51 and bearing 22, bearings 22 and 23 being spaced sufficiently to allow axial movement of link 44 therebetween and axial movement of blade 20 and contact 51 into engagement with contact 47. This hinge contact assembly is especially advantageous in that it minimizes the resistance to rotation of the switch blade 20 and assures positive contact over a large area at all times regardless of the position of switch blade 20 and contacts 12. Accordingly, even though arcing occurs between blade 20 and contacts 12 during opening and closing movement of the switch, full electrical contact is always maintained at the hinged end of the switch.

Referring now to Figures 5 and 6, which illustrate an alternative hinge contact construction, a spherical male contact member 57 forms an extension of a stem 58 which is received within the hollow end of switch blade 20 and rigidly attached thereto as by pin 59. To facilitate assembly, contact 57 is purposely made small enough so that it may be passed through bearings 22 and 23 after being assembled on blade 20. Stem 58 and blade 20 preferably have a press fit to assure full and tight surface engagement between them. Contact 57 is frictionally received in spherical recesses 60 formed in a pair of opposing contacts 61 disposed between ears 50 and rigidly mounted on base 38 as by bolts 62. The frictional engagement between contact 57 and contacts 61 is adjustably maintained by a pair of spring washers 63 which are held in resilient engagement with the outer surface of contacts 61 as by bolts 64. Nut 65 and lock nut 66 are provided to adjust the engaging pressure between contacts 61 and contact 57.

Figures 7 and 8 illustrate a third embodiment of the hinge contact construction which is similar in all respects to the embodiment of Figures 5 and 6 described above except that switch blade 20 is extended so as to be received between a pair of opposing contacts formed by U-shaped member 67 and thus forms one of the contact elements. Spring washers 63, bolt 64 and nuts 65 and 66 similar to those described in connection with Figure 7 are provided to maintain an adjustable frictional engagement between the contacts. The arcuate section 68 at the lower ends of contacts 67 is preferably held in an arcuate seat 68' formed on base 38 by clamping members 69 and bolts 71 threaded into seat 68' of base 38.

Referring again to Figure 4, each of the two pairs of contact jaws 12 is preferably formed from a single relatively flexible piece of metal bent into U-shape and having outwardly flaring portions at its upper end. The bridge section 72 of each pair of jaws 12 is clamped between a lower clamping member 73, which is rigidly attached to insulator 11, and an upper clamping member 74, as by bolts 74'. Clamp 73 is provided with a centrally located upwardly extending ear 75, which is apertured to receive a loosely fitting pin 76. Mounted on pin 76 are spaced lugs 77 attached to the lower edge of a plate 78 which is received between the longitudinally spaced pairs of contact jaws 12, as shown in Figure 1. A pair of opposing spring housings 79 form an integral part of plate 78 and are positioned outwardly of both pairs of contacts 12 (Figure 1). A spring 21 disposed in each housing 79 is compressed between a bearing plate 80 which engages the respective two adjacent contacts 12, and bearing plate 81 received within housing 79. An adjusting screw 82 and lock nut 83 are provided to regulate the respective compression springs 21. A pair of stops 84 are provided on plate 78 to limit the inward movement of contacts 12.

In operation, assuming for example that the switch blade 20 is slightly out of alignment to the left, the engaging pressure on the left side of extension 19 will initially be greater than that on the right side. This will result in a slight displacement of the left contact jaws 12 to the left, increasing the compression of the left spring 21. Since plate 78 is free to pivot about pin 76, it will be rotated slightly in a counterclockwise direction until the compression of the opposing spring 21 is substantially equal. Thus, the entire contact assembly will tend to come into automatic alignment with the switch blade 20.

It will be understood that the degree to which the contact jaws are self-aligning depends in large measure on the flexibility of the contact shoes. If, as in the prior art, the jaws are made sufficiently rigid to furnish the entire contact pressure between the jaws and the blade contact, the contact jaws or shoes will absorb the excessive contact pressure due to misalignment of the blade and impose a high resistance to movement of the blade to fully closed or opened position. This invention, therefore, contemplates the use of relatively light, flexible jaws or shoes and self compensating opposed pressure springs 21 which are brought into play in event of misalignment to permit relatively free and successive lateral movement of the jaws in the same direction to a position in substantial alignment with the blade. On the other hand, the shoes must possess sufficient rigidity to prevent deformation beyond their elastic limit. In practice, the jaws or shoes may have any degree of flexibility above that necessary to avoid permanent deformation but less than that which will prevent relatively free lateral displacement by the blade moving to closed position, the optimum flexibility being determined in individual cases with regard to the size of the switch, the twist blade, and the amount of use required in service.

It is also to be noted that in the completely closed position of the blade 20, shown in Figure 4, extension 19 is centered with respect to spring 21. Consequently, the contact pressure is exerted directly through the center line of the extension, thereby assuring uniformity of the contact pressure and minimizing the objectionable effects of bending or wear of the contact jaws 12.

It is felt that the operation of the various hinge contact assemblies will be obvious from the foregoing description.

It is to be noted that in each construction the hinged contacts are in resilient engagement at all times, that the area of contact is constant in all positions of the switch arm, that the contacts are self cleaning because of the rotation about two axes in each operation of the switch, and that in each of the constructions the frictional resistance to twisting and swinging movement of the switch arm is minimized.

The invention may be embodied in other specific forms without department from the spirit or essential characteristics thereof, the present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Patent is:

1. An electric transmission line switch comprising a pair of spaced, fixed supporting insulators; a fixed bifurcated contact mounted on one of said fixed insulators; a twist blade switch pivotally and rotatably mounted on said other insulator and adapted to be rotated about its longitudinal axis to establish firm contact with said fixed bifurcated contact and to swing around its pivotal axis into and out of contact with said fixed bifurcated contact; a second stationary contact mounted on said other insulator and having a contact portion in transversely aligned relation to the pivotal axis of said switch blade; and contact means on said switch blade of circular cross-section in a plane normal to the axis of said switch blade rotatably and pivotally movable therewith and comprising an elongated portion extending into the pivoted end of said switch and having an enlarged contact end protruding axially of said switch blade into cooperating engagement with said contact portion of said second stationary contact and adapted to establish contact therewith in full contacting capacity and constant contact area in all positions of said switch blade.

2. The combination defined in claim 1 wherein said switch blade is mounted for limited axial movement in a pair of axially spaced journal sockets and a compression spring is mounted in encircling relation to the end of said switch blade with its opposite ends respectively engaging said enlarged contact end and the adjacent one of said spaced journal sockets to resiliently urge said switch blade and its attached contact means

axially into firm engagement with said second contact stationary contact.

3. A hinge contact assembly for a twist blade switch comprising a blade contact having an elongated portion extending into the pivotal end of said switch blade and an enlarged contact end protruding axially from switch blade end and providing a spherical contact area coincident with the longitudinal axis of said switch blade; and a stationary terminal contact element adapted to continuously engage said blade contact and having a reversely mating spherical contact area the center of which is coincident with the pivotal axis of said switch blade and the longitudinal axis of said switch blade whereby, upon pivotal and twisting movement of said blade, said mating contact areas are maintained in full surface contacting capacity and constant contact area.

4. The combination defined in claim 3 together with means to resiliently urge said contacts into firm mating engagement to assure good electrical contact and a self-cleaning rubbing contact between said contacting areas.

5. The combination defined in claim 4 wherein said means for resiliently urging said contacts into engagement comprises a compression spring adapted to urge said switch blade and said blade contact axially into engagement with said stationary contact.

6. The combination defined in claim 4 wherein said stationary contact comprises a pair of laterally spaced arms having oppositely inwardly facing depressions and spring means is provided comprising a transversely extending headed bolt member extending freely through said spaced arms, a pair of dished spring washers respectively disposed in contact with said head and on its opposite end, and a nut threadedly associated with said opposite end and adapted to be threaded thereon to tension said spring washers to resiliently urge said arms inwardly into contact with said blade contact.

7. The combination defined in claim 4 wherein said stationary contact comprises a ball shaped member and said resilient means comprises a compression spring disposed in encircling relation to said switch blade end with one end in contact with said enlarged contact end so as to urge said blade contact axially into engagement with said ball shaped member.

8. In an electrical twist blade switch having a hinge end contact assembly: a swing end jaw contact assembly for receiving the swing end of said blade comprising highly flexible laterally spaced jaws and means associated with said spaced jaws to automatically shift said respective jaw contacts to properly receive the swing end of said blade and thereafter maintain uniform pressure engagement between each of said jaws and said blade in the closed position of said switch whereby proper contact is assured in spite of slight misalignment of said twist blade and said contact assemblies and the number of opening and closing movements of said switch.

9. In an electric twist blade switch: a bifurcated relatively stationary swing end contact; a blade contact movable into and out of engagement with said stationary contact; and means to automatically shift said relatively stationary contact with respect to said blade contact to assure substantially equal pressure contact between said blade contact and the arms of said bifurcated contact when said blade is moved into engagement with said stationary contact.

10. In an electric twist blade switch: a swing end contact assembly comprising a blade contact, a pair of opposed jaw contacts adapted to engage opposite sides of said blade contact; respective resilient means adapted to control the engaging pressure between said blade contact and each of said opposed jaw contacts; and means responsive to engagement of said blade contact with said opposed jaw contacts to vary the pressure exerted by one of the said pair of resilient means in response to a variation in the pressure exerted by the other of said pair of resilient means.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,560,165	Johnson	Nov. 3, 1925
1,831,843	Cornfield	Nov. 17, 1931
2,363,307	Florschutz	Nov. 21, 1944
2,453,011	Graybill	Nov. 2, 1948
2,531,165	Scheurmeyer	Nov. 21, 1950
2,545,940	Caldwell	Mar. 20, 1951