July 31, 1962 P. SCISCIONE 3,047,685

HIGH VOLTAGE DISCONNECT SWITCH

Filed June 6, 1960 2 Sheets-Sheet 1

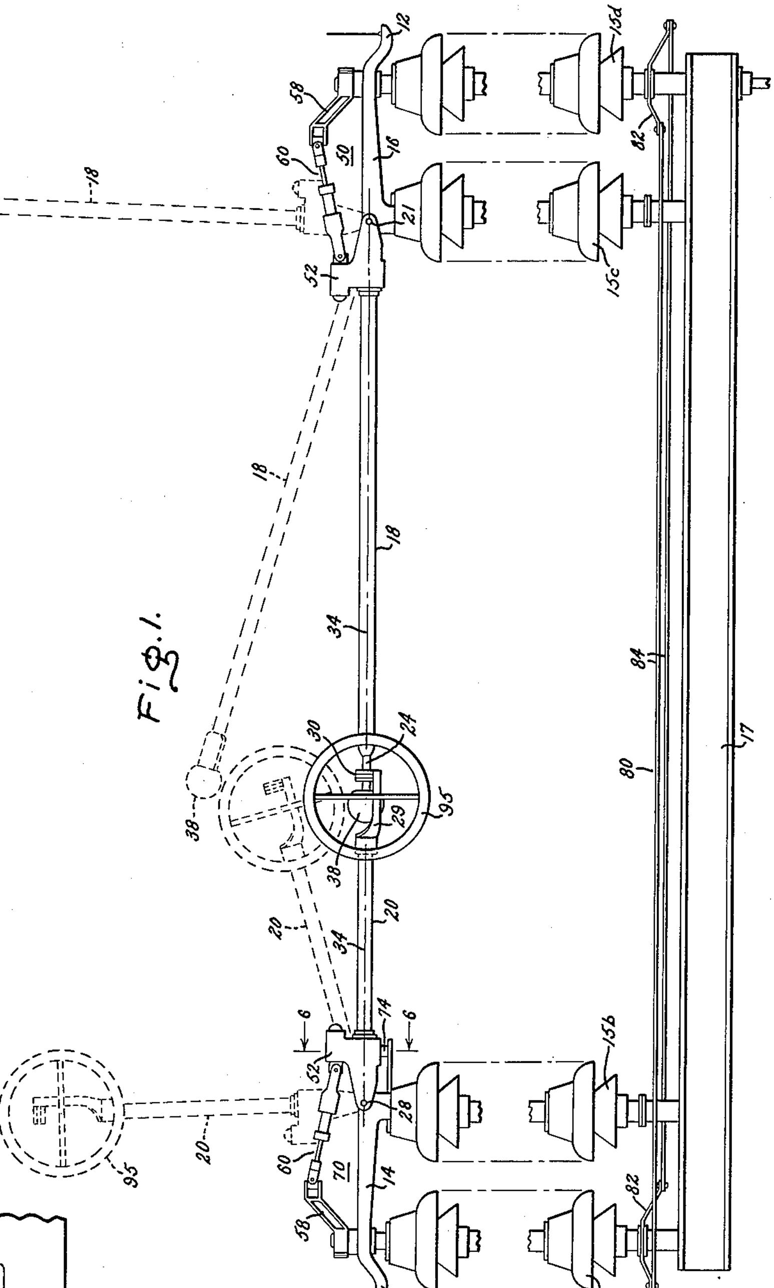

Fig. 1.

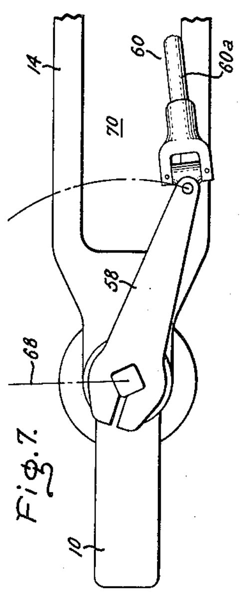

Fig. 7.

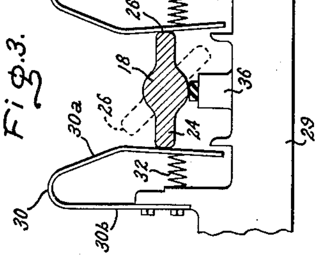

Fig. 3.

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July 31, 1962 P. SCISCIONE 3,047,685

HIGH VOLTAGE DISCONNECT SWITCH

Filed June 6, 1960 2 Sheets-Sheet 2

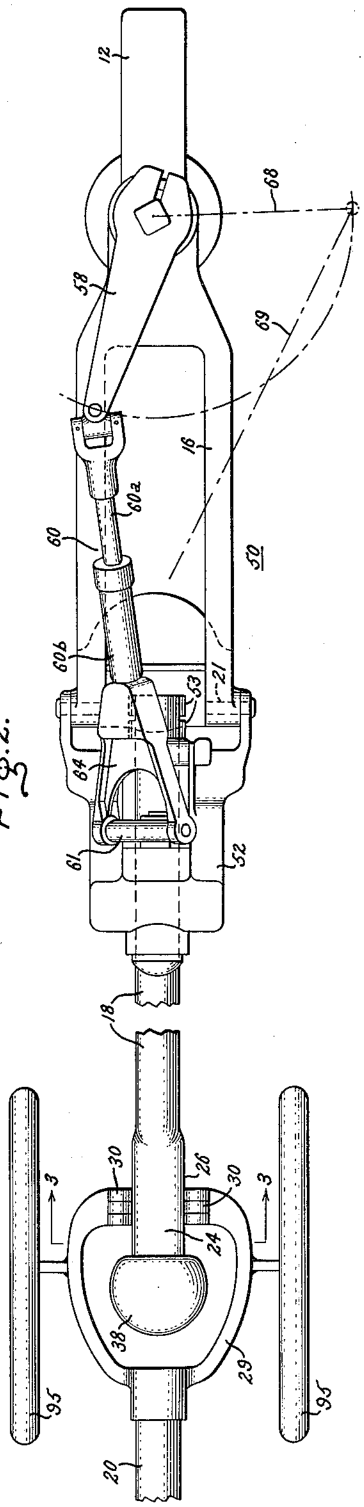

Fig. 2.

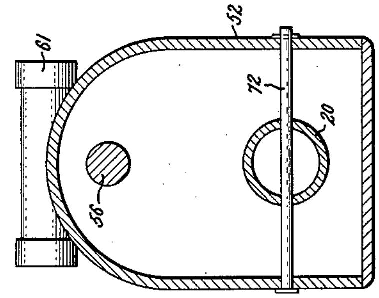

Fig. 6.

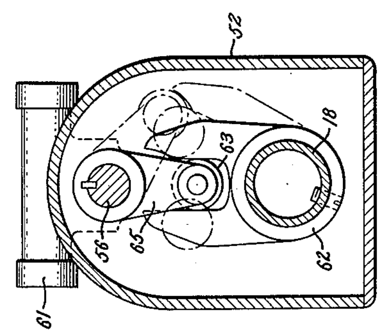

Fig. 5.

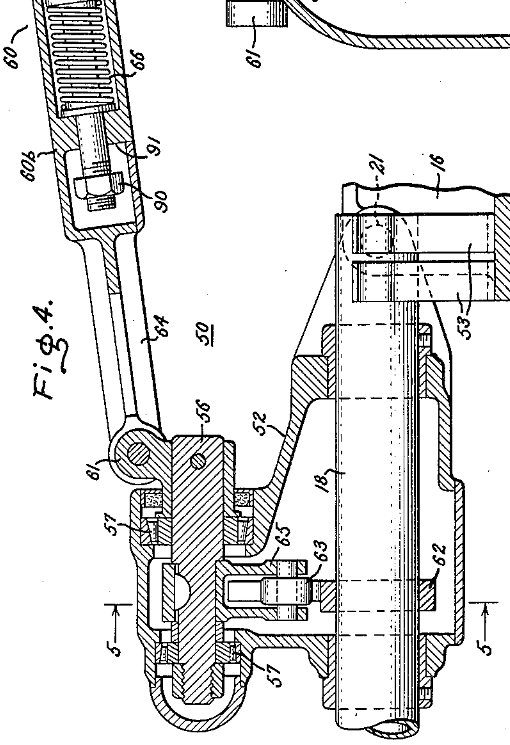

Fig. 4.

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United States Patent Office

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HIGH VOLTAGE DISCONNECT SWITCH

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Filed June 6, 1960, Ser. No. 34,026
7 Claims. (Cl. 200—48)

This invention relates to an electric switch of the disconnect type and, more specifically, to a disconnect switch that is particularly adapted for extra high voltage power circuits, such as those rated in excess of 345 kv.

A type of disconnect switch that has proven itself to be exceptionally reliable for outdoor applications is the so-called twist blade type of switch. This type of switch typically comprises an elongated switch blade that is mounted for pivotal motion about a suitable pivot and for twisting motion about its longitudinal axis. Switch-closing is effected by first swinging the blade about its pivot to position its free end between a pair of spaced contact jaws and by then twisting the blade about its longitudinal axis to effect high pressure engagement between the free end of the blade and the jaws. Opening is effected through a reverse sequence of operations, i.e., by first twisting the blade out of high pressure engagement with the jaws and then swinging the blade into an open circuit position. The twisting motion serves not only to produce or to relieve high pressure engagement at the contacts but serves also to break up any ice that might have formed on the contact-making portions of the switch, thereby preventing such ice from interfering with the desired operation of the switch.

An important determinant of the amount of voltage that such a switch can successfully withstand in its open circuit position is the length of the gap between the movable switch blade and the contact jaws when the switch blade is in its fully open position. The higher the voltage rating of the switch, the greater this length of gap must ordinarily be. In a typical twist blade switch, the contact jaws are mounted in a fixed location and the blade alone is relied upon for bridging the above-described gap when the switch is closed. Hence, the longer the gap, the longer has been the blade of the switch. When switch voltage ratings begin exceeding about 345 kv., the blade length becomes so great and the blade so massive that it no longer becomes possible to rely upon a switch operating mechanism of reasonable proportions. An operating mechanism of undue size and strength becomes necessary to accommodate the high forces and deflections that tend to result from the long and massive blade. As an illustration of the blade lengths involved, a typical 345 kv. twist blade switch employs a blade of approximately fourteen feet in length.

Accordingly, an object of my invention is to design a twist blade switch in such a manner that a blade of a relatively short length, considerably less than the open circuit distance between the blade and the contact jaws, can be utilized for bridging the gap between the contact jaws and the pivot of the blade when the switch is closed.

In carrying out this object, I provide the switch with two movable blades, one a main blade that is mounted for twisting motion as well as pivotal motion and the other an auxiliary blade that is mounted for pivotal motion only. The contact jaws of the switch are mounted on this auxiliary blade. Switch-closing is effected by simultaneously pivoting the two blades into positions wherein the free end of the main blade enters the space between the contact jaws carried by the auxiliary blade. Pivotal motion of the two blades is then terminated, after which the main blade is twisted to establish high pressure engagement between its free end and the contact jaws. The auxiliary blade remains fixed during such twisting motion of the main blade.

A particular problem that arises in connection with this type of dual blade switch is how to insure that the free end of the movable blade will be properly positioned between the contact jaws when pivotal motion of the two blades is terminated and twisting motion of the main blade begins. In this regard, improper coordination of the pivotal movements of the two blades could result in failure of the main blade to enter the space between the jaws or in jamming of the switch in a partially open position.

Accordingly, another object of my invention is to construct this type of dual blade switch in a manner that insures that the free end of the main blade will properly enter the space between the jaws.

Still another object is to achieve proper entry of the free end of the main blade into the space between the jaws without the necessity of maintaining precise coordination between the pivotal movements of the two blades. Attaining this object insures that minor delays in the closing motion of either blade will not interfere with proper positioning of the blade within the contact jaws.

With regard to switch-opening motion, another object is to insure that no opening motion of the auxiliary blade occurs while the free end of the main blade is still in high pressure engagement with the contact jaws. Such opening motion of the auxiliary blade while high pressure engagement is still present could result in damage to the contact-making parts of the switch.

In carrying out my invention in one form, I mount the spaced-apart contact jaws on an auxiliary blade which is of a substantially shorter length than the main blade of the switch. The main blade is mounted for both pivotal and twisting motion, but the auxiliary blade is mounted for pivotal motion only. During closing, the two blades are simultaneously pivoted into positions of general alignment wherein the free end of the main blade is disposed between the jaws carried by the auxiliary blade, and the free end of the main blade is then twisted into high pressure engagement with the jaws while the auxiliary blade is maintained in a fixed position. Entry of the free end of the movable blade into the space between the jaws can be effected only from behind the auxiliary blade considered in the direction of pivotal closing motion. The relatively short length of the auxiliary blade in comparison to the length of the main blade assures that closing motion of the two blades through identical angles at approximately equal angular speeds will result in the free end of the main blade being positioned behind the contact jaws near the end of the closing stroke. Accordingly, the free end of the main blade is then so positioned that final pivotal closing motion results in entry of the free end into the space between the jaws.

For a better understanding of my invention, reference may be had to the following description taken in conjunction with the accompanying sheets of drawings, wherein:

FIG. 1 is a side elevational view of a twist blade disconnect switch embodying one form of my invention.

FIG. 2 is a plan view of a portion of the switch of FIG. 1.

FIG. 3 is a cross-sectional view of the switch of FIGS. 1 and 2 taken along the line 3—3 of FIG. 2.

FIG. 4 is a sectional view taken along the lines *4a*—*4a* and *4b*—*4b* in FIG. 2.

FIG. 5 is a sectional view taken along the line **5—5** of FIG. 4.

FIG. 6 is a sectional view taken along the line **6—6** of FIG. 1.

FIG. 7 is a plan view of a portion of the switch of FIG. 1.

Referring now to FIG. 1, the switch shown therein comprises a pair of spaced-apart terminals **10** and **12** which are respectively adapted to be connected into a high voltage power circuit. These terminals are carried by metallic cross-braces **14** and **16**, which are mounted atop spaced-apart stacks of insulators serving to isolate the high voltage parts of the switch from the grounded framework **17** on which the switch is mounted. The insulators for cross-brace **14** are designated **15***a* and **15***b* and those for cross-brace **16** are designated **15***c* and **15***d*. When the switch is in its solid-line closed position of FIG. 1, the terminals **10** and **12** are electrically interconnected by means including a pair of relatively movable switch blades **18** and **20** having their free ends disposed intermediate the two cross-braces **14** and **16**. The switch blade **18**, which will be referred to hereinafter as the main blade, is mounted for pivotal motion about a stationary pivot **21** and also for rotation, or twisting motion, about its centrally disposed longitudinal axis. At its free end the main switch blade **18** carries a flattened portion **24** that has longitudinally extending contact-making surfaces **26** extending along its laterally spaced edges. These contact-making surfaces are best shown in FIG. 3 which is a cross-sectional view taken along the line 3—3 of FIG. 2.

The other switch blade **20**, which will be referred to as an auxiliary blade, is mounted for pivotal motion on a stationary pivot **28** but, unlike the main switch blade **18**, is incapable of rotating about its longitudinal axis. This auxiliary blade **20** includes at its free end an annular adaptor **29** on which a pair of laterally spaced contact jaws **30** are mounted. When the switch is in its closed position, the flattened end of the main blade is in its solid line position of FIG. 3 and the jaws **30** are in high pressure engagement with the edges **26** of this flattened portion of the main blade, thus providing a current-carrying connection between the two blades **18** and **20**.

Referring to the detailed view of FIG. 3, each of the contact jaws **30** is an inverted U-shaped member comprising an inner arm **30***a* and an outer arm **30***b* interconnected at their upper ends. The outer arm **30***b* of each contact jaw is connected electrically and mechanically to the supporting adaptor **29**, but the inner arm **30***a* is spaced from this adaptor **29** and is electrically connected thereto only through the outer arm. Accordingly, current flowing through the inner arm **30***a* must also flow through the outer arm **30***b*, but in an opposite direction. Current flowing through these adjacent arms in opposite directions creates magnetic repulsion between these two arms that forces the inner arm **30***a* into high pressure engagement with the contact-making surface **26** of the main blade with a force that varies as a direct function of the square of the current, thus assuring that these contact-making parts will be in high pressure engagement even under the most severe short circuit conditions. Adequate pressure is provided under light current conditions by means of compression springs **32** urging the inner arms **30***a* into engagement with the contact-making surfaces **26** of the main blade **18**. Each of the springs **32** is suitably insulated from arm **30***a* and adaptor **29** to prevent current from finding a path through the spring.

A hairpin type contact arrangement, in addition to providing magnetic forces urging the inner arms of the hairpin contacts into high pressure engagement with the blade, also provides a magnetic force tending to force the blade against its stop **36**. The portion of the stop **36** against which the blade rests is made of insulating material in order to prevent current from finding a path through the stop. This magnetic force that urges the blade into engagement with stop **36** results from the loop-shaped configuration of current path extending through the inner arms of the jaws into the blade. This latter force serves the highly desirable purpose of aiding in holding the blade in its fully-closed position under short-circuit conditions. This latter force could be defeated if the blades themselves, as viewed in FIG. 1, defined an upwardly bowing loop, since such a loop would have a magnetic effect tending to force the blades through their respective opening strokes. The presence of such magnetic forces has been eliminated from the disclosed switch by constructing the switch in such a manner that the blades are aligned when in their closed circuit position. Thus, there is no loop circuit having a magnetic effect tending to open the switch.

A feature of my switch that enables the blades **18** and **20** to be aligned when in their closed position is the cooperating relationship between the annular adaptor **29** carried by the auxiliary blade **20** and the large corona ball **38** at the free end of the main blade **18**. Because this adaptor **29** is of annular, or hollow, form, the corona ball **38** can fit within the central hollow in the adaptor **29**, and there will be no interference between these parts to impede motion of the blades **18** and **20** into and out of their aligned position of FIG. 1.

When the switch is fully open, the blades **18** and **20** are disposed in their substantially vertical dotted-line positions of FIG. 1. In these fully open positions the blades are disposed approximately perpendicular to a horizontal reference plane **34** that includes the axes of the blade pivots **21** and **28**. Closing of the switch is effected by a mechanism soon to be described which acts to swing the blades substantially simultaneously toward their solid line positions in the horizontal reference plane **34**. As the blades approach their solid line position after passing through the approximate intermediate position shown in FIG. 1, the free end of the main blade enters the space between the jaws **30** and eventually seats against the stop **36** carried by the auxiliary blade as the end of the pivotal portion of the closing stroke is reached. The longitudinal axes of the two blades are then in substantial alignment and the free end of the blade is in the dotted line position depicted in FIG. 3. Thereafter, the main blade is twisted about its longitudinal axis in a counterclockwise direction, as viewed in FIG. 3, to drive the contact-making surfaces **26** into high pressure engagement with the inner arms **30***a* of the jaws **30**. During this twisting motion of the main blade **18**, the auxiliary blade **20** remains fixedly positioned, resisting any tendency of the main blade to impart twisting motion thereto by forces transmitted through the jaws **30**, thereby assuring high pressure engagement between the jaws **30** and the contact-making surfaces **26**. The twisting motion of the main blade **18** serves in a known manner to break up any ice formed on the contact-making parts of the switch, as well as to establish the required high pressure engagement between the contact-making parts.

It will be apparent from FIG. 3 that the free end of the blade **18** can enter the space between the jaws **30** only from the top of the contact jaws, i.e., from behind the contact jaws considered in the direction of closing motion of the auxiliary blade **20**. Entry from the bottom, or ahead, of the jaws would be blocked by the adaptor **29** and the stop structure **36**, whereas entry in a longitudinal direction from the free end of the auxiliary blade would be blocked by the large corona ball **38** carried at the free end of the main blade. In the switch of the present invention, proper entry of the free end of the main blade into the space between the jaws has been assured by constructing the auxiliary blade of a much shorter length than the length of the main blade. As a result, approximately equal angular speeds of the two blades **18** and **20** from their dotted line fully open positions toward their closed positions will result in the auxiliary blade approaching its closed position well ahead of the longer main blade. This is illustrated in the dotted line intermediate position depicted in FIG. 1, where the two blades are shown after each has moved approximately 80 degrees from its fully open position. It can be seen that the contact jaws **30** are well ahead of the free end of the main blade **18**, and thus the free end of the main blade can readily enter the space between the jaws from behind the jaws as further closing motion occurs. Even if, for some reason, the auxiliary blade **20** were slightly delayed in its closing travel, it would still approach its closed position well ahead of the longer main blade 18, thereby enabling the free end of the main blade 18 readily to enter the space between the jaws 30. Thus, there is no necessity for any highly critical adjustments in the travel or speed of my two blades. Despite minor variations in speed or travel of either blade, the shorter length of the auxiliary blade assures proper seating of the main blade within the jaws.

In a preferred form of my invention, the shorter auxiliary blade 20 moves at a slightly higher closing speed than the main blade 18, and this provides a further margin of safety that assures that even with heavy accumulations of ice on the free ends of the two blades, the auxiliary blade will approach its closed position ahead of the main blade and without prior interference from the main blade.

For operating the two switch blades 18 and 20 in the manner set forth hereinabove, a separate operating mechanism is provided for each switch blade at its pivoted end. The operating mechanism 50 for the main blade 18 may be of any suitable conventional design but is preferably of the design in Patent No. 2,531,165—Scheuermeyer, assigned to the assignee of the present invention. This operating mechanism is illustrated and will be described only in sufficient detail to provide an understanding of the present invention, and reference may be had to the Scheuermeyer patent for a more detailed description of the mechanism. In its simplified form shown in the drawing, particularly FIG. 4, this operating mechanism 50 comprises a blade-supporting hinge member 52 that is pivotally mounted on the stationary pivot structure 21. The blade proper is suitably journaled in this hinge member 52 for rotation relative thereto and is suitably prevented from moving axially with respect to the hinge member 52 by means not shown. Suitable U-shaped sliding contacts 53 located adjacent the pivot 21 bear against the outer periphery of the blade 18 to provide a permanent electrical connection between the blade 18 and the crossbrace 16. A rotatable intermediate shaft 56 is journaled by means of bearings 57 in the hinge member 52 at its upper end, and, through this shaft 56, both blade-pivoting and blade-twisting forces are applied. As will soon appear more clearly, rotation of this intermediate shaft 56 produces twisting of the switch blade, whereas bodily movement of this intermediate shaft is effective to pivot the hinge member 52 and hence the blade 18 about the pivot 21.

Forces for pivoting and rotating the blade 18 are transmitted to the operating mechanism 50 through the outer stack of insulators 15*d*. This outer stack 15*d* of insulators is mounted for rotation about its longitudinal axis and has a crank 58 coupled thereto at its upper end. The outer end of the crank 58 is coupled to the shaft 56 by means of a compressible swivel link 60 universally connected at one end of the crank 58 and pivotally connected at its other end to the intermediate shaft 56. The pivotal connection between the shaft 56 and the compressible swivel link 60 comprises a short crank 61 pinned to the shaft 56 and a yoke 64 carried by the swivel link 60 and pivotally connected to the short crank 61. The swivel link 60 comprises two telescoping sections 60*a* and 60*b* and a compression spring 66 tending to lengthen the link 60. The swivel link 60 and the crank 58, in effect form a toggle that is driven into an overcenter position coincident with final closing motion of the switch. The dead center position of the mechanism occurs when the swivel link 60 and the crank 58 are aligned, as viewed from the top of the switch.

When the switch is in a fully open position, the crank 58 will be disposed in the position indicated by the dotted line 68 of FIG. 2, and the swivel link 60 will be in the position indicated by the dotted line 69. Switch closing is effected by rotating the crank 58 in a clockwise direction about the axis of the outer insulating stack 15*d*. This motion loads the swivel link 60 in compression and acts through the intermediate shaft 56 to swing the hinge 52 and blade 18 counterclockwise about their pivot 21. Continued rotation of the crank 58 produces continued counterclockwise pivotal motion of the blade 18 until the free end of the blade enters the jaws 30 of the other contact and engages the stop 36, after which point pivotal motion of the blade is terminated. At this instant, the crank 58 and swivel link 60 are positioned a short distance ahead of dead center. Further movement of the crank 58 into dead center position after the blade 18 has engaged its stop 36 shortens the compressible link 60 and produces rotation of the intermediate shaft 56. The crank 58 continues moving slightly past dead center toward its fully closed position of FIG. 2, continuing to rotate the intermediate shaft 56 and allowing the swivel link to lengthen.

Twisting of the blade 18 is effected in response to the above-described rotation of the intermediate shaft 56 during movement of the parts 58, 60 through the region of dead center. The mechanism for converting rotary motion of the intermediate shaft 56 into blade-twisting comprises a driving element 65 keyed to the intermediate shaft 56 and a driven element 62 attached to the blade 18. The driving element 65 is an arm having a roller 63 at its outer end, and the driven element 62 is a slotted cam member that receives the roller in its slotted portion. Rotation of the driving element 65 in one direction transmits forces to the blade 18 through the roller 63 and one leg of the cam member 62 to effect blade-rotation in one direction, whereas, rotation of the driving element 65 in an opposite direction transmits forces to the blade 18 through the roller 63 and the other leg of the cam member 62 to effect blade-rotation in an opposite direction. During switch-closing the driving element 65 is rotated in a direction to drive the flattened end of the blade 18 into engagement with the contact jaws, i.e., from the dotted line position to the solid line position of FIG. 3, whereas during switch-opening, the driving element 60 is rotated in a direction to release the flattened end of the blade 18 of the jaws, i.e., from the solid line position to the dotted line position of FIG. 3.

Switch-opening is effected by rotating the main driving crank 58 from its fully-closed position of FIG. 2 in a counterclockwise direction. Initial switch-opening, i.e., movement of the crank 58 and the swivel link 60 from the position of FIG. 2 into dead center position causes no pivotal motion of the blade 18 but rotates the intermediate shaft 56, thus twisting the flattened end of blade 18 out of engagement with the contact jaws 30. This movement of the crank into dead center compresses the swivel link 60, and further movement in the region immediately past dead center allows the swivel link 60 to expand. During this expansion of the swivel link, the blade 18 is being further rotated but not yet pivoted. When the swivel link 60 reaches its maximum length, as determined by engagement of the nut 90 with the wall 91 of the yoke 64, it acts as a rigid link in tension, and thereafter rotation of the crank 58 in a counterclockwise direction pivots the blade 18 in an opening direction. The blade 18 reaches its fully-open position shown by the dotted lines of FIG. 1 when the crank 58 enters its dotted line position 68 of FIG. 2.

For operating the auxiliary blade 20, an operating mechanism 70 similar in construction to the operating mechanism 50 is provided. The corresponding parts of these two blade-operating mechanisms 50 and 70 have been assigned identical reference numerals. The operating mechanism 70 is substantially identical to the operating mechanism 50 for the main blade except that there is no provision in the operating mechanism 70 for blade-twisting. In this latter regard, the auxiliary blade 20 is pinned to its supporting hinge 52 by meaans of a transverse pin 72, and there is no connection in the mechanism 70 for converting rotary motion of the intermediate shaft 56 into blade-twisting motion, as there is in the operating mechanism 50. Thus when the auxiliary blade 20 reaches its stop, shown at 74 in FIG. 1, after being pivoted from its dotted-line fully open position of FIG. 1 into its solid-line closed position, it is maintained fixed in this latter position, and no twisting motion follows. The crank 58 and the swivel link 60 of mechanism 70 continue moving after the auxiliary blade 20 encounters its stop 74 but this is merely lost motion that produces no blade twisting inasmuch as there is no connection for transmitting twisting motion to the blade 20 from the intermediate shaft 56. The intermediate shaft 56 rotates in response to movement of the parts 58, 60 through dead center, but such rotation is not transmitted to the auxiliary blade 20, the auxiliary blade 20 remaining in a fixed position during such rotation of shaft 56 by virtue of its transverse pin 72 and the absence of a connection between intermediate shaft 56 and the auxiliary blade 20.

Switch-opening movement of the auxiliary blade 20 is effected by rotating the crank 58 of mechanism 70 in a counterclockwise direction from its solid line position of FIG. 7 to its dotted line position 68. Movement of the parts 58 and 60 into and just past dead center during this opening stroke produce neither pivotal nor twisting motion of the blade 18, but when the parts 58 and 60 pass a short distance beyond dead center, the swivel link 60 becomes inextensible, as was described in connection with mechanism 50, and thereafter transmits further motion of the crank 58 to the auxiliary blade 20 to begin pivoting the auxiliary blade 20 toward open position.

For causing the switch blades 18 and 20 to be operated substantially simultaneously, a coupling arrangement 80 is provided between the two operating mechanisms 50 and 70 in a location at the bottom of the insulator stacks 15*a*—15*d*. This coupling arrangement 80 comprises a pair of cranks 82 rigidly coupled to each of the rotatable stacks 15*a* and 15*d* of insulators and a pair of metallic rods 84 interconnecting the cranks on the two stacks 15*a* and 15*d*. Coupled to the right hand insulator stack 15*d* is suitable motor means (not shown) capable of rotating this stack 15*d* through either an opening or closing stroke. The coupling arrangement 80 causes such rotation of the stack 15*d* through a closing stroke to rotate the other insulator stack 15*a* substantially simultaneously in the same angular direction to effect movement of the crank 58 of the operating mechanism 70 through its closing stroke. Rotation of the insulator stack 15*d* in a reverse direction drives the operating mechanisms 50 and 70 substantially simultaneously through their opening strokes.

As was pointed out hereinabove, initial opening movement of the mechanism 70 produces no motion of the auxiliary blade 20, but initial opening movement of the mechanism 50 produces twisting of the main blade 18. Thus, the auxiliary blade 20 and the contact jaws 30 remain stationary while the free end of the main blade is being twisted out of engagement with the contact jaws 30. The mechanisms 50 and 70 are so adjusted that the free end of the main blade is twisted out of high pressure engagement with the jaw contacts 30 prior to the point at which pivotal motion of the auxiliary blade about its pivot 28 begins. Delaying pivotal motion of the auxiliary blade to this extent assures that no substantial pivotal motion of either blade will occur while the contacts are in high pressure engagement, thus safeguarding the contact-making parts of the switch from possible damage that could occur if high pressure engagement were present during such pivotal motion.

When the insulator stack 15*d* is rotated to produce switch-closing, the two operating mechanisms 50 and 70 swing their respective blades 18 and 20 substantially simultaneously about their pivots 21 and 28 into their substantially horizontal positions of FIG. 1. Continued operation of the two operating mechanisms causes simultaneous rotation of the intermediate shaft 56 of each operating mechanism. Rotation of this intermediate shaft 56 in operating mechanism 70 produces no motion of the auxiliary blade 20, but rotation of the intermediate shaft 56 of operating mechanism 50 causes twisting of the blade 18 in the manner described hereinabove. Thus, the operating mechanism 70 is moving through lost motion travel with respect to its blade 20 while the operating mechanism 50 is twisting its blade 18.

The present invention is particularly applicable to switches designed for extra high voltage circuits, having been embodied in switches designed for 690 kv. power circuits. The required open break gap length for switch of such voltage rating is approximately 18 feet. If a single pivotally-mounted blade were used for bridging this gap, an approximate blade length of 21 feet would be required. A blade of such great length and correspondingly great mass would require for its actuation a huge operating mechanism of unreasonable size and strength. By departing from the single blade approach and by mounting the contact jaws of the switch on a movable auxiliary blade 20 instead of in a stationary location, it has been possible to reduce the length of the main blade 18 to about 14 feet, and this has made it possible to use a considerably smaller operating mechanism than would otherwise have been required.

For suppressing the formation of corona from the high voltage parts of the switch adjacent its contacts, there is provided a corona shield, in the form of two conductive rings 95, suitably supported on the adaptor 29 at laterally-opposite sides thereof. These rings act in a well-known manner to provide a more uniform distribution of the electrical field adjacent the contacts. Other corona shields are also provided adjacent other parts of the switch, but these have been omitted from the drawing for the sake of simplification.

While I have shown and described a particular embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention in its broader aspects and I, therefore, intend in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electric switch comprising a pair of spaced-apart pivots disposed in a predetermined reference plane, a first blade mounted on one of said pivots for pivotal motion movement in an operating plane generally perpendicular to said reference plane, a pair of contact jaws mounted on said first blade at a free end thereof and spaced-apart laterally of said operating plane, a second blade mounted on the other of sid pivots for pivotal movement in said operating plane, said second blade having a contact-making portion at its free end for engaging said contact jaws, said blades having switch-open positions generally perpendicular to said reference plane and switch-closed positions substantially in said reference plane, switch-operating means for pivoting said blades substantially simultaneously from their respective switch-open positions to their respective switch-closed positions to locate said contact-making portion of said second blade between said jaws, means for twisting said contact-making portion into high pressure engagement with said jaws after said second blade has reached its switch-closed position, means for maintaining said first blade in a fixed position during twisting of said contact-making portion, the distance between said jaws and the pivot of said first blade being substantially less than the distance between said contact-making portion and the pivot of said second blade.

2. An electric switch comprising a pair of spaced-apart pivots, a first blade mounted on one of said pivots for pivotal motion in a predetermined operating plane between predetermined switch-open and switch-closed positions, a pair of contact jaws mounted on said first blade at a free end thereof and spaced-apart laterally of said operating plane, a second blade mounted on the other of said pivots for pivotal motion between a predetermined switch-open position and a switch-closed position in which

said first blade is substantially in alignment with said second blade, said second blade having a contact-making portion at its free end which is positioned between said jaws when said blades are their switch-closed positions, switch-operating means for pivoting said blades from their respective switch-open positions to their respective switch-closed positions to locate said contact-making portion between said jaws, means for twisting said contact-making portion into high pressure engagement with said jaws after said second blade has reached its switch-closed position, means for maintaining said first blade in a fixed position during twisting of said contact-making portion, the distance between said jaws and the pivot of said first blade being substantially less than the distance between said contact-making portion and the pivot of said second blade.

3. The switch of claim 2 in which said switch operating means comprises a first operating mechanism coupled to said first blade, a second operating mechanism coupled to said second blade, means for coupling said mechanisms together to produce substantially simultaneous operation thereof, said first mechanism having a lost-motion connection with respect to said first blade that allows operation of said first mechanism in a switch-closing direction to continue after said first blade has entered its switch-closed position without producing further motion of said first blade, said second mechanism acting to twist said second blade into high pressure engagement with said jaws while said first mechanism is moving through lost motion travel relative to said first blade.

4. The switch of claim 2 in which said switch operating means comprises a first operating mechanism coupled to said first blade, a second operating mechanism coupled to said second blade, means for coupling said mechanisms together to produce substantially simultaneous operation thereof, said first mechanism having a lost motion connection with said first blade that allows initial operation of said first mechanism in a switch-opening direction to occur without producing motion of said first blade, said second mechanism acting to twist said second blade out of high pressure engagement with said jaws while said first mechanism is moving through lost motion travel relative to said first blade, said coupling acting to cause said mechanism to produce substantially simultaneous pivoting motion of said blades in an opening direction after said first blade is out of high pressure engagement with said jaws.

5. An electric switch comprising a pair of spaced-apart pivots disposed in a predetermined reference plane, a first blade mounted on one of said pivots for pivotal movement in an operating plane generally perpendicular to said reference plane, a pair of laterally spaced contact jaws mounted on said first blade at a free end thereof, a second blade pivotally mounted on the other of said pivots for pivotal movement in said operation plane, said second blade having a contact-making portion at its free end for engaging said contact jaws, said blades having switch-open positions transversely disposed relative to said reference plane and switch-closed positions substantially in said reference plane, said switch being so constructed that entry of the free end of said second blade into the space between said jaws can be effected only from behind the first blade considered in the direction of pivotal closing motion, switch operating means for pivoting said blades substantially simultaneously from their switch-open positions to their respective switch-closed positions at such speeds that said first blade is located ahead of said second blade during closing travel near said switch closed positions, closing travel into said switch-closed positions resulting in entry of said contact-making portion into the space between said jaws, means for twisting said contact-making portion into high pressure engagement with said jaws after said second blade hase reached its switch closed position, means for maintaining said first blade in a fixed position during twisting of said contact-making portion.

6. The switch of claim 5 in which the distance between said jaws and the pivot of said first blade is considerably less than the distance between said contact-making portion and the pivot of said second blade.

7. The switch of claim 6 in which said first blade comprises a hollow support for said contact jaws located ahead of said contact jaws during switch-closing motion, said first blade carrying at its free end an enlargement that is received in the hollow region of said support when said blades are in their switch-closed positions.

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