Oct. 12, 1937. H. J. CRABBS 2,095,796

SWITCH

Filed July 11, 1928 2 Sheets-Sheet 1

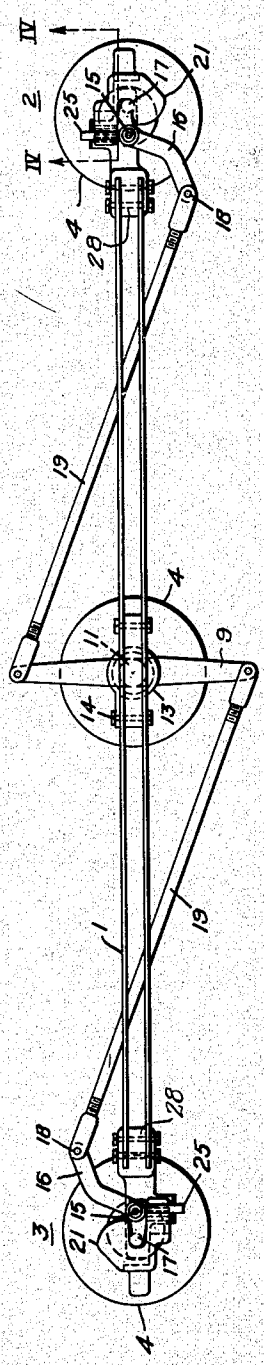


Fig. 1.

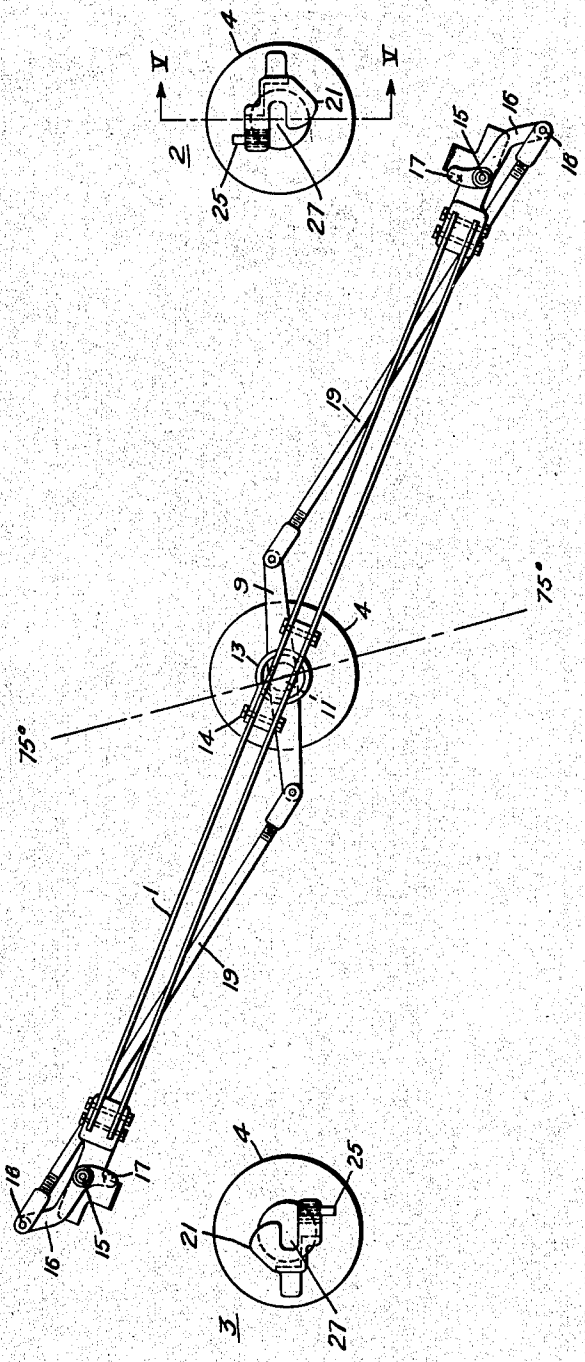


Fig. 2.

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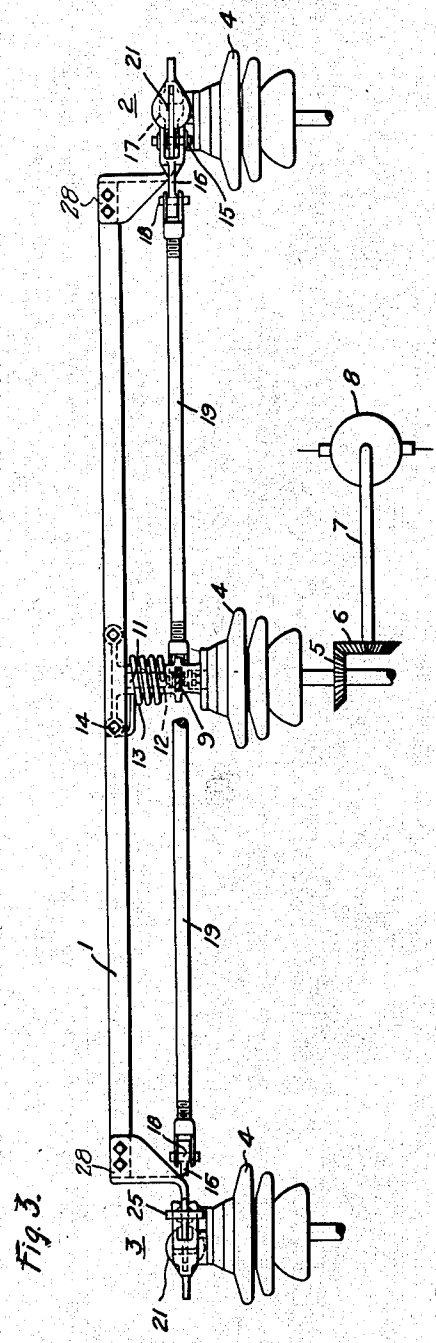


Fig. 3.

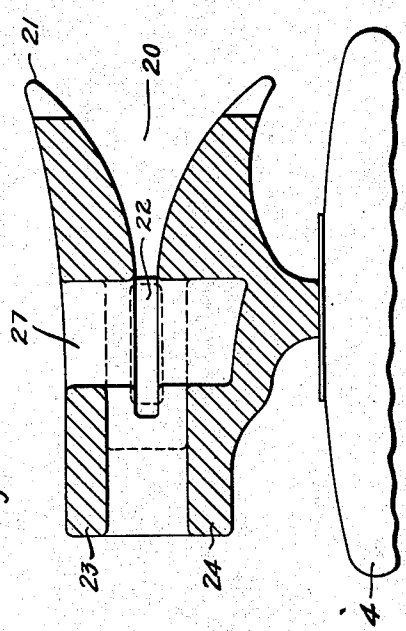


Fig. 5.

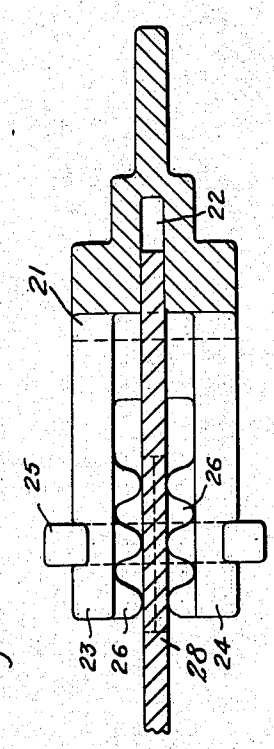


Fig. 4.

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2,095,796

SWITCH

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Application July 11, 1928, Serial No. 291,749

22 Claims. (Cl. 200—48)

My invention relates to circuit interrupters and more particularly to disconnecting switches for high-voltage circuits.

With the advent of exceedingly high-voltage systems in recent years, switch-gear problems have been considerably increased in difficulty and, at the present time, are a limitation to a further increase in the voltages of such systems. One difficulty experienced is with disconnecting switches for outdoor service and relates to poor contact between the switch blade and the switch jaws, usually caused by corrosion or lack of sufficient pressure and resulting in a large voltage drop across the contact surfaces.

In accordance with my invention, I overcome the above-mentioned difficulty by providing exceedingly high-pressure contacts, forming either a surface contact or a plurality of line contacts under heavy pressure.

The difficulty of employing high-pressure contacts in the past was due to inability to push and pull a long blade into and out of engagement with its engaging jaws, under such high pressures. Another source of difficulty was the large stresses imposed upon the insulator columns and the operating mechanism employed in high-voltage apparatus.

I eliminate the foregoing difficulties by providing a cam lever on each end of the blade to engage a member on each of the jaws to thereby pry the blade into and out of engagement when the switch is closed or is moved to open position.

It is a further object of my invention to provide a cam for forcing the blade into and out of circuit-closing position which shall also act as a latch for retaining the blade in its closed position.

It is a further object of my invention to provide a cam lever for prying the blade into and out of closed-circuit position that shall fold up when the blade is in open position, so that the air gap between the jaws and the blade will not be shortened.

These and other objects that will be made apparent throughout the further description of my apparatus will best be understood by referring to the drawings, wherein;

Figure 1 is a top plan view of an embodiment of my invention, with the switch blade in closed position,

Fig. 2 is a view, similar to Fig. 1, showing the blade in partly-open position,

Fig. 3 is a view, in elevation, of the embodiment of my invention shown in Fig. 1 and Fig. 2, parts being broken away,

Fig. 4 is a sectional view of the high-pressure contact, taken along the section line IV—IV of Fig. 1, and

Fig. 5 is a sectional view of the guide member of the high-pressure contact, taken along the section line V—V of Fig. 2.

My invention comprises, in general, a main blade 1, the ends of which have tips 28 which engage high-pressure contacts 2 and 3. The central portion of the blade 1 and the high-pressure contacts 2 and 3 are mounted on bases or pedestals 4 that are supported on a suitable frame (not shown). The central pedestal 4 has attached thereto a bevel gear 5 to engage a bevel gear 6 that may be connected, by a shaft 7, to a motor 8 or to a hand-operated mechanism of a type well known in the art.

Referring to Figs. 1, 2, and 3, a cross arm or double crank 9 is mounted directly on the central insulating base 4 and is rotatively movable therewith. A stud 11 extends above the crank or arm 9, co-axial with the axis of the insulator 4, and has a recess in its upper end to receive a pin 12 with which the blade 1 is provided. By so mounting the blade 1, with respect to the arm 9, the latter may be rotatively moved with respect to the blade. However, in order to normally position the blade with respect to the arm, a heavy coil spring 13 is provided, one end of which is attached to the stud 11 and the other end of which is attached, by a bolt 14, to one side of the blade 1.

The normal position of the crank or arm 9, relative to the blade 1, i. e., the angle which spring 13 maintains between them, is one in which the crank or arm 9 is almost parallel to the blade, as indicated in Fig. 2. The above-mentioned relative positions of the blade and arm are desirable, when the switch is in the full open position, indicated by the line 75°—75°, because the arm, if otherwise positioned, would decrease the air gap separating the two high-pressure contacts 2 and 3.

Pivoted at 15 to each tip 28 on the ends of the blade 1 is a cam lever or link 16 having a rounded prying lug 17 at its free end and having its other end connected to one end of the crank or arm 9 by a member 19. By the foregoing arrangement, a rotative movement in a counter-clockwise direction, applied to the central insulator 4, will first move the crank or arm 9 and the blade 1 from the open toward the closed position without changing the relative angular positions shown in Fig. 2. This condition will persist until such time as the tips 28 of the blade 1 come into contact with the

high-pressure contacts 2 and 3, after which the main blade 1 will move no farther.

Continued rotative movement of the central insulator 4, in a counter-clockwise direction, will turn the crank or arm 9, with respect to the main blade 1, in a counter-clockwise direction, so that the members 19 move longitudinally to turn each of the cam levers 16 in a clockwise direction. This relative movement of the arm 9 and the blade 1 is permitted by the deflection of the spring 13.

Each of the high-pressure contacts 2 and 3 comprises a bifurcated portion 21 to receive the tip 28 of the blade and guide it between the high-pressure contact members, the entrance portion of the guide space 20 being wider than its inner portion, as shown in Fig. 5.

Referring to Fig. 4, the enlarged sectional view there shown discloses an inner slot 22 of the guide member 21 which is the inner portion of the space between its arms, the left-hand portion showing the high-pressure contact 2, comprising upper and lower jaws 23 and 24 biased toward each other by a heavy U-shaped spring 25. The contact jaws 23 and 24 make contact with the tip 28 of the blade 1 along the lines of the projections 26. By providing the projections 26, the pressure exerted at the ends thereof will be so great that they will be pressed into intimate mechanical contact with the metal of the tips 28 on the blade 1. By this means, the copper of the tips on the blade and that of the jaws are so firmly united that no oxides can exist between them, and sufficient metal will always be in contact to eliminate the trouble heretofore experienced with the heating of the contacts and the drop of potential. The projections or ridges 26 extend parallel to the direction of movement of the blade tip 28 when entering between the jaws, thereby providing a wiping action along the line of contact, which still more effectively removes any oxides or other coating which might offer resistance to flow of electric current.

The spring 25 exerts such compressive force upon the upper and lower contact jaws 23 and 24 that the tip 28 of the blade 1 cannot be forced home therein by direct rotation of the central insulator 4. For this reason, a recess 27 is provided in the blade-guiding member 21 and the upper and lower contact jaws 23 and 24 to serve as a fulcrum for the cam lever 16, the prying lug 17 of which will move into it, as a result of the continued movement of the arm or crank 9 after the blade has engaged the contacts. Further movement of the arm 9 will force the tip 28 on the blade 1 between the projections 26 of the high-pressure contacts 2 and 3 and will thereafter move the blades into fully closed position, as shown in Fig. 1, by the prying force exerted through the cam lever or link 16.

Assuming that the switch is in closed position, as shown in Fig. 1, it is held in this position by the cam lever 16 because of the rotatively-movable insulating member 4 being held in that position by the operating mechanism that turns it. When the operating mechanism is moved to turn the member 4 in a clockwise direction, the tips 28 of the switch blade 1 will remain in contact with the high-pressure contacts 2 and 3, so that the arm or crank 9 will turn with respect thereto, causing the cam levers or links 16 to be moved about their pivot points 15 in a counter-clockwise direction. During this movement, the deflection of the spring is released. This movement pries the tips on the blade ends from between the high-pressure contact jaws 23 and 24, as a result of the engagement of the prying lug 17 with the walls of the recess.

After the tips 28 of the switch blade 1 are forced out of engagement with the high pressure contacts 2 and 3, a continued movement of the central insulating member 4 and the arm 9 will move the blade 1 through the medium of the spring 13, to the full open position. During this movement, the relative position of the blade 1 with respect to the arm 9 is that shown in Fig. 2, in which there is little or no deflection in the spring 13, as the resistance to turning offered by the blade 1 is negligible after it has become disengaged from the contacts 2 and 3.

It will thus be seen that I have provided a switch with high-pressure contacts and with a set of cam members that are operated by mechanism similar to that heretofore employed in operating switches without cams; and that such cams are employed, both in closing and in opening the circuit interrupter, to force the blade into and out of closed-circuit position.

Although I have shown and described a disconnecting switch in which the blades are swung in a horizontal plane between two contact jaws, it will be apparent to any one skilled in the art that my device will work equally as well on single-break interrupters that may turn in either a horizontal plane or a vertical plane. I do not wish, therefore, to be limited to the particular structure herein shown as regards specific structural or operating characteristics, except as limitations may be imposed by the prior art and expressed in the appended claims.

I claim as my invention:

1. The combination, in a disconnect switch structure having a swinging blade mounted on a central rotatable member, contact members oppositely disposed at the sides of the said member and adapted to receive the blade and complete a circuit when the said central member is rotatively actuated, a cam lever associated with each end of the blade and actuated by the central member, and stationary engaging members to receive the cam levers to thereby enable the cam levers to force the blade into and out of full contact engagement.

2. The combination with a pivoted blade member and a jaw member forming a switch structure, of a cam member associated with the blade member, a cam-engaging member associated with the jaw member, and a member pivoted about the axis of the pivot of said blade for actuating the cam member after its engagement with the cam-engaging member to force the blade member into and out of engaged position with the jaw member.

3. A switch structure comprising a blade member, an actuating member having a stationary axis of motion, stationary contact members, camming members associated with the ends of the blade, cam-engaging members associated with the jaws, and connecting means between the camming members and the actuating member so that the actuating member moves the blade into and out of engagement with the stationary contact members.

4. The combination in a switch comprising a blade and a cooperating contact member, of an actuating member for supporting the blade and for moving it to and from contact with the contact member, and a cam attached to the blade member and independently operated by the actuating member to move the blade into and out of full engagement with the contact member.

5. The combination with a switch blade and contact jaws therefor, of an operating lever for moving the blade bodily and having a pivoted connection therewith, whereby the lever may be moved without moving the blade, a cam member mounted on the end of the blade and connected to the lever, a cam-engaging member on the contact jaws whereby the first movement upon opening and the last movement upon closing the blade member is a rotative movement of the lever with respect to the blade to cam the blade out of or into complete engagement with the jaws.

6. The combination with a rotatively movable blade and a supporting lever therefor that is movable relatively thereto, of contact members oppositely disposed with respect to the blade for engaging the ends thereof to complete a circuit therewith, a cam member mounted on each end of the blade and connected to the lever, a cam-engaging member on each contact member, whereby, when closing or opening the switch, the final movement into and the initial movement out of the contact members is produced by the movement of the lever relative to the blade to cause actuation of the cam by the cam-engaging member.

7. In a switch structure, the combination with a bridging member, of a member rotatable about a stationary axis for actuating said bridging member, contact members engageable by each end thereof and a camming means associated with each end of said bridging member and said contact members for forcing the former into and out of intimate engagement with the latter.

8. In a switch structure, the combination with a bridging member, of contact members engageable by each end thereof, a camming means associated with each end of said bridging member and contact members for forcing the former into and out of intimate engagement with the latter, and a common actuating member for operating said camming means.

9. In a switch structure, the combination with a bridging member, of contact members engageable by each end thereof, a camming means associated with each end of said bridging member and the respective contact members for forcing the former into and out of intimate engagement with the latter, and a common actuating member for moving said bridging member and operating said camming means.

10. In a switch structure, the combination with a bridging member, of a contact member therefor, actuating means flexibly connected to and supporting said bridging member for rotation about said connection, and camming means directly connected to said bridging member for forcing the same into and out of intimate engagement with said contact member and operated by said actuating means independent of the actuation of said bridging member.

11. In a switch structure, a movable switch blade the current-carry portions of which form a substantially rigid portion and a contact jaw having means for frictionally holding said switch blade in contact therewith, means mounted on said switch blade for prying said switch blade into and out of said frictional engagement with said jaw, and means having a stationary axis of motion for actuating said prying means on said blade.

12. In a switch structure, a contact member and a switch blade movable into engagement with said contact member, said switch blade having current-carrying portions forming a substantially rigid structure, means movably mounted on said switch blade for prying said blade into and out of engagement with said contact member, and means comprising an actuating member pivoted about a stationary axis and connected to said switch blade and to said movable prying means for moving said prying means on said blade and for moving said blade.

13. In a switch structure, a contact member and a switch blade movable into engagement with said contact member, means movably mounted on said switch blade for prying said blade into and out of engagement with said contact member, and means comprising an actuating member pivoted about a stationary axis and having a flexible connection to said switch blade and a positive connection to said movable prying means for moving said prying means on said blade and for moving said blade.

14. In a switch structure, a contact jaw member and a pivoted switch blade for making contact therewith, means pivoted on the end of said switch blade and engageable with said jaw member for prying said blade into and out of contact with said jaw member, and means comprising an actuating member pivoted about a stationary axis and connected to said switch blade and to said pivoted prying means for rotating said blade and prying means about their respective pivots.

15. In a switch structure, a pivoted switch blade and a contact jaw having means for frictionally holding said switch blade in contact therewith, means pivoted on the end of said switch blade and engageable with said jaw for prying said switch blade into and out of said frictional engagement with said jaw, and means comprising an actuating member pivoted about the axis of the pivot of said switch blade and having a flexible connection to said blade and a positive connection to said prying means for rotating said blade and prying means about their respective pivots.

16. In a switch structure, the combination of a first contact member, a second contact member movable into and out of engagement therewith, a lever pivoted to the second contact member, and operating means connected to the second contact member, said parts being so arranged that switch-closing movement of the operating means first effects movement of the lever and the second contact member toward the first contact member until one part of said lever abuts the first contact member, whereupon the latter serves as a fulcrum for the lever and continued movement of the operating means effects rotary movement of the lever forcing the second contact into engagement with the first contact member.

17. An electric switch including a rotatable actuating insulator, a switch blade pivotally mounted on said insulator for rotation relative thereto and actuated by said insulator, the pivot of the switch blade being coincident with the axis of rotation of the insulator, spring means connected at one end to a movable point on said rotatable insulator to be actuated thereby and at the other end to said switch blade to cause actuating thereof, and means engageable by said switch during movement to closed position when it has reached a position closely adjacent to closed position for retarding movement of said switch blade and stressing said spring as said insulator continues to rotate so that said spring is stressed when the switch blade is in closed position.

18. An electric switch including a rotatable actuating insulator, a switch blade pivotally mount-

ed thereon and actuated thereby, said switch blade having a contact surface substantially rigid therewith, the pivot of the switch blade being at a fixed point coincident with the axis of rotation of the insulator and said blade and said insulator being relatively movable, contact means engageable by the contact surface on said blade when said switch is in the closed circuit position, spring means through which said blade is actuated by said insulator during at least the major part of its travel, said spring means tending to maintain said blade and insulator in a predetermined angular position with respect to one another, means for causing the contact surface rigid with said blade and said contact means to move relative to each other with a high pressure wiping action during the final part of the circuit closing operation of said switch, and means whereby said means for producing a wiping engagement of the cooperating contact surfaces is actuated by the rotation of said rotatable insulator during the circuit closing operation; the pivotal mounting of said blade allowing said insulator to move independently of said blade when causing the actuation of said actuating means.

19. An electric switch including a contact, a rotatable actuating insulator, a switch blade having a contact at one end thereof for engaging the first said contact, said switch blade being pivotally mounted on and rotatable relative to said insulator and being actuated thereby, the pivot of the switch blade being coincident with the axis of rotation of the insulator, spring means connected at one end to a point movable rigidly with the insulator to be actuated thereby and connected at the other end to actuate the blade and to tend to maintain them in a predetermined angular position with respect to one another, and means causing said rotatable insulator to rotate relative to said blade against the bias of said spring to increase its stress after preliminary engagement of the contacts and as they move into final high pressure contact.

20. In an electric switch, a supporting insulator, a contact means associated with said insulator, a second supporting insulator, a blade member and a second member supported on said second insulator, a contact portion rigidly mounted on the end of said blade member, and actuating means for moving said blade member into and out of engagement with said contact means, said blade member and said second member being joined together adjacent the end which engages said contact means by a link pivoted to both the blade member and the second member, at least one of said members being longitudinally movable, with respect to the other of said members, during the circuit closing operation to actuate said link and means for causing the contact portion rigidly mounted on said blade member to wipe and engage said contact means with high pressure upon actuation of said link.

21. In an electric switch, a stationary supporting insulator, a contact means associated with said insulator, a rotatable supporting insulator, a blade member and a second member supported on said rotatable insulator for movement to the open and to the closed circuit position, a contact portion rigidly carried by said blade member, and actuating means supported on said rotatable insulator for causing said members to be moved into and out of engagement with said contact means, in response to the rotation of said rotatable insulator, said members being joined together adjacent the end which engages said contact means by a tie link pivotally fastened to both said blade member and said second member, at least one of said members being longitudinally movable, with respect to the other of said members, during the circuit closing operation to cause said link to move so as to effect an intimate engagement between the contact portion rigidly carried by said blade member and said contact means.

22. In an electric switch, contact means, a pair of members one of which has a contact portion rigid therewith for engaging said contact means, support means for said members, actuating means for moving said members into and out of position to engage said contact means, and means operable during the closing operation of said switch to produce a high pressure, wiping engagement between said contact portion rigid with said one member and said contact means, said means for producing a high pressure, wiping engagement including a connecting link joining said members adjacent the contact portion which engages said contact means, and said actuating means causing at least one of said members to move longitudinally with respect to the other of said members, during the circuit closing operation to actuate said pressure engagement securing means.

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