Sept. 22, 1959 | C. W. UPTON, JR | 2,905,794

ELECTRIC SWITCH

Filed June 22, 1956

Fig. 1.

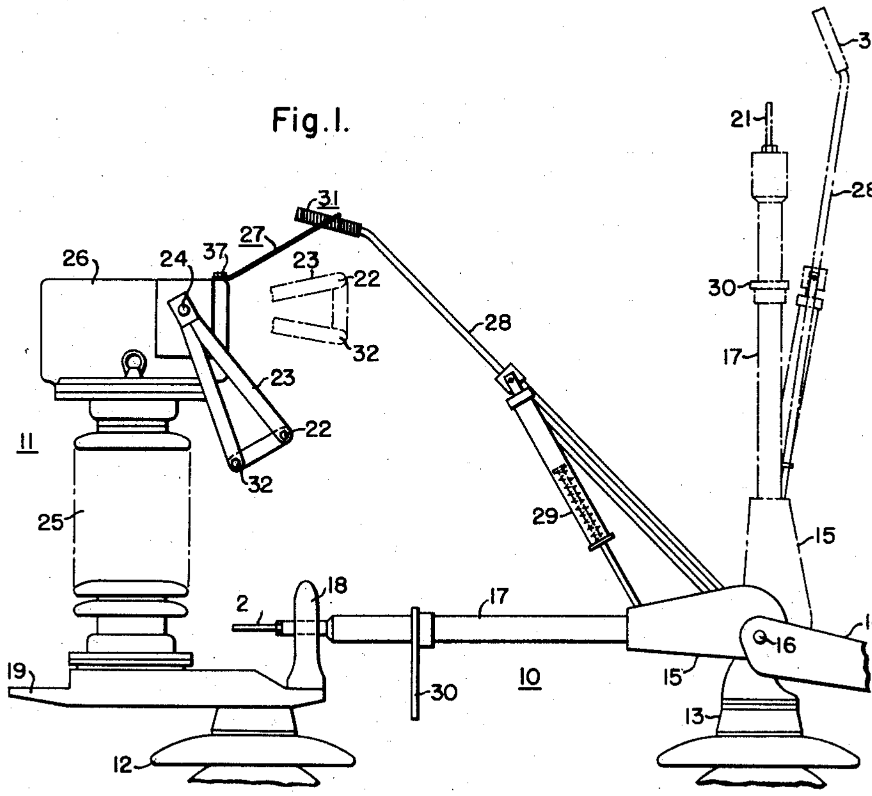


Fig. 4.

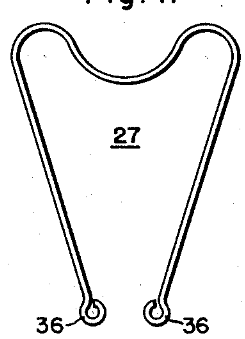


Fig. 2.

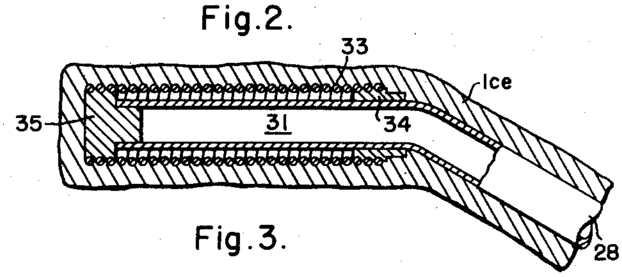


Fig. 3.

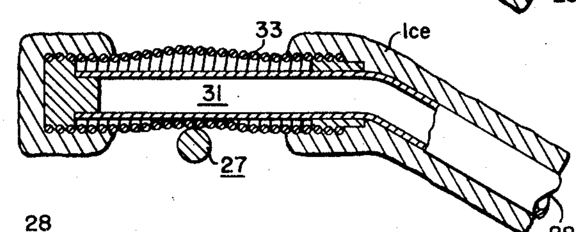
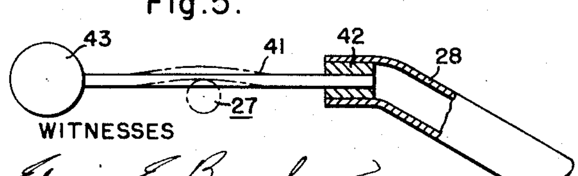


Fig. 5.



WITNESSES

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ELECTRIC SWITCH

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7 Claims. (Cl. 200—146)

My invention relates, generally, to electric switches, and, more particularly, to contact members for an electric switch of the load break type which has an interrupting device connected into the load circuit during opening of the switch.

Such a switch may be utilized for causing ice to melt on transmission lines. Normally, the switch will be open. During weather conditions when ice forms on the lines the switch may be closed for a short time interval to establish a circuit and circulate enough current to melt the ice on the lines. The switch is then reopened.

The problem involved is to be able to establish an electrical circuit through the auxiliary blade and the interrupter, which are covered with ice, so that when the switch is reopened, the interrupter will be in the circuit and be able to function properly as a load break device. Also, if the circuit is not established through the auxiliary blade and the interrupter when closing, there will be arcing external to the interrupter. However, the arcing, when closing, is not as dangerous as it is when opening, since the arc will decrease in length and go out when the main switch blade closes; whereas, in opening the arc length increases, and phase to phase or line to ground faults are possible.

Therefore, the problem of removing ice from the auxiliary blade contacts becomes an important factor in properly establishing the circuit. These contacts are necessarily light weight, low pressure, non-wiping contacts to which relatively little impact can be applied. It has been established by extensive tests that the most effective way to break ice is to apply tension or bending stresses to the ice.

An object of my invention is to provide auxiliary contact members for a disconnect switch which are so constructed that during closing, bending stresses are applied to ice formed on the contact members.

Another object of my invention is to provide a switch contact member having a relatively large amount of flexibility and resiliency.

A further object of my invention is to provide a switch contact member which returns to its original shape after being bent during closing of the switch.

Other objects of my invention will be explained fully hereinafter or will be apparent to those skilled in the art.

In accordance with one embodiment of my invention, a coil spring having its turns spaced closely together surrounds a tubular switch blade at one end. The spring is spaced from the blade by spring seats which retain the spring on the blade. The closely spaced turns prevent ice formation within the spring which is readily distorted by light loading at an angle to its axis. The cooperating contact member is a flexible and resilient wire or rod formed into an inverted W with the ends of the legs so attached to the interrupter unit of the switch that the rod flexes when the spring contact strikes the crotch of the inverted W, thereby breaking the ice on both contact members.

For a better understanding of the nature and objects

of the invention, reference may be had to the following detailed description taken in conjunction with the accompanying drawing, in which:

Figure 1 is a view, in side elevation, of a portion of a disconnecting switch structure embodying the principal features of the invention;

Fig. 2 is an enlarged view, in section, of a portion of an auxiliary or isolating blade of the switch and showing the blade covered with ice;

Fig. 3 is a view, similar to Fig. 2, showing the ice broken away from the contact member at the end of the switch blade;

Fig. 4 is an enlarged view, in elevation, of an auxiliary contact member which is engaged by the auxiliary switch blade during closing of the switch, and

Fig. 5 is an enlarged view, partly in section and partly in elevation, of a modified blade and contact member.

Referring to the drawings, and particularly to Fig. 1, the structure shown therein comprises a portion of a disconnecting switch assembly **10** and an interrupting device **11**. The disconnecting switch assembly **10** may be of the type described in Patent No. 2,363,360, issued November 21, 1944, to H. L. Rawlins. The switch structure comprises three spaced insulator stacks, only two of which are shown in the present drawing. The insulator stacks are mounted upon a base which is not shown in the present drawing.

One of the insulator stacks **12** is fixed on the base, and the insulator stack **13** is rotatably mounted on the base. The third insulator stack is fixed on the base, and the top of the stack is connected to the switch structure by means of a supporting and bracing member **14**. A housing **15** is pivotally mounted on the member **14** by means of pivot pins **16**. As described in the aforesaid patent, a disconnecting switch blade **17** may be actuated into and out of engagement with spaced contact jaws **18** by rotating the insulator **13** by means of a suitable driving mechanism.

The operating mechanism for the disconnecting switch is so constructed that the switch blade **17** is first rotated about its axis to release contact pressure between the end of the switch blade and the spaced contact jaws **18**, and is then pivotally actuated from the horizontal position to a substantially vertical position as shown by the broken lines in Fig. 1. Thus, a power conductor (not shown) which may be connected to a terminal plate **19** mounted on the insulator **12**, is disconnected from a conductor (not shown) which may be connected to a terminal plate mounted on the third insulator stack and connected to the member **14**.

When the blade **17** is disconnected from the contact jaws **18**, the current is compelled to flow through the interrupting device **11** which may be of the type disclosed in a copending application of J. B. Owens et al., Serial No. 417,622, filed March 22, 1954. As the blade **17** is raised, a tip end **21** on the blade **17** strikes a laterally extending projection **22** disposed at the end of a crank arm **23** to effect rotation of a drive shaft **24**, thereby causing operation of an overcenter toggle spring mechanism disposed inside a housing **26** mounted on the upper end of the interrupting device **11**.

The operation of the toggle mechanism causes separation of contact members disposed inside an insulating housing **25** of the interrupting device, thereby interrupting the circuit which previously extended from the terminal plate **19** through the contact members in the interrupting device, the housing **26**, an auxiliary contact member **27** mounted on top of the housing **26**, and an auxiliary or isolating switch blade **28** to the supporting member **14** to which the blade **28** is pivotally connected. The auxiliary blade **28** is biased by a spring assembly **29** toward the auxiliary contact member **27**. Since the arc is interrupted inside the interrupting device **11**, no arc is drawn between the auxiliary contact member 27 and the auxiliary blade 28 during opening of the circuit.

As previously explained, the tip 21 on the blade 17 engages the projection 22 on the crank arm 23 to actuate the crank arm to the position shown by the broken lines in Fig. 1. Subsequently, an arm 30, which is attached to the blade 17 and is rotated to extend in a lateral direction, engages the auxiliary blade 28 and moves the latter to the position shown by the broken lines as the main blade 17 is raised to its open position.

During the closing operation, the main switch blade 17, together with the auxiliary blade 28, swing in a counterclockwise direction about the pivot pins 16. As the blades are being closed, a spring contact member 31 on the end of the auxiliary blade 28 first engages the auxiliary contact member 27 mounted on the housing 26 of the circuit interrupting device 11. However, the circuit through the interrupter 11 is not closed at this time because of the separated condition of the contact members inside the housing 25. As the blade 17 continues to travel in a counterclockwise direction, the tip 21 engages a projection 32 on the crank arm 23, thereby actuating the crank arm to the position shown by the full lines and causing the operation of the toggle mechanism in the housing 26 to close the contact members of the interrupting device. This completes the circuit through the interrupting device and continued travel of the main switch blade 17 causes it to move between the spaced jaws 18.

The rotation of the blade 17 at the end of its closing movement causes an increase in the contact pressure between the blade 17 and the contact jaws 18. Thus, a low resistance path is provided through the main switch members, thereby causing current flow through the low resistance, high pressure contact path rather than the relatively high resistance path through the interrupting device and the auxiliary switch members.

As explained hereinbefore, a switch of the present type may be utilized to cause ice to be melted from a transmission line by closing a switch, which is normally open, to cause current to flow through the line, thereby melting the ice. However, since ice will also be formed on the contact members of the switch, it is necessary to break the ice from the contact members before a circuit can be established through the switch.

It has been demonstrated that heavy ice accumulations can be removed from high pressure contacts to which an impact blow can be delivered prior to the blade twisting motion which establishes high pressure contact. The nature of the low pressure contact of the interrupter isolating blade is such that a heavy impact blow cannot be delivered readily. Therefore, it is necessary to provide a flexible contact which will cause ice breakage with the application of relatively small forces.

As shown in Figs. 2 and 3, the novel contact member 31, which I have provided, comprises a coil spring 33 disposed at the end of the auxiliary switch blade 28 which is preferably of a tubular construction. The turns of the spring 33 are preferably in contiguous relation. The spring 33 is spaced from the blade 28 by a spring seat 34 which surrounds the blade 28 and a spring seat 35 part of which is disposed in the end of the blade 28. The spring 33 should be so spaced from the blade 28 that it can be readily distorted by engagement with the auxiliary contact member 27 as shown in Fig. 3.

The distortion of the spring 33 causes a bending stress on the ice formed on the contact member, thereby breaking the ice bond and causing it to fall free to permit direct contact between the spring 33 and the member 27. The closely spaced turns of the spring 33 prevent ice from forming within the spring and assure the possibility of distortion of the spring when it engages the member 27 at an angle to the axis of the spring. Even if the spring turns are slightly separated, the small crevices between the turns will be the first point to bridge with ice and prevent an ice accumulation between the spring and the blade 28. In this manner flexibility and resiliency of the spring are assured under all conditions.

In order that ice may also be broken from the contact member 27, it is preferably composed of the same flexible material as the spring 33. A material, such as silicon bronze or beryllium copper, having a relatively high degree of conductivity as well as flexibility and resiliency, is suitable for the spring 33 and the contact member 27. As shown most clearly in Fig. 4, the contact 27 comprises a rod which is formed into an inverted W with an eye 36 at the end of each leg for attaching the legs to the housing 26 by means of bolts or screws 37.

The contact member 31 on the end of the auxiliary switch blade 28 is disposed in the crotch of the inverted W when the switch is in the closed position. Since the member 27 is composed of a material having a relatively high degree of flexibility and resiliency, the contact member 27 is flexed by the contact member 31 striking the wire or rod 27 during the closing operation. The flexing of the contact 27 causes bending stresses on the ice surrounding it, thereby breaking the ice from the member 27 as well as from the member 31 during closing of the switch. Thus, an electrical circuit is established through the auxiliary contact members of the switch to prevent external arcing during closing and opening of the switch, and particularly during opening of the switch.

Without this invention, an accumulation of ice on the end of the blade 28 could prevent effective electrical connection to the interrupter 11 with the result that the arc interrupting means in the interrupter 11 would not be used and arcing would take place between the main contacts 18 and 21. The flow of current through the main blade 17 and contacts 18 and 21 would not melt the ice on the end of the auxiliary blade 28. Thus, when the switch is opened the full current would flow between the separated main contacts 18 and 21 and this power arc in addition to burning the main contacts, could cause flash-over to other apparatus or to one of the power lines with serious consequences. By making the auxiliary contact portions 27 and 31 of resilient material which is more flexible than the body of the auxiliary switch arm 28, the bending of the resilient material during the closing operation will break the ice as heretofore explained and insure proper functioning of the interrupter 11 and avoid the drawing of an external arc between the main contacts.

In the modification of the invention shown in Fig. 5, a straight rod 41, which may be composed of silicon bronze or beryllium copper so as to be more flexible than the blade 28, has one end secured in the end of the blade 28 by means of an insert 42 secured in the end of the blade 28. A relatively heavy weight 23, which is preferably in the shape of a ball, is secured on the other end of the rod 41.

As shown by the broken lines in Fig. 5, the weight 43 causes the rod 41 to momentarily bend slightly when it strikes the fixed contact member 27, thereby causing bending stresses in the ice which breaks the ice from the rod 41 as well as from the contact member 27 in the manner previously explained. Since the rod 41 is composed of a material which is both flexible and resilient, the rod returns to its original shape after the initial impact between the rod and the fixed contact member. The contact member 27 is also returned to its original shape after the initial impact.

From the foregoing description, it is apparent that I have provided for breaking ice from the contact members of electric switches without requiring high impact between the members of a switch during the closing operation. Thus, the auxiliary contact members of a disconnecting switch of the load break type may be composed of relatively light weight material to which relatively little impact can be applied. The present switch is particularly suitable for utilization in power systems where it is necessary for the switch to establish an electrical circuit through the contact members of the switch when they are covered with ice. The ice is broken from the auxiliary contact members in the manner hereinbefore described, and it is broken from the main contact members by impact and the rotating action of the main switch blade to force the spaced contact jaws apart during the closing operation. Thus, the switch may be utilized under adverse conditions caused by ice forming on the contact members of the switch.

Since numerous changes may be made in the above-described construction, and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In an electric switch, in combination, a main switch blade, a main contact member engaged by the main switch blade, an auxiliary switch blade actuated by the main blade, a flexible and resilient auxiliary contact member, a support to which said auxiliary contact member is attached, a member more flexible and resilient than the auxiliary blade having one end attached at the end of the auxiliary blade and the other end being unattached, said flexible and resilient member engaging the auxiliary contact member between the ends of the flexible and resilient member to bend it about a transverse axis prior to the engagement of the main blade with the main contact member during closing of the switch, and said transverse axis being located substantially midway between the attached and the unattached ends of the flexible and resilient member.

2. In an electric switch, in combination, a main switch blade, a main contact member engaged by the main switch blade, an auxiliary switch blade, a flexible and resilient auxiliary contact member which is generally of the shape of an inverted W, a support to which the legs of the auxiliary contact member are attached, a flexible and resilient member having one end attached at the end of the auxiliary blade and the other end being unattached, said flexible and resilient member engaging the crotch of the inverted W between the ends of the flexible and resilient member to bend it about a transverse axis prior to the engagement of the main blade with the main contact member during closing of the switch, and said transverse axis being located susbtantially midway between the attached and the unattached ends of the flexible and resilient member.

3. In an electric switch, in combination, a main switch blade, a main contact member engaged by the main switch blade, an auxiliary switch blade actuated by the main blade, a flexible and resilient auxiliary contact member, an interrupting device connected to the main contact member, the auxiliary contact member being attached to said interrupting device, a member more flexible and resilient than the auxiliary blade having one end attached at the end of the auxiliary blade and the other end being unattached, said flexible and resilient member engaging the auxiliary contact member between the ends of the flexible and resilient member to bend it about a transverse axis prior to the engagement of the main blade with the main contact member during closing of the switch, and said transverse axis being located between the attached and the unattached ends of the flexible and resilient member.

4. In an electric switch, in combination, a main switch blade, a main contact member engaged by the main switch blade, an auxiliary switch blade, an auxiliary contact member engaged by the auxiliary switch blade when the switch is closed, and a coil spring attached at the end of the auxiliary switch blade to engage the auxiliary contact member between the ends of the spring to bend the spring about a transverse axis prior to engagement of the main blade with the main contact member during closing of the switch.

5. In an electric switch, in combination, a main switch blade, a main contact member engaged by the main switch blade, an auxiliary switch blade actuated by the main blade, a flexible and resilient contact member having a crotch, a support to which the auxiliary contact member is attached, and a coil spring attached at the end of the auxiliary blade to engage the crotch of the auxiliary contact member between the ends of the spring to bend the spring about a transverse axis prior to the engagement of the main blade with the main contact member during closing of the switch.

6. In an electric switch, in combination, a main switch blade, a main contact member engaged by the main switch blade, an auxiliary switch blade, an auxiliary contact member engaged by the auxiliary switch blade when the switch is closed, and a coil spring surrounding the end of the auxiliary switch blade to engage the auxiliary contact member between the ends of the spring to bend the spring about a transverse axis prior to engagement of the main blade wtih the main contact member during closing of the switch.

7. In an electric switch, in combination, a main switch blade, a main contact member engaged by the main switch blade, an auxiliary switch blade actuated by the main blade, an auxiliary contact member engaged by the auxiliary switch blade when the switch is closed, a coil spring surrounding the end of the auxiliary switch blade to engage the auxiliary contact member between the ends of the spring to bend the spring about a transverse axis prior to engagement of the main blade with the main contact member during closing of the switch, and supporting means for spacing said spring from the auxiliary switch blade.

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