Dec. 1, 1942. H. J. CRABBS 2,303,914

CIRCUIT INTERRUPTER

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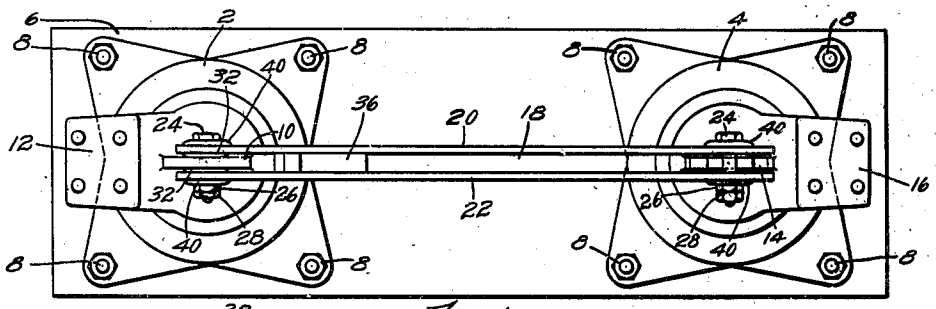


Fig. 1.

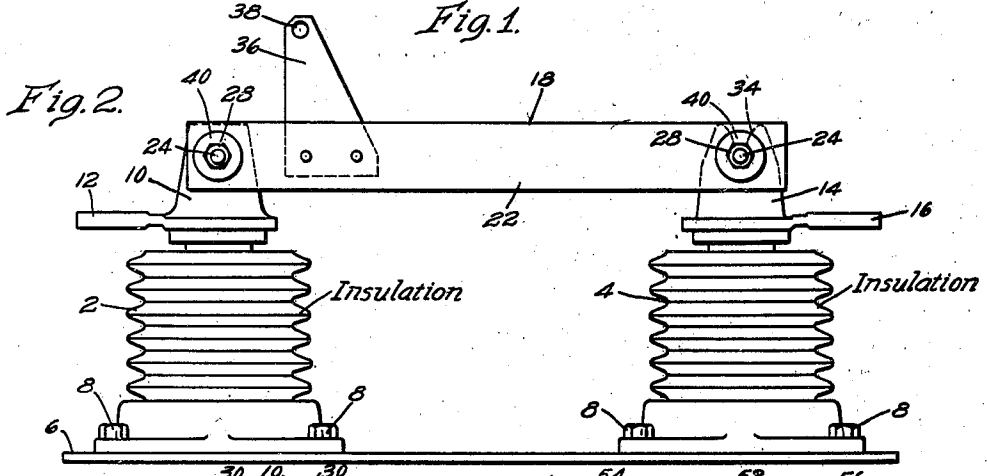


Fig. 2.

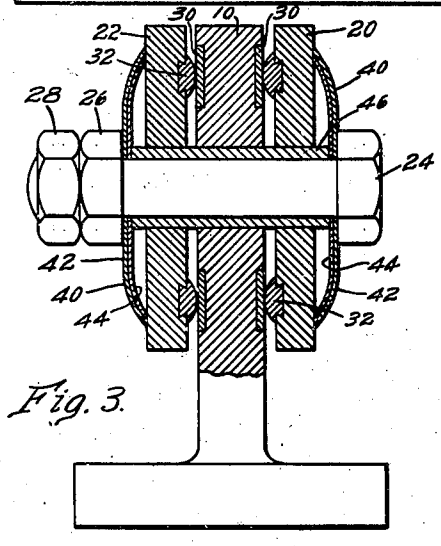


Fig. 3.

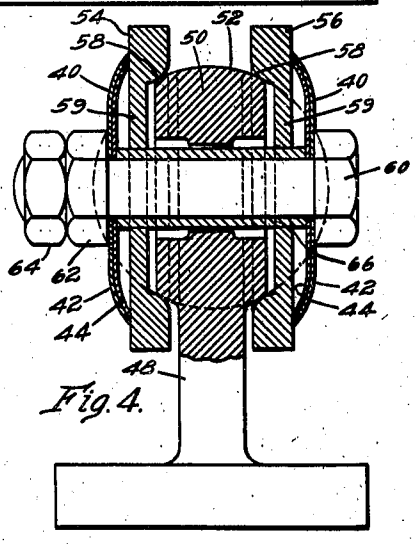


Fig. 4.

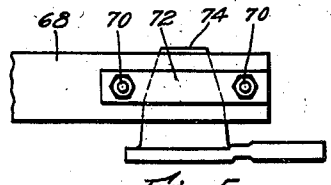


Fig. 5.

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CIRCUIT INTERRUPTER

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8 Claims. (Cl. 200—162)

My invention relates, generally, to circuit interrupters, and is particularly embodied in disconnecting switches.

My invention is especially adapted for split blade disconnecting switches, and it is a primary object of my invention to provide new and improved means in conjunction with such switches, for insuring at all times adequate contact pressure on the separable contacting portions of these switches, while providing for proper alignment of the blade and its break tongue.

It is a well known fact that practically all known conductors and contact mediums will corrode under adverse atmospheric conditions. One metal will build up a thicker layer of corrosion under a given influence than another, although the thicker layer may produce the lower contact drop, depending on the conducting qualities of the corrosion layer. All corrosions to some degree tend to increase contact drop and, therefore, increase heating of the contact which, in turn, accelerates corrosion.

High contact pressure over a reduced area tends to maintain a metal-to-metal contact and reduce corrosion at the contact surface. Lower contact pressures reduce wear on the contact surfaces caused by opening and closing of switches and tends to avoid galling of metals, which sometimes results when too high wiping pressures are used.

It, therefore, would appear that the ideal wiping contact would be one on which a moderately heavy contact pressure is normal, which pressure would, under average atmospheric conditions, result in a contact drop that would not cause abnormal heating of the switch contacts; but which under abnormal atmospheric conditions and resultant heating would automatically increase the pressure between contacts, resulting in high pressure metal areas tending to pierce the corrosion and again lower the contact drop and temperature, and retard the acceleration of corrosion.

It is therefore, an object of my invention to provide contact pressure means which is automatically responsive to the contact temperature to increase the pressure with a rise in contact-temperature.

It is a further object of my invention to provide bimetallic pressure means for the contacting portions of a switch, to very the pressure on such portions in accordance with their temperature.

It is well known that in the assembly of disconnecting switches, especially where the hinge and break tongues of a switch are independently mounted on a support, that it is often impossible to easily obtain perfect alignment of the break tongue with the plane of closing movement of the blade.

Another object of my invention, therefore, is to provide a novel form of disconnecting switch, parts of which are relatively movably mounted to properly align the blade and break tongue parts.

A further object of my invention is to provide a switch blade having a universal mounting to insure proper alignment of the blade and its associated break tongue.

These and other objects of my invention will become more apparent when considered in connection with the following detailed description and the attached drawing, which discloses preferred embodiments of my invention:

In the drawing:

Figure 1 is a plan view of a disconnecting switch showing one form of switch in which my invention may be embodied;

Fig. 2 is a side view of the switch shown in Fig. 1;

Fig. 3 is an enlarged cross-sectional view through the hinge tongue of the switch shown in Figs. 1 and 2;

Fig. 4 is a cross-sectional view similar to Fig. 3, but showing a modified hinge construction; and

Fig. 5 is a partial side view of a modified break end construction for a disconnecting switch.

Referring to Figs. 1 and 2, I have shown a pair of insulating support members **2** and **4**, having flanged apertured bases secured to the supporting base **6**, as by the machine screws **8**. The insulators **2** and **4** may be of any desired insulating material, such for example, as porcelain or the like. The insulator **2** supports a hinge tongue **10** having a laterally extending terminal portion **12**, and the insulator **4** supports a break tongue **14** having a laterally extending terminal portion **16**. A split switch blade structure **18**, which includes the spaced side portions **20** and **22**, is pivotally secured to the hinge tongue **10**, as by means of the bolt **24** passing through the sides **20** and **22** of the blade **18** and through an aperture in the hinge tongue **10**. The bolt is secured in this position by a nut **26** and a locking nut **28**. The opposite ends of the sides of the split blade **18** are also secured together by a bolt **24** in the same manner as the hinge end of the blade **18**. The bolt **24** at the break end, however, is received in a slot **34** in

the break tongue 14 to provide for movement of the blade 18 into and out of engagement with the break tongue 14, pivoting about the bolt 24 as an axis.

The hinge tongue 10 is provided with annular flat inserts 30 which are adapted to be contacted by annular inserts 32 secured in the inner sides of the sides 20 and 22 of the split blade 18. The inserts 32 have their outer faces convex in form to provide substantially a line contact between the blade 18 and the hinge tongue 10. The inserts 30 and 32 preferably have at least the surface thereof of some noble metal, such as silver. The inserts may be of solid silver or may be of bimetallic construction, such as a base of copper or the like, having a silver coating. Obviously, similar inserts or straight strip inserts may be provided at the break end of the switch. Secured between the sides of the split blade 18 at a point adjacent to but spaced from the hinge end of the blade is an operating lever 36 which is rigidly secured to the blade in any suitable manner, such for example, as by riveting or the like. The operating lever 36 is provided with an aperture 38 in its outer end for connection to switch operating mechanism, or for the reception of a hook stick operating member.

At each end of the blade between the outer sides of the blade and the head of bolts 24 and nuts 26, respectively, I have provided generally cup-shaped resilient washer elements 40. These washer elements 40 are of laminated or a bimetallic construction comprising the outer metallic washer element 42 of any desired material having a relatively high coefficient of expansion, such for examples, as brass, and an inner layer 44 of any suitable material having a relatively lower coefficient of expansion, such for example, as steel. The laminations 42 and 44 are secured together in any desired manner, such for example as by welding. Between the bolt 24 and the hinge tongue and blade, I have provided a bearing sleeve 46 over the bolt.

In the operation of this form of my invention, the bimetallic washers 40, upon assembly of the device, are given an initial tension or deflection by drawing up the nut 26 to give the desired pressure. Upon the occurrence of abnormal atmospheric conditions, or upon the building up of corrosion on the contacts due to any cause whatever, an amount sufficient to produce a voltage drop across the contacts sufficient to cause heating of the blade 18, the bimetallic washers will act to increase their convexities, thereby pressing the sides 20 and 22 of the blade 18 together with a greater force. This action will tend to break through the corrosion and provide a better contact between the blade and hinge tongue, and thus reduce the voltage drop across these parts, this resulting in decrease of the heating effect.

In Fig. 4, I have shown a slightly modified construction of the hinged end of a disconnecting switch. The hinge tongue 48 in this form of my invention includes an outer enlarged head portion 50 having its peripheral edge surface 52 in the form of a segment of a sphere. The sides 54 and 56 of the blade of this construction embody annular convex contacting portions 58, extending inwardly from the central blade portion 59. The portions 58 engage the spherical surface 52 of the hinge tongue, thus providing a universal connection for the hinge end of the blade. The blade contact portions 58, and the tongue contact surface 52, may be provided with contact inserts like the inserts 30 and 32 shown in Fig. 3, if desired. As in the previous embodiment, the blades are maintained in engagement with the hinge tongue by a bolt 60 which passes through apertures in the sides 54 and 56 of the blade, and through an aperture in the hinge tongue 50, and is secured in position by the nut 62 and a lock nut 64. Between the head of the bolt 60 and the nut 62 and their adjacent sides of the blade, there is also provided here the bimetallic washers 40 which function to maintain the convex contacting portions 58 on the blade sides in engagement with the spherical portion 52 of the hinge tongue. The bimetallic washers 40 are identical with those described in connection with the embodiment shown in Figs. 1 to 3, and function in the same manner in response to heating of the blade as was described in connection with the previous embodiment.

A bearing sleeve 66 is interposed between the bolt 60 and the sides of the switch blade and the head portion 50 of the hinge tongue. This bearing sleeve 66 snugly fits the bolt 60 and the apertures in blade sides 54 and 56, and is loosely mounted in the head portion 50 to allow for limited movement of the switch blade relative to the hinge tongue in all directions, except the direction of movement toward and away from the break tongue, in which direction of movement the blade is free to move a relatively great amount, up to 180° if desired. The relative movement of the blade and hinge tongue in all other directions may be limited, either by the clearance between the hinge tongue and the bearing sleeve 66, or by the clearance between the blade sides and the enlarged portion 50 of the hinge tongue, or by the clearance between the lower edges of the blade sides and the lower portion 48 of the hinge tongue. These clearances can be regulated so as to keep the blade sides in reasonable longitudinal alignment with respect to each other and their associated break tongue.

In the operation of this embodiment of my invention, it is well known that it is often impossible to easily align a switch blade and its associated break tongue, especially where the two are mounted independently on a support. However, with the hinge construction shown in Fig. 4, it is obvious that any slight disalignment of the switch blade and its break tongue is easily compensated for by a slight lateral movement of the blade relative to the hinge tongue in any desired direction, inasmuch as this hinge construction is, in effect, a universal mounting, to give perfect alignment of the switch blade and break tongue. This is a very desirable feature because it promotes more even wear on the contacting portions of the blade, and hinge and break tongues, and also relieves the switch blade and tongues from any torsional or lateral stresses, thus insuring a more efficient switch operation and a longer switching life.

In Fig. 5, I have shown a modification of the break end of a disconnecting switch, which switch is generally of the same type as that shown in Figs. 1 and 2. The modified structure in this embodiment of my invention relates to the bimetallic construction. Instead of using bimetallic washers for pressing the blade sides into engagement with the break tongue, bimetallic strips 72 have their ends bolted to the outer sides of a split switch blade 68 by the bolts 70 which also act to maintain the blades against separation. The bimetallic strips 72 in this instance, however, have the inner laminations thereof of a material having a relatively high coefficient of expansion

and the outer lamination thereof consists of a material having a relatively lower coefficient of expansion, so that upon increased heating of the blade, the outer ends of the bimetallic strips **72** tend to move away from the blade **68** and the reaction force will be exerted at the midpoint of the bimetallic strips **72**, which as shown in Fig. 5, is located substantially at the center of the break tongue **74**. In other words, with an increase in temperature, the bimetallic strips **72** will tend to assume an outwardly concave form. This construction also enables the use of a solid break-tongue **74**, inasmuch as the blade bolts **70** are placed at opposite sides of the break tongue and do not need to pass through the tongue.

It is obvious that I have provided a disconnecting switch blade with a pressure means for both the break and hinge ends of the blade, which pressure means is responsive to rises in temperature to exert a greater pressure on the contacting portions of the blade and tongue, to tend to break down any corrosion on such contacting portions to provide a better contact, and reduce the voltage drop caused by the corrosion, and hence bring down the temperature of the parts. This heat responsive pressure means is obviously adapted for use with any desired type of disconnecting switch. I have shown it applied to two types of hinge constructions in Figs. 3 and 4, and to two different types of break constructions shown in Figs. 1, 2 and 5.

It is also obvious that, in conjunction with the above structure, I have provided a novel hinge construction for a disconnecting switch blade which is, in effect, a ball and socket joint, or a universal joint, permitting movement of the blade in the usual manner into and out of engagement with its associated break tongue, and also permitting a limited movement of the blade in all other directions to provide substantially perfect alignment of the blade with its break tongue, thus relieving the parts of any undue strain caused by disalignment and insuring even contact pressure of the blade on the tongues.

Having described preferred embodiments of my invention in accordance with the patent statutes, I wish it to be understood that my invention shall be interpreted as broadly as possible and not limited to the specific embodiments herein disclosed, inasmuch as it will be obvious, particularly to persons skilled in the art, that many changes and modifications could be made in the structures disclosed without departing from the broad spirit and scope of my invention.

For example, it is obvious that the universal mounting construction shown in Fig. 4 could be used with the ordinary type of resilient cup-shaped washer instead of my bimetallic washers, as shown. Likewise, my invention is equally applicable to a switch construction employing split tongues and a single blade construction receivable between the tongues. This would constitute a mere reversal of parts, and the washer elements in such a case would be applied to the sides of the split tongue construction, rather than to the sides of the split blade, as shown on the attached drawing.

Therefore, I desire that my invention be given as broad an interpretation as possible, and that it be limited only by what is expressly set forth in the following claims.

I claim as my invention:

1. In a switch, a pair of contact members, one of said members embodying spaced sides between which are received a portion of the other member, a pivot pin loosely pivotally connecting said members about a transverse axis, and cooperating means on said members adapted to be maintained in electrical contact irrespective of the relative movements of said members in any direction.

2. In a switch, a pair of contact members loosely pivotally connected about a transverse axis by a pivot pin, and cooperating means on said members adapted to be maintained in contact irrespective of the relative movements of said members in any direction.

3. A pair of switch members movably connected by a universal joint, and means extending through said members for limiting said movement in a lateral direction.

4. In a switch, a contact member having a projection with a spherical periphery, a second contact member having a part engaging said periphery, and means extending loosely through said members for holding said contact members together for relative limited universal movement, including heat responsive pressure means for maintaining said part in good electrical contact with said periphery.

5. In a switch, a switch member having an end in substantially the form of a segment of a sphere, a second switch member having a substantially circular contacting portion of less diameter than said spherical portion engaging the surface of said segment, and means maintaining said parts in engagement.

6. In a switch, a switch member having an end in substantially the form of a segment of a sphere, a second switch member having spaced opposed substantially circular contacting portions of less diameter than said spherical portion engaging the surface of said segment, and means maintaining said parts in engagement.

7. In a switch, a pair of contacts, one of which is movable into and out of engagement with the other, thermally responsive means for urging the contacting portions of said contacts in engagement, said means mounted on one of said contacts and secured thereto at points on opposite sides of the center of the engaging area of said contacts, and said means comprising a laminated bimetallic member with the lamination thereof having the greater coefficient of expansion located adjacent said one contact.

8. A pair of switch members movably connected by a universal joint, one of the parts of said joint including a curved engaging surface fixed with respect to one of said members, the other part of said joint being fixed with respect to the other of said members and configurated so as to make substantially line contact with said first-mentioned part, and means holding said contact members together for relative limited universal movement.

HERBERT J. CRABBS.