Aug. 7, 1962 G. POLINKO, JR 3,048,681

SHIELD MOUNTING ARANGEMENT FOR A VACUUM CIRCUIT INTERRUPTER

Filed Aug. 11, 1960

Fig. 1.

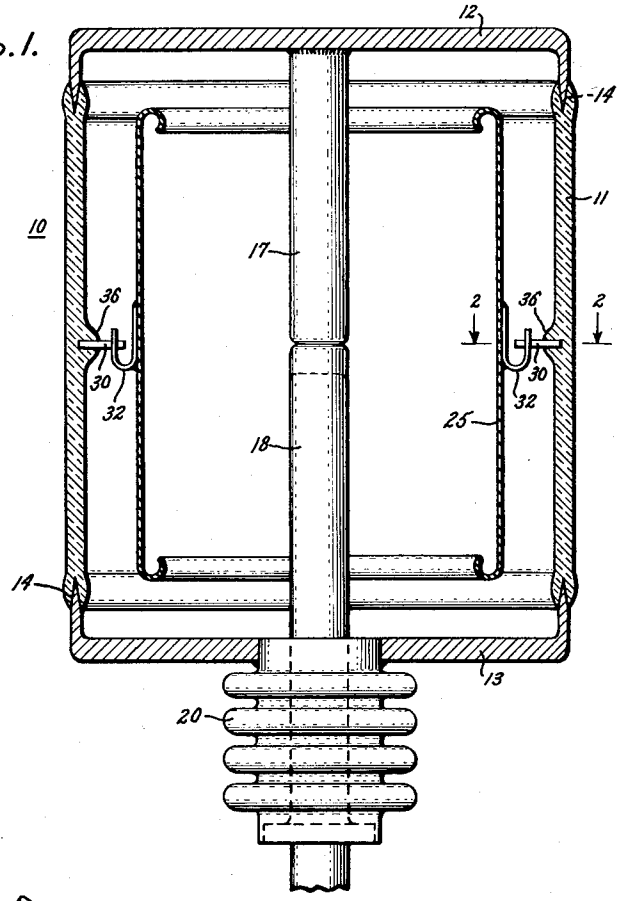


Fig. 2.

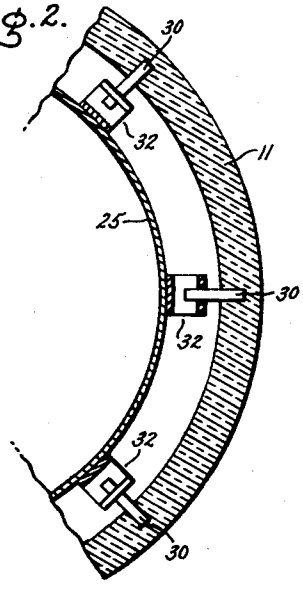
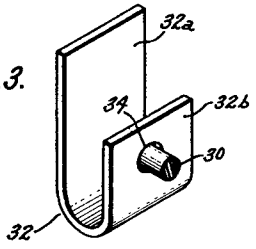


Fig. 3.



Inventor:
George Polinko, Jr.,
by William Freedman
Attorney.

United States Patent Office 3,048,681 Patented Aug. 7, 1962

3,048,681

SHIELD MOUNTING ARRANGEMENT FOR A VACUUM CIRCUIT INTERRUPTER

George Polinko, Jr., Levittown, Pa., assignor to General Electric Company, a corporation of New York

Filed Aug. 11, 1960, Ser. No. 48,907
1 Claim. (Cl. 200—144)

This invention relates to a vacuum-type circuit interrupter and, more particularly, to an improved shielding arrangement for protecting the insulation of the interrupter against the build-up of metallic coatings thereon.

In a vacuum circuit interrupter, the metallic vapors that are produced by arcing tend to condense on the insulating surfaces of the interrupter and, hence, to form metallic coatings which impair the insulating properties of such surfaces. For protecting these surfaces against such metal deposition, a shielding arrangement of the general type disclosed and claimed in U.S. Patent No. 2,892,-911—Crouch, assigned to the assignee of the present invention, has been found effective. Such shielding arrangement comprises a generally tubular metallic shield surrounding the arcing gap between the usual electrodes of the interrupter and electrically isolated from both electrodes and from ground. This electrically isolated shield is physically located between the arcing gap and the internal surface of the usual insulating casing for the interrupter and acts to intercept and condense those metallic vapors traveling toward the insulating surface from the arcing gap.

The supporting arrangements that have been proposed for such shields have either been unduly expensive and complicated or have been difficult to assemble. One such arrangement, for example, has required a supporting plate extending radially outward from the shield through the surrounding insulating casing. This has necessitated making the insulating casing in two parts and has involved two relatively expensive glass-to-metal seals on opposite sides of the supporting plate. Another supporting arrangement that has been proposed includes a groove formed in the insulating casing for receiving radially-outwardly projecting tabs carried by the shield. This arrangement is subject to the disadvantage that it is difficult to assemble since the tabs cannot easily be positioned adjacent the groove and then bent into position without scratching or otherwise impairing the internal surface of the insulating housing and is subject to the additional disadvantage that the groove in the usual casing tends to unduly weaken the casing from a mechanical strength standpoint.

Accordingly, an object of my invention is to provide a vacuum circuit interrupter with an improved shield-supporting arrangement that is simple and inexpensive, is easily assembled with little risk of impairing the internal surface of the insulating housing, and does not unduly detract from the mechanical strength of the insulating casing.

Another object is to construct this shield-supporting arrangement in such a manner that it requires no glass-to-metal seals to prevent leakage into the vacuum envelope.

Another object is to construct the shield supporting arrangement in such a manner that the metallic shield can expand and contract in response to temperature changes without unduly stressing the surrounding insulating housing.

In carrying out my invention in one form, I provide a vacuum-type circuit interrupter comprising a tubular casing of insulating material and a generally tubular metallic shield surrounding the usual arcing gap of the interrupter and disposed between the arcing gap and the insulating casing. A plurality of metallic pins are embedded

in the casing in circumferentially spaced-apart relationship and are bonded thereto. The pins extend in a generally radial direction relative to the casing and extend only partially through the casing. A plurality of tabs are secured to the outer periphery of the tubular shield in circumferential alignment with certain of the radially-extending pins. These tabs are provided with apertures that receive the pins and thus support the shield on the pins. In a preferred form of the invention the apertures are made appreciably larger than the pins to permit free movement of the tabs relative to the pins in response to thermally induced expansion and contraction of the metallic shield.

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

FIG. 1 is a cross-sectional view of a vacuum-type circuit interrupter embodying my invention in one form.

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

FIG. 3 is a perspective view of a portion of the interrupter of FIGS. 1 and 2.

Referring now to the interrupter of FIG. 1, there is shown a highly-evacuated envelope **10** comprising a tubular casing **11** of insulating material, such as a suitable glass, and a pair of metallic end caps **12** and **13** closing off the ends of the casing. Suitable seals **14** are provided between the end caps and the casing to render the envelope **10** vacuum-tight.

Located within the envelope is a pair of separable electrodes, or rod contacts, **17** and **18** shown by solid lines in the closed-circuit position. The electrode **17** is a stationary electrode suitably united to the upper end cap **12**, whereas the electrode **18** is a movable electrode suitably mounted for vertical movement and projecting through an opening in the lower end cap **13**. A flexible metallic bellows **20** interposed between the end cap **13** and the movable electrode **18** provides a seal about the movable electrode and allows for vertical movement thereof without imparing the vacuum inside the interrupter. As shown on the drawing, the bellows **20** is sealingly secured at its respective opposite ends to the electrode **18** and the end cap **13**.

Coupled to the lower end of the movable electrode **18**, I provide suitable actuating means (not shown) which is capable of driving the electrode rapidly downwardly from its solid-line position of FIG. 1 to its dotted-line position to open the interrupter and which is also capable of returning the electrode to the solid-line position to close the interrupter.

When the electrode is driven downwardly to open the interrupter, a circuit- interrupting, or arcing, gap is established between the adjacent ends of the electrodes, and the resulting arc, though quickly extinguished, vaporizes some of the metal of the electrodes.

In order to prevent this metallic vapor from condensing on the internal insulating surfaces of the casing **11**, there is provided a metallic shield **25** which corresponds in certain respects to a similarly designated shield in the aforesaid Crouch application. This metallic shield **25** is of a generally tubular configuration and extends along the length of the casing **11** for substantial distances on opposite sides of the gap between the electrodes. The shield **25** is electrically isolated from both of the electrodes **17** and **18** and, preferably, is also isolated from ground, or in other words, is at a floating potential relative to the two electrodes.

This electrical isolation between the shield **25** and the electrodes **17** and **18** is achieved by mounting the shield **25** on the insulating casing adjacent the central region of the shield and by spacing the shield radially inward from

the tubular insulating casing **11** at all points on opposite sides of the centrally disposed mounting region.

Essentially all straight line paths extending from the general region of the arcing gap to the insulating casing **11** are intercepted by the floating central shield **25**. As a result of this relationship, substantially all metallic particles that are liberated from the electrodes by arcing are intercepted and captured either by the shield **25** or the end caps **12** and **13** before they can reach the internal surfaces of the casing **11**.

The shield-supporting arrangement comprises a plurality of metallic pins **30** circumferentially spaced about the casing **11** and extending radially inward from the casing **11**. These pins **30** are embedded in the casing **11** and are bonded to the glass of the casing. The pins **30** are incorporated into the casing **11** during the manufacturing process by any suitable procedure, such as first heating the casing to a plastic condition in its central region and then forcing the pins into the plastic glass. The pins **30** are constructed of a suitable metal that has substantially the same coefficient of thermal expansion as the glass so as to prevent the glass from being unduly stressed or the pins loosened by expansion and contraction of the parts in response to temperature changes.

The shield-supporting arrangement further comprises a plurality of U-shaped tabs **32**, each having an inner leg **32***a* and an outer leg **32***b*. The inner leg **32***a* of each tab is welded to the outer periphery of the shield **25** in a position wherein the tabs are disposed in circumferential alignment with the pins **30**. The outer leg of each tab **32** has an aperture **34** therein for receiving one of the pins **30**. Prior to assembly of the shields **25** inside the casing **11**, at least some of the tabs are slightly flattened, as by bending the outer leg **32***b* of a tab toward the shield **25**. The shield is then positioned inside the casing **11** with the apertures **34** of the tabs in alignment with the pins **30**, after which the flattened tabs are expanded into their position of FIG. 1 so that the aperture of each tab receives its corresponding pin **30**. The shield is then supported on the pins **30** in the manner shown in FIG. 1. In a preferred form of my invention, I use six tabs equally-spaced about the periphery of the shield **25**, though a greater or lesser number may be used if desired.

Preferably, the apertures **34** that receive the pins **30** are appreciably larger than the pins **30**. The resulting clearance between the pins **30** and the apertures **34** allows the shield, in response to temperature changes, to contract and expand independently of the casing **11** without stressing the casing **11** inasmuch as the tabs **32** are free to move relative to the pins **30** during such expansion and contraction. Thus, the casing is protected from mechanical stresses that might otherwise result from unequal expansion and contraction of the shield **25** and the casing **11**.

As an added measure of protection against the transmission of objectionably high forces to the casing **11**, the yieldability of the tabs can be relied upon to lessen the magnitude of the forces transmitted to the casing **11**. If the yieldability of the tabs is to be relied upon for this protection, the apertures **34** can be made smaller than where clearance between the pins **30** and the apertures **34** is alone relied upon.

It is to be noted that the pins **30** extend only partially through the casing **11**, the outer peripheral portion of the casing remaining imperforate. Thus, there is no significant possibility that an imperfect bond between the pins **30** and the glass of the casing will result in a leak from the surrounding atmosphere along the junction between the pin and the casing. It is to be further noted that the disclosed shield supporting arrangement permits

the casing **11** to be made of a single integral part, rather than in two parts joined together with glass-to-metal seals, as has been the case with some prior arrangements. Also, the imperforate nature of the outer peripheral portion of the insulating casing **11** contributes to increased creepage paths along this outer surface in comparison to those available with equal length casings that include metallic parts extending therethrough.

The fact that the pins **30** are bonded to the surrounding glass results in a mechanically stronger construction than one in which an open groove or hole is present in the casing since both tensile and compressive forces in the disclosed casing can be transmitted to the pin through the bond, thus reducing mechanical stress concentrations in the material of the casing. Preferably, the area of the bond is increased by providing the internal surface of the casing **11** with an annular embossment **36** for receiving the pins **30**. The increased bonding area made available by this embossment contributes to a stronger bond and a stronger casing (**11**).

Where the advantages gained from having a casing with an imperforate outer periphery are not of controlling importance, I can utilize for practicing my invention in its broader aspects a construction identical to that disclosed but with the pins **30** extending entirely through the casing **11**.

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 claim 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:

A vacuum-type circuit interrupter comprising an evacuated tubular casing of insulating material, a pair of electrodes disposed within said casing and having a spaced-apart position defining an arcing gap therebetween, a generally tubular metallic shield surrounding said arcing gap and extending along the length of said casing for substantial distances on opposite sides of said arcing gap, said metallic shield being electrically isolated from said electrodes and having its end portions radially-spaced from said casing, a plurality of metallic pins embedded in said casing in circumferentially spaced-apart relationship and bonded thereto, said pins extending in a generally radial direction relative to said casing and extending only partially through said casing, a plurality of circumferentially spaced generally U-shaped tabs each having spaced-apart inner and outer legs, the inner of said legs being attached to the outer periphery of said shield and the outer of said legs being located radially outward from said other leg, said tabs being secured to the outer periphery of said shield in circumferential alignment with certain of said radially extending pins, and means for supporting said tabs on said pins comprising apertures in said outer legs receiving said pins, said apertures being appreciably larger than said pins to permit free movement of said tabs relative to said pins in response to thermally induced expansion and contraction of said metallic shield.

References Cited in the file of this patent

UNITED STATES PATENTS

1,696,103	Seibt	Dec. 18, 1928
1,875,765	Scherbius	Sept. 6, 1932
2,228,157	Steenbeck	Jan. 7, 1941
2,745,981	Sanabria	May 15, 1956
2,892,911	Crouch	June 30, 1959