

Description

This invention pertains to a method of manufacturing fused capacitors, especially solid electrolyte capacitors, and lead frames which facilitate assembling these capacitors.

Background of the Invention

Solid dielectric capacitors are well-known and commonly used in electrical circuits. In many instances, fused capacitors are desired such that excessive current will be interrupted by the fuse in the capacitor and prevent damage to other components in the circuit. With respect to solid electrolyte capacitors such as tantalum capacitors, the capacitors have a defined polarity, i.e., defined anodes and cathodes. If these solid electrolyte capacitors are installed in a circuit backwards, the capacitor will not function properly. Consequently, fusing can prevent damage to the electrical circuit caused by the incorrect installation of the capacitor. Moreover, with tantalum capacitors, fusing is desired in applications where high power levels are present, since a short circuit can possibly result in enough heat being generated to ignite the tantalum metal which burns exothermically.

Fused capacitor assemblies are disclosed for instance, in U.S. Patent Nos. 4,106,184; 4,107,762; 4,224,656; and 4,763,228, and in Japanese laid-open patent applications (Kokai) 62-272156 and 63-128707. In one type of capacitor, the fuse extends between terminals inside the encapsulating insulator of the capacitor such that all electrical current passing between the terminals passes through the fuse.

Numerous advances in fuse materials have occurred. Exothermic fuses are generally preferred and widely used. Unlike conventional fuses that are adapted to melt at a predetermined current level, exothermic fuses contain metals which alloy exothermically when brought to a threshold temperature. The exothermic alloying breaks electrical continuity. Typical exothermic fuses comprise a bi-metallic composite of aluminum and a precious metal such as palladium. Su, in U.S. Patent No. 4,763,228, discloses a further improvement in exothermic fuse assemblies in which the fuse material is surrounded by silicone such that when the fuse ignites, an electrically-conductive carbon residue does not result which could otherwise serve to conduct electricity between the terminals.

Particular attention has been directed by workers in the field to the manufacture of capacitors (particularly electrolytic capacitors) containing fuses, especially exothermic fuses, and the design of the capacitors to assure reliable performance of the fuses. Capacitor assembly, in order to be com-

petitive, must be capable of being automated. To facilitate automation, lead frames containing the electrode leads for a plurality of capacitors are used and the capacitor is built on these frames. The frames can be easily transported from station to station. The use of these frames is virtually mandated by the miniaturization of capacitors which can be too small to easily handle on a capacitor-by-capacitor basis.

The lead frames should therefore be designed to enable all assembly operations to be automated. Automating the installation of the fuse wire is particularly difficult in that the fuse wire is delicate, e.g., may only be 0.05 mm (0.002 inch) in diameter, and, if an exothermic fuse is used, risks of igniting the fuse during installation exist. The ease of fabrication, however, cannot be at the expense of performance. For example, when assembling circuit boards, the components such as capacitors are typically inserted in the boards and then the boards are bathed in solder. Any solder bridging that may occur between the terminals bridging the fuse would defeat the purpose of the fuse.

Japanese Kokai 62-272516, November 26, 1987, discloses a fused, electrolytic capacitor in which a lead frame has a cathode lead (negative lead) and either a "U"-shaped or "L"-shaped lead positioned between the anode lead (positive lead) and the electrolytic capacitor body (i.e., the component of the capacitor performing the electronic function). A wire extends from the electrolytic capacitor body to the either "U"-shaped or "L"-shaped lead and a fuse extends between that lead and the anode lead. This type of capacitor design can provide several problems. First, both the "U"-shaped (or "L"-shaped) lead and the anode lead extend from the insulating casing in close proximity. This increases the risk of solder bridging. Second, especially with the "L"-shaped lead, it is relatively easy for this lead and the anode lead to move with respect to each other making automated assembly more difficult. Further, severing the "U"-shaped or "L"-shaped lead from the lead frames poses difficulties especially in view of its proximity to the anode lead.

Japanese Kokai 63-128707, June 1, 1988, discloses another electrolytic capacitor design. In making this capacitor, a lead frame is used which has a plurality of anode leads and a plate, or ribbon, perpendicular to the anode leads which join each of the anode leads at the ends intended to be encapsulated in insulator material. The ribbon has elongated slots such that the sides of the ribbon are joined only between the capacitors when assembled. The anode lead wire from the electrolytic capacitor body is attached to one side of the ribbon. A fuse is installed to provide electrical communication between the sides of the ribbons. After

assembly of the fuse, the capacitor is severed. A cutting block is used in severing the ribbon or more exotic means such as laser cutting is used, either of which increase the complexity of automated assembly. When using a cutting block, the capacitor is placed on the block and a blade is used to sever the ribbon on each side of the encapsulated capacitor. While this design provides greater stability than that described above and severing the ribbon is facilitated, there remain drawbacks. For instance, the close proximity of each side of the ribbon as it protrudes from the encapsulating insulator provides significant risk of solder bridging.

Summary of the Invention

By this invention a lead frame has been provided which facilitates the assembly of fused, solid dielectric capacitors by automated means and provides capacitors having desirable performances. In accordance with this invention, the lead frames have cross ties that extend between the first electrode side and the other electrode side of the lead frame between every space intended to be occupied by a capacitor and a fuse tie which extends between the cross ties. The fuse tie is intended to be in electrical contact with an electrode of the solid dielectric capacitor body and to receive a fuse conductor which is also connected to the first electrode lead from the lead frame.

The fuse tie, by being secured to the cross ties, has desirable positional stability such that automated assembly is facilitated. Furthermore, the first electrode lead and the fuse tie are positioned relatively far apart as they extend from an encapsulating insulator surrounding the dielectric capacitor body such that little, if any, risk of solder bridging exists. The increased strength to the lead frame provided by the cross ties and the fuse tie has also proven to enable breaking the fuse ties at each side of the capacitor after encapsulation without the need for special cutting blocks or laser cutting systems.

In preferred aspects of the invention, the fuse tie can be relatively large, e.g., thicknesses of at least 0.05 mm (50 microns), say, about 0.1 to 0.4 mm (0.004 to 0.015 inches), and widths of at least about 0.25, say, about 0.5 to 2 millimeters. This large size enables not only increased strength, but also minimizes the likelihood of the fuse tie warping when, for instance, in an electrolytic capacitor the axial anode lead from the electrolytic capacitor body is welded to the fuse tie. Additionally, the surface area of the fuse tie facilitates exothermic alloying fuses to be ultrasonically bonded to the fuse tie since the energy from the ultrasonic bonding can more readily be accommodated. As a

further benefit, the end fuse tie which is exposed at the exterior of the encapsulating insulator can be sufficiently large to enable the integrity of the fuse to be checked.

In another aspect of the invention, the fuse tie and the first electrode lead from the lead frame can be in the same plane which facilitates automated assembly operations.

Description of the Drawings

FIG. 1 is a schematic representation of a portion of a lead frame assembly in accordance with this invention.

FIG. 2 is a breakaway cross-section depiction of a lead frame assembly in accordance with this invention on which a solid electrolytic capacitor body, fuse conductor and encapsulating insulator have been installed.

FIG. 3 is a schematic representation of a portion of a lead frame assembly on which a solid electrolytic capacitor body and fuse conductor have been installed.

FIG. 4 is a schematic depiction of the juncture between the axial anode lead from a solid electrolytic capacitor body and the fuse tie.

FIG. 5 is a perspective view of a capacitor in accordance with the method of the invention.

Detailed Discussion

The following discussion will be made with reference to solid electrolyte capacitors which are polar and have an anode (positive electrode) and a cathode (negative electrode). It will be readily apparent that the principles described herein are applicable to non-polar dielectric capacitors.

With reference to FIG. 1, a lead frame assembly 100 is provided with a plurality of regions adapted to receive the components for manufacturing a capacitor. In this manner, the manufacture of capacitors can be performed efficiently and through automated manufacturing techniques. The lead frame assembly is conveniently of unitary construction of electrically conductive material which is capable of being soldered and welded.

The lead frame assembly comprises a rigid anode tie frame 102 having a plurality of spaced-apart, rigid anode leads 104 extending therefrom. While the material of the lead frame assembly may be capable of bending, sufficient rigidity exists such that the lead frame members retain the desired spacial relationships during handling and processing. Often, the material of the lead frame assembly exhibits a modulus of elasticity of at least about 1×10^5 MPa (15 x 10 pounds per square inch) (psi). Metals useful for the lead frame assembly include nickel, copper-nickel-zinc alloys, etc.

Parallel to the anode tie frame 102 is rigid cathode tie frame 106 having a plurality of spaced cathode leads 108 extending therefrom. For the sake of convenience, the cathode tie frame and the anode tie frame fall within the same plane. As depicted, the cathode leads 108 bend such that the end portions 110 of each cathode lead fall below the plane defined by the anode lead frame 102 and cathode lead frame 106. With this relationship, the axial anode lead from the solid electrolytic capacitor body is substantially in the plane defined by the anode lead frame 102 and cathode lead frame 106 when the solid electrolytic capacitor body contacts the end portion 110 of the cathode lead. In solid electrolytic capacitor bodies, the exterior surface of the body is generally the cathode surface and cathode lead 108 is therefore adapted to contact the cathode surface of the electrolytic capacitor body.

Extending between the anode tie frame 102 and cathode tie frame 106 are cross ties 112. A cross tie 112 is positioned between each cathode lead 108 and anode lead 104 pair intended to be assembled into a capacitor. The cross tie can be in substantially the same plane as the anode tie frame 102 and cathode tie frame 106 for ease of handling. A fuse tie 114 extends substantially perpendicular between each cross tie 112 in substantially the same plane as the cross ties. The fuse tie 114 is intermediate the anode lead 104 and the cathode lead 108 which are paired by adjacent cross ties. A zone for receiving a solid electrolytic capacitor body (having an axial anode lead extending therefrom) is defined by the fuse tie, the adjacent cross ties and the anode tie frame. The zone is such that the electrolytic capacitor body can be in electrical contact with the cathode lead and the axial lead from the electrolyte body can be in contact with the fuse tie 114. The fuse tie 114 is spaced away from anode lead 104 and both the fuse tie 114 and anode lead 104 are adapted to receive opposite ends of a fuse conductor.

This spacial relationship can be readily appreciated from FIG. 2 and FIG. 3. (In all of the figures, like reference numerals refer to like parts.) Both figures depict a solid electrolytic capacitor body 116 and a fuse conductor 118 in position. The solid electrolytic capacitor body base comprises an anodized valve metal as dielectric material in a form suitable for providing capacitance. Dielectric materials that have been proposed include the oxides of tantalum, aluminum and niobium. In typical tantalum capacitors a tantalum axial lead is welded to or otherwise contacted with a tantalum body which is treated at its exterior surface to form a dielectric layer. The electrolytic capacitor body will have other coatings on the dielectric layer such as manganese dioxide or other electrolyte material and

carbon and/or silver to provide or enhance capacitor performance and/or facilitate electrical contact with cathode lead 108.

While the foregoing discussion has been with respect to electrolytic capacitors, the dielectric material is not critical to the inventions and may be any solid material capable of providing the desired capacitance. Hence, the invention can find utility in non-polarized, dielectric capacitors in which the dielectric capacitor body comprises ceramics, barium titanate, lead perovskites, etc.

As can be seen from FIG. 2, the solid electrolytic capacitor body has an exterior surface in contact with end portion 110 of cathode lead 108. This contact is electrically conductive and can be effected by any suitable means including, but not limited to, solder and electrically conductive adhesives. The solid electrolytic capacitor body 116 has extending therefrom axial lead 120. The axial lead 120 is an anode lead and, for example, for tantalum capacitors is a tantalum lead. The axial lead 120 is attached in an electrically conductive manner to the fuse tie 114. The attaching can be by any suitable means including, but not limited to, solder, welding, electrically conductive adhesives and the like. Axial lead 120 should not contact anode lead 104.

FIG. 2 and FIG. 3 also depict a fuse conductor 118 extending between the fuse tie 114 and the anode lead 104. While any type of fuse conductor can be used, the preferred fuse conductors are exothermic fuses comprising a reactive bimetal, e.g., aluminum and palladium, that exothermically alloy upon reaching a threshold temperature. Bimetal fuses can also be fabricated from low melting metals such as magnesium and magnesium-aluminum alloys with palladium, copper, silver and other base metals. Palladium is often a preferred metal in exothermic fuses. The exothermic fuses may be constructed with one component of the bimetal sheathed by the other. Typically, palladium has surrounded aluminum or aluminum alloy, and in some instances, a hardening component such as ruthenium has been added to the palladium. Especially when ultrasonically bonding the fuse conductor, it is desirable to make the exterior sheath of a malleable metal or alloy such as aluminum or aluminum alloy.

Each end of the fuse conductor 118 is attached in an electrically conductive manner. Especially if exothermic fuses are employed, the means by which the fuses are attached can be important since high temperatures approaching the kindling point of the bimetal of an exothermic fuse or the melting point of the metal of a conventional fuse must be avoided. Moreover, the means for attaching the fuse conductor should be reliable such that failures do not occur. One particularly attractive means for attaching the fuse conductor to each of

the fuse tie and anode lead is by ultrasonic bonding. There are two aspects of the lead frame assemblies of this invention that facilitate using ultrasonic bonding of fuse conductors. First, the fuse tie 114 is spatially stable since it extends perpendicularly between cross ties 112 and is in the same plane as anode lead 104. This stability and positioning facilitate the use of automated equipment for ultrasonic bonding. Second, the fuse tie 114 and anode lead 104 can be made sufficiently large to aid in accommodating the energy generated by ultrasonic bonding.

Because of the need to avoid high temperatures when using exothermic fuse conductors, the axial lead 120 from the solid electrolyte body 116 is typically attached to fuse tie 114 prior to installing the fuse conductor 118. The attaching is often done by welding. Common welding operations involve the generation of a sufficiently high temperature that the material of fuse tie 114 melts and/or becomes alloyed with the material of the axial lead 120 from the electrolytic capacitor body. FIG. 4 depicts the localized deformation caused by the welding of axial lead 120 and fuse tie 114. Because of the energy generated, the welding operations could deform the fuse tie beyond the localized region of the weld. Any warping or deformation of the fuse tie may make any subsequent operation to ultrasonically bond the fuse conductor to the fuse tie more difficult because of spatial irregularities. Since the assemblies of this invention can permit the use of relatively large fuse ties, the extent of deformation beyond the immediate region of the weld of the axial lead 120 to the fuse tie can be minimized. Fuse ties having a thickness of at least about 0.05 mm (50 microns) and width of at least about 0.5 millimeter, are generally able to dissipate heat during welding and have sufficient structural strength to avoid undue warping or other spatial distortion during the welding of the axial lead 120.

Reference to FIG. 3 readily reveals that inspection of the assembly can be easily conducted prior to encapsulation with insulator material.

FIG. 2 depicts sheath 122 surrounding fuse conductor 118. Sheath 122 is particularly useful for exothermic fuses which can generate sufficient heat to char hydrocarbon-based polymer. The charring of hydrocarbon-based polymer can result in an electrically conductive path between the anode lead 104 and fuse tie 114 to defeat the purpose of the fuse. Sheath 122 is composed of material which does not become, or convert to, electrically conductive material upon the release of the exothermic energy from the fuse. Suitable materials include silicones and glass wool.

The capacitor assembly is encased in an insulator casing 124. The insulator is unitary, i.e., it surrounds the solid electrolytic capacitor body 116

and fuse conductor 118 to protect them from damage or performance deterioration due to infiltration of air, moisture, etc. The exterior, or boundary, of the insulator casing extends over a portion of the anode lead 104 and a portion of cathode lead 108. The fuse conductor 118 and a portion of the fuse tie 114 and the cross ties 112, anode tie frame 102 and cathode tie frame 106 are outside the boundary of the solid insulator. The dotted line 126 in FIG. 3 represents where the boundary of insulator casing 124 would be positioned. The insulator casing 124 may be constructed from any suitable insulating material, i.e., having a conductance of less than about 10^{-11} S (10^{-11} mhos). Typical insulating materials include thermoplastic and thermosetting resins with the latter being preferred. Exemplary materials include epoxies which are curable at substantially lower temperatures than the threshold temperature of any exothermic fuse used. The insulator casing 124 is typically formed by injection molding.

After the encapsulation, the capacitor 128 as depicted in FIG. 5, is removed from the lead frame assembly 100. The anode lead 104 and cathode lead 108 are severed in any convenient manner and extend beyond the exterior of the insulator casing 124. Fuse tie 114 is preferably severed to be flush with the exterior of insulator casing 124. Because of the structural strength provided by the cross ties 112, the severing may readily be accomplished by forcing a blade or bar along the side of the insulator casing 124 and snapping the fuse tie. Without the support by the cross ties 112, the fuse tie 114 would tend to bend rather than being severed by the application of such a force.

In the capacitor 128, the portions of the fuse tie 114 that are exposed at the sides of the insulator casing 124, are remote from anode 104 and cathode lead 108 thereby prevent any risk of solder bridging. Moreover, the exposed portions of the fuse tie 114 can be of a sufficient size to permit checking the integrity of the fuse conductor 118.

Claims

1. A unitary lead frame (100) for the assembly of fused solid dielectric capacitors comprising:
 - (a) a rigid first electrode tie frame (102) having a plurality of spaced-apart, rigid first electrode leads (104) extending therefrom;
 - (b) a diametrically opposed rigid second electrode tie frame (106) having a plurality of spaced-apart second electrode leads (108) extending therefrom;
 - (c) a plurality of rigid cross ties (112) extending between the first electrode tie frame (102) and the second electrode tie frame (106), each of said cross ties (112) extend-

the fuse tie and anode lead is by ultrasonic bonding. There are two aspects of the lead frame assemblies of this invention that facilitate using ultrasonic bonding of fuse conductors. First, the fuse tie 114 is spacially stable since it extends perpendicularly between cross ties 112 and is in the same plane as anode lead 104. This stability and positioning facilitate the use of automated equipment for ultrasonic bonding. Second, the fuse tie 114 and anode lead 104 can be made sufficiently large to aid in accommodating the energy generated by ultrasonic bonding.

Because of the need to avoid high temperatures when using exothermic fuse conductors, the axial lead 120 from the solid electrolyte body 116 is typically attached to fuse tie 114 prior to installing the fuse conductor 118. The attaching is often done by welding. Common welding operations involve the generation of a sufficiently high temperature that the material of fuse tie 114 melts and/or becomes alloyed with the material of the axial lead 120 from the electrolytic capacitor body. FIG. 4 depicts the localized deformation caused by the welding of axial lead 120 and fuse tie 114. Because of the energy generated, the welding operations could deform the fuse tie beyond the localized region of the weld. Any warping or deformation of the fuse tie may make any subsequent operation to ultrasonically bond the fuse conductor to the fuse tie more difficult because of spacial irregularities. Since the assemblies of this invention can permit the use of relatively large fuse ties, the extent of deformation beyond the immediate region of the weld of the axial lead 120 to the fuse tie can be minimized. Fuse ties having a thickness of at least about 0.05 mm (50 microns) and width of at least about 0.5 millimeter, are generally able to dissipate heat during welding and have sufficient structural strength to avoid undue warping or other spacial distortion during the welding of the axial lead 120.

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The capacitor assembly is encased in an insulator casing 124. The insulator is unitary, i.e., it surrounds the solid electrolytic capacitor body 116

and fuse conductor 118 to protect them from damage or performance deterioration due to infiltration of air, moisture, etc. The exterior, or boundary, of the insulator casing extends over a portion of the anode lead 104 and a portion of cathode lead 108. The fuse conductor 118 and a portion of the fuse tie 114 and the cross ties 112, anode tie frame 102 and cathode tie frame 106 are outside the boundary of the solid insulator. The dotted line 126 in FIG. 3 represents where the boundary of insulator casing 124 would be positioned. The insulator casing 124 may be constructed from any suitable insulating material, i.e., having a conductance of less than about 10^{-11} S (10^{-11} mhos). Typical insulating materials include thermoplastic and thermosetting resins with the latter being preferred. Exemplary materials include epoxies which are curable at substantially lower temperatures than the threshold temperature of any exothermic fuse used. The insulator casing 124 is typically formed by injection molding.

After the encapsulation, the capacitor 128 as depicted in FIG. 5, is removed from the lead frame assembly 100. The anode lead 104 and cathode lead 108 are severed in any convenient manner and extend beyond the exterior of the insulator casing 124. Fuse tie 114 is preferably severed to be flush with the exterior of insulator casing 124. Because of the structural strength provided by the cross ties 112, the severing may readily be accomplished by forcing a blade or bar along the side of the insulator casing 124 and snapping the fuse tie. Without the support by the cross ties 112, the fuse tie 114 would tend to bend rather than being severed by the application of such a force.

In the capacitor 128, the portions of the fuse tie 114 that are exposed at the sides of the insulator casing 124, are remote from anode 104 and cathode lead 108 thereby prevent any risk of solder bridging. Moreover, the exposed portions of the fuse tie 114 can be of a sufficient size to permit checking the integrity of the fuse conductor 118.

Claims

1. A unitary lead frame (100) for the assembly of fused solid dielectric capacitors comprising:
 - (a) a rigid first electrode tie frame (102) having a plurality of spaced-apart, rigid first electrode leads (104) extending therefrom;
 - (b) a diametrically opposed rigid second electrode tie frame (106) having a plurality of spaced-apart second electrode leads (108) extending therefrom;
 - (c) a plurality of rigid cross ties (112) extending between the first electrode tie frame (102) and the second electrode tie frame (106), each of said cross ties (112) extend-



- ing substantially parallel between adjacent first electrode lead and second electrode lead pairs, said cross ties (112) being in substantially the same plane as said first electrode tie frame (102) and said second electrode tie frame (106); and
(d) a plurality of rigid fuse ties (114), each of said fuse ties (114) extending substantially perpendicularly between adjacent cross ties (112) and in substantially the same plane as the cross ties, each of said fuse ties (114) being intermediate the first electrode lead (104) and the corresponding opposed second electrode lead (108), a zone being defined between said fuse tie (114), the cross ties (112) and the second electrode tie frame (106) which zone is adapted to receive a solid dielectric capacitor body (116) such that a first electrode of the dielectric capacitor body (116) is in electrical communication with the fuse tie (114) and a second electrode of the dielectric capacitor body (116) is in electrical communication with the second electrode lead (108), and wherein said fuse tie (114) is spaced away from the first electrode lead (104) and both the first electrode lead (104) and the fuse tie (114) are adapted to receive opposite ends of a fuse conductor (118).
2. The lead frame of claim 1 which is for the assembly of electrolytic capacitors and
 - (i) the first electrode tie frame is an anode tie frame;
 - (ii) the first electrode lead is an anode lead;
 - (iii) the second electrode tie frame is a cathode tie frame;
 - (iv) the second electrode lead is a cathode lead;
 - (v) the dielectric capacitor body to be received in the zone defined by the fuse tie, adjacent cross ties and the cathode tie frame is an electrolytic capacitor body having an axial anode lead and a cathode on a portion of its exterior surface;
 - (vi) the fuse tie is adapted to receive the axial anode lead of the electrolytic capacitor body; and
 - (vii) the cathode lead is adapted to contact at least a portion of the cathode of the electrolytic capacitor body.
 3. The lead frame of claim 2 further comprising a fuse conductor extending in electrical contact between the fuse tie and the anode lead.
 4. The lead frame of claim 3 wherein the fuse conductor is an exothermic fuse.
 5. The lead frame of claim 3 wherein the fuse conductor is ultrasonically bonded to each of the fuse tie and anode lead.
 6. The lead frame of claim 2 wherein the fuse tie is of sufficient size to accommodate the energy generated by ultrasonically bonding an exothermic fuse conductor without damaging the fuse conductor.
 7. The lead frame of claim 2 wherein the fuse tie is of sufficient size to accommodate welding an axial anode lead from an electrolytic capacitor body without unduly distorting the fuse tie beyond the weld.
 8. The lead frame of claim 2 having at least one electrolytic capacitor body comprising an axial anode lead and a cathode surface, which body is positioned intermediate the fuse tie and cathode tie and between cross ties, and the axial anode lead is in electrical contact with the cross tie and the cathode lead is in electrical contact with at least a portion of the cathode surface of the electrolytic capacitor body.
 9. The lead frame of claim 8 further comprising a fuse conductor extending in electrical contact between the fuse tie and the anode lead.
 10. The lead frame of claim 9 wherein the fuse conductor is an exothermic fuse.
 11. The lead frame of claim 9 wherein the fuse conductor is ultrasonically bonded to each of the fuse tie and anode lead.
 12. The lead frame of claim 9 wherein a unitary solid insulator casing defines a boundary encapsulating the electrolytic capacitor body and extends over a portion of the anode lead, a portion of the cathode lead, the fuse conductor, and a portion of the fuse tie and wherein the cross ties, cathode tie frame and anode tie frame are outside the boundary of the solid insulator casing.
 13. The lead frame of claim 12 further comprising a fuse conductor extending in electrical contact between the fuse tie and anode lead.
 14. The lead frame of claim 13 wherein the fuse conductor is an exothermic fuse.



15. The lead frame of claim 13 wherein the fuse conductor is ultrasonically bonded to each of the fuse tie and anode lead.

16. A method for making fused solid dielectric capacitors comprising:

(a) providing a unitary lead frame comprising

(i) a rigid first electrode tie frame having a plurality of spaced-apart, rigid first electrode leads extending therefrom;

(ii) a diametrically opposed rigid second electrode tie frame having a plurality of spaced-apart second electrode leads extending therefrom,

(iii) a plurality of rigid cross ties extending between the first electrode tie frame and the second electrode tie frame, each of said cross ties extending substantially parallel between adjacent first electrode lead and second electrode lead pairs, said cross ties being in substantially the same plane as said first electrode tie frame and said second electrode tie frame, and

(iv) a plurality of rigid fuse ties, each of said fuse ties extending substantially perpendicularly between adjacent cross ties and in substantially the same plane as the cross ties, each of said fuse ties being intermediate the first electrode lead and the corresponding opposed second electrode lead, defining a zone being defined between said fuse tie, the cross ties and the second electrode tie frame which zone is adapted to receive a solid dielectric capacitor body such that a first electrode of the dielectric capacitor body is in electrical communication with the fuse tie and a second electrode of the dielectric capacitor body is in electrical communication with the second electrode lead, and wherein said fuse tie is spaced away from the first electrode lead and both the first electrode lead and the fuse tie are adapted to receive opposite ends of a fuse conductor;

(b) providing said dielectric capacitor body having a first electrode and a second electrode;

(c) placing said dielectric capacitor body in said zone such that said first electrode is in electrical communication with said fuse tie and said second electrode is in electrical communication with the second electrical lead;

(d) providing a fuse conductor having two opposing ends;

(e) placing said fuse conductor on said first electrode lead and said fuse tie such that said first electrode lead and said fuse tie receive and are each in electrical contact with a corresponding one of said opposite ends of said fuse conductor;

(f) encapsulating said dielectric capacitor body, said first electrode, and portions of said first electrode lead and said second electrode lead with an insulating material forming a unitary solid insulator casing having an exterior surface defining a front portion, a rear portion, two lateral portions, an upper portion and a lower portion, wherein said dielectric capacitor body is surrounded by said insulator casing, said first electrode lead and said second electrode lead extend through the exterior surface of the insulator casing, and said fuse tie extends between the two lateral portions of the insulator casing exterior; and

(g) subsequently severing said encapsulated body from said lead frame.

17. The method of claim 16, wherein

(i) the first electrode tie frame is an anode tie frame;

(ii) the first electrode lead is an anode lead;

(iii) the second electrode lead is a cathode lead;

(iv) the second electrode lead is a cathode lead;

(v) the dielectric capacitor body to be received in the zone defined by the fuse tie, adjacent cross ties and the cathode tie frame is an electrolytic capacitor body having an axial anode lead and a cathode on a portion of its exterior surface;

(vi) the fuse tie is adapted to receive the axial anode lead of the electrolytic capacitor body; and

(vii) the cathode lead is adapted to contact at least a portion of the cathode of the electrolytic capacitor body.

18. The method of claim 17, wherein the anode lead extends from the front portion of the insulator casing and the cathode lead extends through the rear portion of the insulator casing.

19. The method of claim 18, wherein the fuse tie is exposed at each lateral portion of the insulator.

20. The method of claim 17, wherein the fuse conductor extends in electrical contact between the fuse tie and the anode lead.



21. The method of claim 20, wherein the fuse conductor is an exothermic fuse.

22. The method of claim 21, wherein the exothermic fuse comprises palladium and has an exterior sheath of a malleable metal or alloy capable of being ultrasonically bonded.

23. The method of claim 20, wherein the fuse conductor is ultrasonically bonded to each of the fuse tie and anode lead.

24. The method of claim 17, wherein the fuse tie is of sufficient size to accommodate the energy generated by ultrasonically bonding an exothermic fuse conductor without damaging the fuse conductor.

25. The method of claim 17, wherein the axial anode from the electrolytic capacitor body is welded to the fuse tie and the fuse tie is of sufficient size to accommodate welding the axial anode lead from the electrolytic capacitor body without unduly distorting the fuse tie beyond the weld.

26. The method of claim 17, wherein the fuse tie is at least about 0.05 millimeters in thickness and about 0.5 millimeters wide.

27. The method of claim 17, wherein said lead frame has at least one electrolytic capacitor body comprising an axial anode lead and a cathode surface, which body is positioned intermediate the fuse tie and cathode tie and between cross ties, and the axial anode lead is in electrical contact with the cross tie and the cathode lead is in electrical contact with at least a portion of the cathode surface of the electrolytic capacitor body.

28. The method of claim 27, wherein the lead frame has at least one fuse conductor which extends in electrical contact between the fuse tie and the anode lead associated with the at least one electrolytic capacitor body.

29. The method of claim 28, wherein the fuse conductor is an exothermic fuse.

30. The method of claim 28, wherein the at least one fuse conductor is ultrasonically bonded to each of the fuse tie and anode lead associated with the at least one electrolytic capacitor body.

31. The method of claim 28, wherein the unitary solid insulator casing defines a boundary en-

capsulating the electrolytic capacitor body and extends over a portion of the anode lead, a portion of the cathode lead, the fuse conductor and a portion of the fuse tie and wherein the cross ties, cathode tie frame and anode tie frame are outside the boundary of the solid insulator casing.

32. The method of claim 31, wherein the at least one fuse conductor extends in electrical contact between the fuse tie and anode lead associated with the at least one electrolytic capacitor body.

33. The method of claim 32, wherein the fuse conductor is an exothermic fuse.

34. The method of claim 33, wherein the exothermic fuse comprises palladium and has an exterior sheath of a malleable metal or alloy capable of being ultrasonically bonded.

35. The method of claim 32, wherein the fuse conductor is ultrasonically bonded to each of the fuse tie and anode lead.

Patentansprüche

1. Einheits-Anschlußband (108) für die Montage von Festkörperkondensatoren, gekennzeichnet durch:

(a) ein starres erstes Elektrodenanschlußband (102) mit einer Vielzahl einzeln angeordneter, vom Band ausgehender starrer Anschlüsse für die erste Elektrode (104);

(b) ein genau gegenüber angeordnetes starres zweites Elektrodenanschlußband (106) mit einer Vielzahl einzeln angeordneter, vom Band ausgehender starrer Anschlüsse für die zweite Elektrode (108);

(c) einer Vielzahl starrer Querverbindungen (112), die sich zwischen dem ersten Elektrodenanschlußband (102) und dem zweiten Elektrodenanschlußband (106) erstrecken, jede der genannten Querverbindung (112) erstreckt sich im wesentlichen parallel zwischen den angrenzenden Anschlußpaaren für die erste und zweite Elektrode, die genannten Querverbindungen (112) befinden sich im wesentlichen in der gleichen Ebene wie das genannte erste Elektrodenanschlußband (102) und das zweite Elektrodenanschlußband (106); und

(d) eine Vielzahl von starren Sicherungsanschlüssen (114), jede dieser Sicherungsanschlüsse (114) erstreckt sich im wesentlichen senkrecht zwischen den angrenzenden Querverbindungen (112) und im wesentli-



chen in der gleichen Ebene wie die Querverbindungen, jeder der genannten Sicherungsanschlüsse (114) befindet sich zwischen dem ersten Elektrodenanschluß (104) und dem dazugehörigen gegenüberliegenden zweiten Elektrodenanschluß (108), zwischen den genannten Querverbindungen (112) und dem zweiten Elektrodenanschlußband (106) befindet sich ein Bereich, der zur Aufnahme eines Festkörperkondensatorgehäuses (116) dahingehend angepaßt ist, daß die erste Elektrode des Kondensatorgehäuses (116) mit dem Sicherungsanschluß (114), und die zweite Elektrode (116) mit dem zweiten Elektrodenanschluß (108) elektrisch verbunden sind und in der der genannte Sicherungsanschluß (114) Abstand vom ersten Elektrodenanschluß (104) hat, und daß sowohl der erste Elektrodenanschluß (104) als auch der Sicherungsanschluß (114) zur Aufnahme der gegenüberliegenden Enden eines Sicherungsdrahtes (118) angepaßt sind;

2. Anschlußband nach Anspruch 1 zur Montage von Elektrolytkondensatoren, wobei

- (i) das erste Elektrodenanschlußband ein Anodenanschlußband ist;
- (ii) der erste Elektrodenanschluß ein Anodenanschluß ist;
- (iii) das zweite Elektrodenanschlußband ein Kathodenanschlußband ist;
- (iv) der zweite Elektrodenanschluß ein Kathodenanschluß ist;
- (v) das Elektrolytkondensatorgehäuse, das sich in dem Bereich befindet, der aus dem Sicherungsanschluß, den angrenzenden Querverbindungen und dem Kathodenanschlußband gebildet wird, ein Elektrolytkondensatorgehäuse mit einem axialen Anodenanschluß und einer Kathode auf einem Teilbereich seiner Außenseite ist;
- (vi) der Sicherungsanschluß so ausgebildet ist, daß er den axialen Anodenanschluß des Elektrolytkondensatorgehäuses aufnehmen kann; und
- (vii) der Kathodenanschluß so ausgebildet ist, daß er wenigstens mit einem Teilbereich der Kathode des Elektrolytkondensatorgehäuses Kontakt hat.

3. Anschlußrahmen nach Anspruch 2, dadurch gekennzeichnet, daß der Sicherungsdraht den Sicherungsanschluß und den Anodenanschluß elektrisch miteinander verbindet.

4. Anschlußband nach Anspruch 3, dadurch gekennzeichnet, daß der Sicherungsdraht eine

Schmelzsicherung ist.

5. Anschlußband nach Anspruch 3, dadurch gekennzeichnet, daß der Sicherungsdraht mittels Ultraschall mit dem Sicherungsanschluß und dem Anodenanschluß verbunden ist.

6. Anschlußband nach Anspruch 2, dadurch gekennzeichnet, daß der Sicherungsanschluß genügend groß ist, um die Energie, die während des ultraschalltechnischen Befestigens des Schmelzsicherungsdrahtes entsteht, abzuleiten, ohne dabei den Sicherungsdraht zu beschädigen.

7. Anschlußband nach Anspruch 2, dadurch gekennzeichnet, daß der Sicherungsanschluß genügend groß ist, den Lötprozeß des axialen Anodenanschluß des Elektrolytkondensatorgehäuses ohne gewellte Verzerrungen nach dem Löten zu überstehen.

8. Anschlußband nach Anspruch 2 mit mindestens einem Elektrolytkondensatorgehäuse mit einem axialen Anodenanschluß und einer Kathoden-Außenfläche, dessen Gehäuse sich zwischen dem Sicherungsanschluß und dem Kathodenanschluß einerseits, und zwischen den Querverbindungen andererseits befindet, und in dem der axiale Anodenanschluß mit der Querverbindung sowie der Kathodenanschluß mit mindestens einem Teilbereich der Kathodenfläche des Elektrolytkondensatorgehäuses elektrisch verbunden sind.

9. Anschlußband nach Anspruch 8, dadurch gekennzeichnet, daß es einen Sicherungsdraht, der den Sicherungsanschluß mit dem Anodenanschluß elektrisch verbindet, beinhaltet.

10. Anschlußband nach Anspruch 9, dadurch gekennzeichnet, daß der Sicherungsdraht eine Schmelzsicherung ist.

11. Anschlußband nach Anspruch 9, dadurch gekennzeichnet, daß der Sicherungsdraht mittels Ultraschall mit dem Sicherungsanschluß und dem Anodenanschluß verbunden ist.

12. Anschlußband nach Anspruch 9, dadurch gekennzeichnet, daß das Einheitsgehäuse aus einem Festkörperisolator eine Abgrenzung bildet, die das Elektrolytkondensatorgehäuse einschließt und einen Teil des Anodenanschlusses, einen Teil des Kathodenanschlusses, den Sicherungsdraht und einen Teil des Sicherungsanschlusses überdeckt, und wo sich die Querverbindungen, das Kathodenanschlußband



und das Anodenanschlußband außerhalb der Abgrenzung des Festkörperisolatorgehäuses befinden.

13. Anschlußrahmen nach Anspruch 12, dadurch gekennzeichnet, daß der Sicherungsdraht den Sicherungsanschluß und den Anodenanschluß elektrisch miteinander verbindet. 5
14. Anschlußband nach Anspruch 13, dadurch gekennzeichnet, daß der Sicherungsdraht eine Schmelzsicherung ist. 10
15. Anschlußband nach Anspruch 13, dadurch gekennzeichnet, daß der Sicherungsdraht mittels Ultraschall mit dem Sicherungsanschluß und dem Anodenanschluß verbunden ist. 15
16. Verfahren zur Herstellung von Festkörperkondensatoren, daß folgende Schritte beinhaltet: 20
 - (a) Herstellung eines Einheits-Anschlußbandes, gekennzeichnet durch
 - (i) ein starres, erstes Elektrodenanschlußband mit einer Vielzahl einzeln angeordneter, von dem Band ausgehender starrer erster Elektrodenanschlüsse; 25
 - (ii) ein genau gegenüber angeordnetes starres zweites Elektrodenanschlußband mit einer Vielzahl einzeln angeordneter, vom Band ausgehender starrer Anschlüsse für die zweite Elektrode; 30
 - (iii) einer Vielzahl starrer Querverbindungen, die sich zwischen dem ersten Elektrodenanschlußband und dem zweiten Elektrodenanschlußband erstrecken, jede der genannten Querverbindung erstreckt sich im wesentlichen parallel zwischen den angrenzenden Anschlußpaaren für die erste und zweite Elektrode, die genannten Querverbindungen befinden sich im wesentlichen in der gleichen Ebene wie das genannte erste und zweite Elektrodenanschlußband; und 40
 - (iv) eine Vielzahl von starren Sicherungsanschlüssen, jede dieser Sicherungsanschlüsse erstreckt sich im wesentlichen senkrecht zwischen den angrenzenden Querverbindungen und im wesentlichen in der gleichen Ebene wie die Querverbindungen, jeder der genannten Sicherungsanschlüsse befindet sich zwischen dem ersten Elektrodenanschluß und dem dazugehörigen, gegenüberliegenden zweiten Elektrodenanschluß, zwischen den genannten Querverbindungen und dem zweiten Elektrodenanschlußband befindet sich ein Bereich, der zur Aufnahme eines Festkörperkondensatorge-

häuses dahingehend angepaßt ist, daß die erste Elektrode des Gehäuses des Kondensatorgehäuses mit dem Sicherungsanschluß sowie die zweite Elektrode mit dem zweiten Elektrodenanschluß elektrisch verbunden sind, und in der der genannte Sicherungsanschluß Abstand vom ersten Elektrodenanschluß hat, und daß sowohl der erste Elektrodenanschluß als auch der Sicherungsanschluß zur Aufnahme der gegenüberliegenden Enden eines Sicherungsdrahtes angepaßt sind;

- (b) Herstellung von genanntem Kondensatorgehäuse mit einer ersten und einer zweiten Elektrode;
- (c) Plazieren des Kondensatorgehäuses in den Bereich, so daß die erste Elektrode mit dem Sicherungsanschluß und die zweite Elektrode mit dem zweiten elektrischen Anschluß elektrisch verbunden sind;
- (d) Herstellung eines Sicherungsdrahtes mit zwei sich gegenüberliegenden Enden;
- (e) Plazieren des Sicherungsdrahtes auf dem ersten Elektrodenband und dem Sicherungsanschluß, so daß das erste Elektrodenband und der erste Sicherungsanschluß ein Ende der sich gegenüberliegenden Enden des Sicherungsdrahtes bekommen und mit diesem in elektrischer Verbindung sind;
- (f) Umschließen des Kondensatorgehäuses der ersten Elektrode und Teilen des ersten und zweiten Elektrodenbands mit einem Isolatormaterial, so daß ein Einheitsgehäuse aus einem Festkörperisolator entsteht, dessen Außenfläche aus einer Vorderseite, einer Rückseite, zwei Seitenteilen, einer Oberseite und einer Unterseite gebildet wird, in dem das Elektrolytkondensatorgehäuse von dem Isolatormaterial umgeben ist, der erste und zweite Elektrodenanschluß durch die Außenfläche des Isolatorgehäuses herausgeführt werden und der Sicherungsanschluß zwischen den beiden Seitenteilen der Außenfläche des Isolatorgehäuses durchgeführt wird;
- (g) Späteres Abtrennen des umschlossenen Gehäuses von dem Anschlußband.

17. Verfahren nach Anspruch 16, dadurch gekennzeichnet, daß

- (i) das erste Elektrodenanschlußband ein Anodenanschlußband ist;
- (ii) der erste Elektrodenanschluß ein Anodenanschluß ist;
- (iii) das zweite Elektrodenanschlußband ein Kathodenanschlußband ist;



- (iv) der zweite Elektrodenanschluß ein Kathodenanschluß ist;
- (v) das Elektrolytkondensatorgehäuse, das sich in dem Bereich befindet, der aus dem Sicherungsanschluß, den angrenzenden Querverbindungen und dem Kathodenanschlußband gebildet wird, ein Elektrolytkondensatorgehäuse mit einem axialen Anodenanschluß und einer Kathode auf einem Teilbereich seiner Außenseite ist;
- (vi) der Sicherungsanschluß so ausgebildet ist, daß er den axialen Anodenanschluß des Elektrolytkondensatorgehäuses aufnehmen kann; und
- (vii) der Kathodenanschluß so ausgebildet ist, daß er wenigstens mit einem Teilbereich der Kathode des Elektrolytkondensatorgehäuses Kontakt hat.
18. Verfahren nach Anspruch 17, dadurch gekennzeichnet, daß der Anodenanschluß durch die Vorderseite des Isolatorgehäuses und der Kathodenanschluß durch die Rückseite des Isolatorgehäuses geht.
19. Verfahren nach Anspruch 18, dadurch gekennzeichnet, daß der Sicherungsanschluß durch beide Seitenteile des Isolators geführt ist.
20. Verfahren nach Anspruch 17, dadurch gekennzeichnet, daß der Sicherungsdraht den Sicherungsanschluß und den Anodenanschluß elektrisch miteinander verbindet.
21. Verfahren nach Anspruch 20, dadurch gekennzeichnet, daß der Sicherungsdraht eine Schmelzsicherung ist.
22. Verfahren nach Anspruch 21, dadurch gekennzeichnet, daß die Schmelzsicherung Palladium beinhaltet, und eine Außenhülle aus einem schmiedbaren Metall oder einer schmiedbaren Legierung hat, die mittels Ultraschall verbunden werden kann.
23. Verfahren nach Anspruch 20, dadurch gekennzeichnet, daß der Sicherungsdraht mittels Ultraschall mit dem Sicherungsanschluß und dem Anodenanschluß verbunden ist.
24. Verfahren nach Anspruch 17, dadurch gekennzeichnet, daß der Sicherungsanschluß genügend groß ist, um die Energie, die während des ultraschalltechnischen Befestigens des Schmelzsicherungsdrahtes entsteht, abzuleiten, ohne dabei den Sicherungsdraht zu beschädigen.
25. Verfahren nach Anspruch 17, dadurch gekennzeichnet, daß die axiale Anode des Elektrolytkondensatorgehäuses mit dem Sicherungsanschluß verlötet ist und der Sicherungsanschluß genügend groß ist, den Lötprozeß des axialen Anodenanschluß des Elektrolytkondensatorgehäuses ohne gewellte Verzerrungen nach dem Löten zu überstehen.
26. Verfahren nach Anspruch 17, dadurch gekennzeichnet, daß der Sicherungsanschluß mindestens etwa 0,05 mm dick, und etwa 0,5 mm breit ist.
27. Verfahren nach Anspruch 17, dadurch gekennzeichnet, daß das genannte Anschlußband mindestens ein Elektrolytkondensatorgehäuse mit einem axialen Anodenanschluß und einer Kathoden-Außenfläche hat, dessen Gehäuse sich zwischen dem Sicherungsanschluß und dem Kathodenanschluß einerseits, und zwischen den Querverbindungen andererseits, befindet und in dem der axiale Anodenanschluß mit der Querverbindung sowie der Kathodenanschluß mit mindestens einem Teilbereich der Kathodenfläche des Elektrolytkondensatorgehäuses elektrisch verbunden sind.
28. Verfahren nach Anspruch 27, dadurch gekennzeichnet, daß das Anschlußband mindestens einen Sicherungsdraht hat, der den Sicherungsanschluß und den Anodenanschluß zusammen mit mindestens einem Elektrolytkondensatorgehäuses elektrisch leitend verbindet.
29. Anschlußband nach Anspruch 28, dadurch gekennzeichnet, daß der Sicherungsdraht eine Schmelzsicherung ist.
30. Verfahren nach Anspruch 28, dadurch gekennzeichnet, daß mindestens ein Sicherungsdraht ultraschalltechnisch sowohl mit dem Sicherungsanschluß einerseits, als auch mit dem Anodenanschluß andererseits, der mindestens einem Elektrolytkondensatorgehäuse zugeordnet ist, verbunden ist.
31. Verfahren nach Anspruch 28, dadurch gekennzeichnet, daß das Einheitsgehäuse aus einem Festkörperisolator eine Abgrenzung bildet, die das Elektrolytkondensatorgehäuse einschließt und einen Teil des Anodenanschlusses, einen Teil des Kathodenanschlusses, den Sicherungsdraht und einen Teil des Sicherungsanschlusses überdeckt, und wo sich die Querverbindungen, das Kathodenanschlußband und das Anodenanschlußband außerhalb der Abgrenzung des Festkörperisolatorgehäuses befinden.



inden.

32. Verfahren nach Anspruch 31, dadurch gekennzeichnet, daß mindestens ein Sicherungsdraht den Sicherungsanschluß mit dem Anodenanschluß elektrisch verbindet, der mindestens einem Elektrolytkondensatorgehäuse zugeordnet ist.

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33. Verfahren nach Anspruch 32, dadurch gekennzeichnet, daß der Sicherungsdraht eine Schmelzsicherung ist.

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34. Verfahren nach Anspruch 33, dadurch gekennzeichnet, daß die Schmelzsicherung Palladium beinhaltet, und eine Außenhülle aus einem schmiedbaren Metall oder einer schmiedbaren Legierung hat, die mittels Ultraschall verbunden werden kann.

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35. Verfahren nach Anspruch 32, dadurch gekennzeichnet, daß der Sicherungsdraht mittels Ultraschall mit dem Sicherungsanschluß und dem Anodenanschluß verbunden ist.

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Revendications

1. Cadre conducteur monobloc (100) pour le montage de condensateurs à diélectrique solide et à fusibles, comportant :

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(a) un bâti rigide (102) de liaison de premières électrodes duquel partent plusieurs conducteurs rigides et espacés (104) de premières électrodes ;

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(b) un bâti rigide et diamétralement opposé (106) de liaison de secondes électrodes duquel partent plusieurs conducteurs espacés (108) de secondes électrodes ;

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(c) plusieurs traverses rigides (112) s'étendant entre le bâti (102) de liaison de premières électrodes et le bâti (106) de liaison de secondes électrodes, chacune desdites traverses (112) s'étendant sensiblement parallèlement entre des paires d'un conducteur de première électrode et d'un conducteur de seconde électrode adjacents, lesdites traverses (112) étant sensiblement dans le même plan que ledit bâti (102) de liaison de premières électrodes et ledit bâti (106) de liaison de secondes électrodes ; et

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(d) plusieurs fusibles rigides (114) de liaison, chacun desdits fusibles (114) de liaison s'étendant sensiblement perpendiculairement entre des traverses adjacentes (112) et sensiblement dans le même plan que les traverses, chacun desdits fusibles (114) de liaison étant situé entre le conducteur (104) de première électrode et le conducteur op-

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posé correspondant (108) de seconde électrode, une zone étant définie entre ledit fusible de liaison (114), les traverses (112) et le bâti (106) de liaison de secondes électrodes, laquelle zone est destinée à recevoir un corps diélectrique (116) de condensateur solide de manière qu'une première électrode du corps diélectrique (116) de condensateur soit en communication électrique avec le fusible (114) de liaison et qu'une seconde électrode du corps diélectrique (116) du condensateur soit en communication électrique avec le conducteur (108) de seconde électrode, ledit fusible (114) de liaison étant espacé du conducteur (104) de première électrode et le conducteur (104) de première électrode et le fusible (114) de liaison étant tous deux destinés à recevoir des extrémités opposées d'un conducteur fusible (118).

2. Cadre conducteur selon la revendication 1, qui est destiné au montage de condensateurs électrolytiques et dans lequel

(i) le bâti de liaison de premières électrodes est un bâti de liaison d'anodes ;

(ii) le conducteur de première électrode est un conducteur d'anode ;

(iii) le bâti de liaison de secondes électrodes est un bâti de liaison de cathodes ;

(iv) le conducteur de seconde électrode est un conducteur de cathode ;

(v) le corps diélectrique de condensateur devant être reçu dans la zone définie par le fusible de liaison, des traverses adjacentes et le bâti de liaison de cathodes est un corps de condensateur électrolytique ayant un conducteur axial d'anode et une cathode sur une partie de sa surface extérieure ;

(vi) le fusible de liaison est destiné à recevoir le conducteur axial d'anode du corps de condensateur électrolytique ; et

(vii) le conducteur de cathode est destiné à entrer en contact avec au moins une partie de la cathode du corps de condensateur électrolytique.

3. Cadre conducteur selon la revendication 2, comportant en outre un conducteur fusible s'étendant en contact électrique entre le fusible de liaison et le conducteur d'anode.

4. Cadre conducteur selon la revendication 3, dans lequel le conducteur fusible est un fusible exothermique.

5. Cadre conducteur selon la revendication 3, dans lequel le conducteur de fusible est lié par



- ultrasons à chacun des fusible de liaison et conducteur d'anode.
6. Cadre conducteur selon la revendication 2, dans lequel le fusible de liaison est d'une dimension suffisante pour supporter l'énergie générée par une liaison par ultrasons d'un conducteur fusible exothermique sans endommager le conducteur fusible. 5
 7. Cadre conducteur selon la revendication 2, dans lequel le fusible de liaison est d'une dimension suffisante pour supporter le soudage d'un conducteur axial d'anode partant d'un corps de condensateur électrolytique sans déformation excessive du fusible de liaison au-delà de la soudure. 10
 8. Cadre conducteur selon la revendication 2, ayant au moins un corps de condensateur électrolytique comportant un conducteur axial d'anode et une surface de cathode, lequel corps est positionné entre le fusible de liaison et l'élément de liaison de cathode et entre des traverses, et le conducteur axial d'anode est en contact électrique avec la traverse et le conducteur de cathode est en contact électrique avec au moins une partie de la surface de cathode du corps de condensateur électrolytique. 20 25 30
 9. Cadre conducteur selon la revendication 8, comportant en outre un conducteur fusible s'étendant en contact électrique entre le fusible de liaison et le conducteur d'anode. 35
 10. Cadre conducteur selon la revendication 9, dans lequel le conducteur fusible est un fusible exothermique. 40
 11. Cadre conducteur selon la revendication 9, dans lequel le conducteur fusible est lié par ultrasons à chacun du fusible de liaison et du conducteur d'anode. 45
 12. Cadre conducteur selon la revendication 9, dans lequel une enveloppe isolante solide monobloc définit une limite encapsulant le corps de condensateur électrolytique et s'étend sur une partie du conducteur d'anode, une partie du conducteur de cathode, le conducteur fusible et une partie du fusible de liaison, et dans lequel les traverses, le bâti de liaison de cathodes et le bâti de liaison d'anodes sont en dehors de la limite de l'enveloppe isolante solide. 50 55
 13. Cadre conducteur selon la revendication 12, comportant en outre un conducteur fusible s'étendant en contact électrique entre le fusible de liaison et un conducteur d'anode.
 14. Cadre conducteur selon la revendication 13, dans lequel le conducteur fusible est un fusible exothermique.
 15. Cadre conducteur selon la revendication 13, dans lequel le conducteur fusible est lié par ultrasons à chacun du fusible de liaison et du conducteur d'anode.
 16. Procédé de fabrication de condensateur à diélectrique solide et à fusibles, consistant :
 - (a) à utiliser un cadre conducteur monobloc comportant
 - (i) un premier bâti rigide de liaison de premières électrodes duquel partent plusieurs conducteurs espacés et rigides de premières électrodes ;
 - (ii) un bâti rigide et diamétralement opposé de liaison de secondes électrodes duquel partent des seconds conducteurs espacés d'électrodes,
 - (iii) plusieurs traverses rigides s'étendant entre le bâti de liaison de premières électrodes et le bâti de liaison de secondes électrodes, chacune desdites traverses s'étendant sensiblement parallèlement entre des paires d'un conducteur de première électrode et d'un conducteur de seconde électrode, adjacents, lesdites traverses étant sensiblement dans le même plan que ledit bâti de liaison de premières électrodes et ledit bâti de liaison de secondes électrodes, et
 - (iv) plusieurs fusibles rigides de liaison, chacun desdits fusibles de liaison s'étendant sensiblement perpendiculairement entre des traverses adjacentes et sensiblement dans le même plan que les traverses, chacun desdits fusibles de liaison étant situé entre le conducteur de première électrode et le conducteur opposé et correspondant de seconde électrode, une zone étant définie entre ledit fusible de liaison, les traverses et le bâti de liaison de secondes électrodes, laquelle zone est destinée à recevoir un corps de condensateur à diélectrique solide de manière qu'une première électrode du corps diélectrique de condensateur soit en communication électrique avec le fusible de liaison et qu'une seconde électrode du corps diélectrique de condensa-



teur soit en communication électrique avec le conducteur de seconde électrode, ledit fusible de liaison étant espacé du conducteur de première électrode et le conducteur de première électrode et le fusible de liaison étant tous deux destinés à recevoir des extrémités opposées d'un conducteur fusible ;

(b) à utiliser ledit corps de condensateur diélectrique ayant une première électrode et une seconde électrode ;

(c) à placer ledit corps diélectrique de condensateur dans ladite zone de manière que ladite première électrode soit en communication électrique avec ledit fusible de liaison et que ladite seconde électrode soit en communication électrique avec le second conducteur électrique ;

(d) à utiliser un conducteur fusible ayant deux extrémités opposées ;

(e) à placer ledit conducteur fusible sur ledit conducteur de première électrode et ledit fusible de liaison de manière que ledit conducteur de première électrode et ledit fusible de liaison reçoivent, et soient chacun en contact électrique avec, l'une, correspondante, desdites extrémités opposées dudit conducteur fusible ;

(f) à encapsuler ledit corps diélectrique de condensateur, ladite première électrode et des parties dudit conducteur de première électrode et dudit conducteur de seconde électrode avec une matière isolante formant une enveloppe isolante solide monobloc ayant une surface extérieure définissant une partie avant, une partie arrière, deux parties latérales, une partie supérieure et une partie inférieure, ledit corps diélectrique de condensateur étant entouré par ladite enveloppe isolante, ledit conducteur de première électrode et ledit conducteur de seconde électrode s'étendant à travers la surface extérieure de l'enveloppe isolante, et ledit fusible de liaison s'étendant entre les deux parties latérales de l'extérieur de l'enveloppe isolante ; et

(g) à sectionner ensuite ledit corps encapsulé dudit cadre conducteur.

17. Procédé selon la revendication 16, dans lequel

(i) le cadre de liaison de première électrode est un cadre de liaison d'anodes ;

(ii) le conducteur de première électrode est un conducteur d'anode ;

(iii) le conducteur de seconde électrode est un conducteur de cathode ;

(iv) le conducteur de seconde électrode est un conducteur de cathode ;

(v) le corps diélectrique de condensateur devant être reçu dans la zone définie par le fusible de liaison, des traverses adjacentes et le bâti de liaison de cathodes est un corps de condensateur électrolytique ayant un conducteur axial d'anode et une cathode sur une partie de sa surface extérieure ;

(vi) le fusible de liaison est destiné à recevoir le conducteur axial d'anode du corps de condensateur électrolytique ; et

(vii) le conducteur de cathode est destiné à entrer en contact avec au moins une partie de la cathode du corps de condensateur électrolytique.

18. Procédé selon la revendication 17, dans lequel le condensateur d'anode s'étend depuis la partie avant de l'enveloppe isolante et le conducteur de cathode s'étend à travers la partie arrière de l'enveloppe isolante.

19. Procédé selon la revendication 18, dans lequel le fusible de liaison est à découvert à chaque partie latérale de l'isolant.

20. Procédé selon la revendication 17, dans lequel le conducteur fusible s'étend en contact électrique entre le fusible de liaison et le conducteur d'anode.

21. Procédé selon la revendication 20, dans lequel le conducteur fusible est un fusible exothermique.

22. Procédé selon la revendication 21, dans lequel le fusible exothermique comprend du palladium et comporte une gaine extérieure en métal ou en alliage malléable pouvant être lié par ultrasons.

23. Procédé selon la revendication 20, dans lequel le conducteur fusible est lié par ultrasons à chacun des fusible de liaison et conducteur d'anode.

24. Procédé selon la revendication 17, dans lequel le fusible de liaison est d'une dimension suffisante pour supporter l'énergie générée par la liaison par ultrasons d'un conducteur fusible exothermique sans endommager le conducteur fusible.

25. Procédé selon la revendication 17, dans lequel l'anode axiale partant du corps de condensateur électrolytique est soudée au fusible de liaison et le fusible de liaison est d'une dimension suffisante pour supporter le soudage du conducteur axial d'anode partant du corps de



condensateur électrolytique sans déformation excessive du fusible de liaison au-delà de la soudure.

26. Procédé selon la revendication 17, dans lequel le fusible de liaison est d'au moins environ 0,05 millimètre d'épaisseur et environ 0,5 millimètre de largeur. 5
27. Procédé selon la revendication 17, dans lequel ledit cadre conducteur comporte au moins un corps de condensateur électrolytique comprenant un conducteur axial d'anode et une surface de cathode, lequel corps est positionné entre le fusible de liaison et l'élément de liaison de cathode et entre des traverses, et le conducteur axial d'anode est en contact électrique avec la traverse et le conducteur de cathode est en contact électrique avec au moins une partie de la surface de cathode du corps de condensateur électrolytique. 10 15 20
28. Procédé selon la revendication 27, dans lequel le cadre conducteur comporte au moins un conducteur fusible qui s'étend en contact électrique entre le fusible de liaison et le conducteur d'anode associé au ou à chaque corps de condensateur électrolytique. 25
29. Procédé selon la revendication 28, dans lequel le conducteur fusible est un fusible exothermique. 30
30. Procédé selon la revendication 28, dans lequel le ou chaque conducteur fusible est lié par ultrasons à chacun des fusible de liaison et conducteur d'anode associés au ou à chaque corps de condensateur électrolytique. 35
31. Procédé selon la revendication 28, dans lequel l'enveloppe isolante solide monobloc définit une limite encapsulant le corps de condensateur électrolytique et s'étend sur une partie du conducteur d'anode, une partie du conducteur de cathode, le conducteur fusible et une partie du fusible de liaison, et dans lequel les traverses, le bâti de liaison de cathodes et le bâti de liaison d'anodes sont à l'extérieur de la limite de l'enveloppe isolante solide. 40 45 50
32. Procédé selon la revendication 31, dans lequel le ou chaque conducteur fusible s'étend en contact électrique entre le fusible de liaison et le conducteur d'anode associés au ou à chaque corps de condensateur électrolytique. 55
33. Procédé selon la revendication 32, dans lequel le conducteur fusible est un fusible exothermique.

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34. Procédé selon la revendication 33, dans lequel le fusible exothermique comprend du palladium et comporte une gaine extérieure en métal ou en alliage malléable pouvant être lié par ultrasons.
35. Procédé selon la revendication 32, dans lequel le conducteur fusible est lié par ultrasons à chacun des fusible de liaison et conducteur d'anode.

