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3,534,146

DOUBLE SHIELDED RFI ENCLOSURE

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FIG. 1

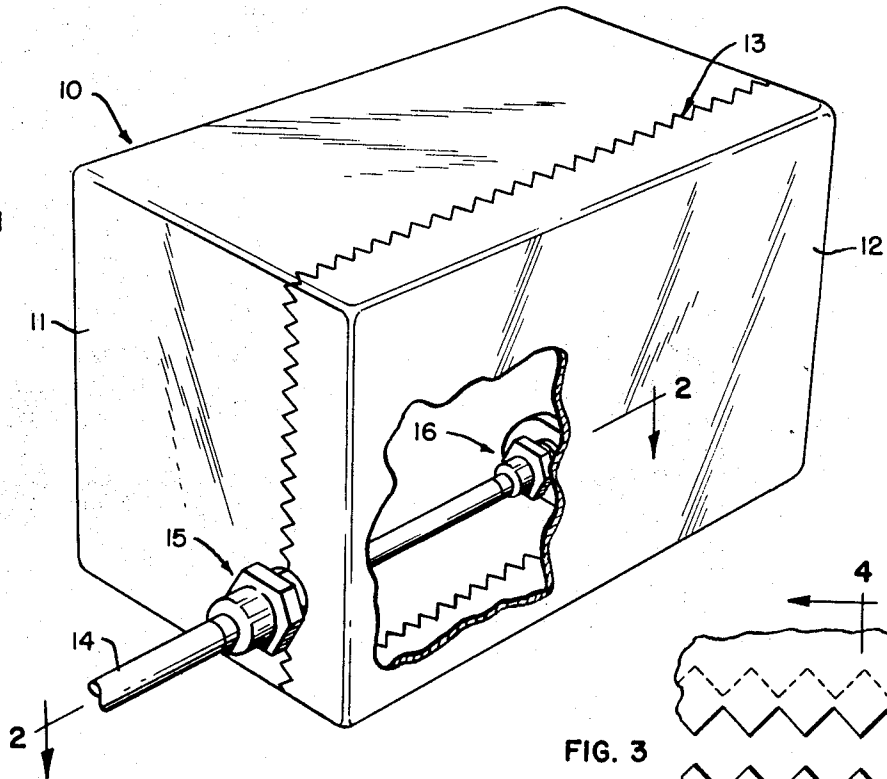


FIG. 3

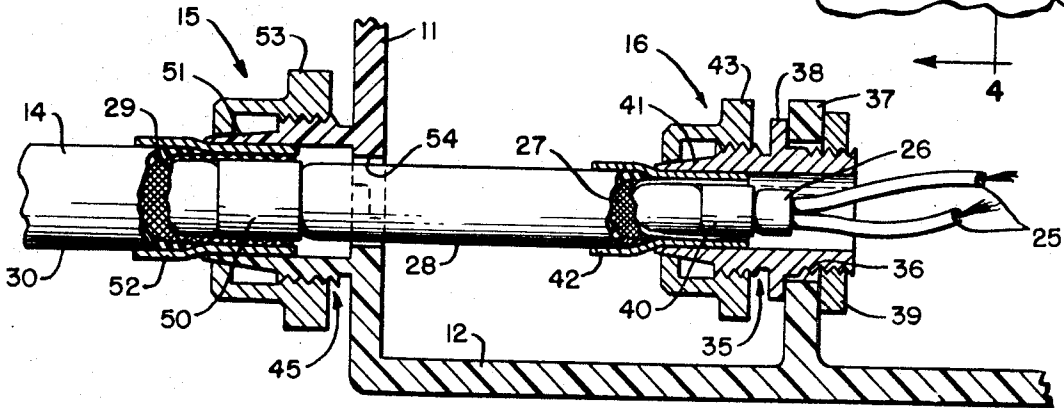
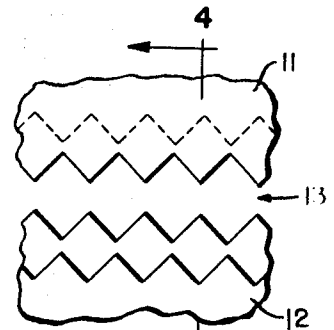


FIG. 2

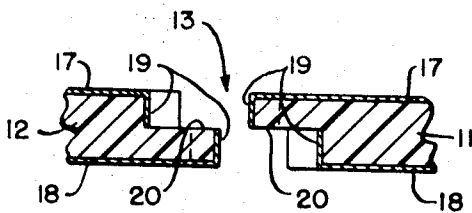


FIG. 4

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DOUBLE SHIELDED RFI ENCLOSURE

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4 Claims

ABSTRACT OF THE DISCLOSURE

A shielded enclosure comprises a container having disconnected layers of electrical shielding extending over its entire inner and outer surfaces and a closure for the container having similar layers of shielding extending over its entire inner and outer surfaces. A saw-toothed butt joint between the container and the closure electrically connects their respective layers of shielding. A length of double shielded electrical cable conveys electrical signals into the enclosure, and connectors are provided for connecting the inner and outer shields of the double shielded cable to the layers of shielding on the inner and outer surfaces of the enclosure, respectively.

BACKGROUND OF THE INVENTION

Recently the communications industry has been required to meet increasingly high standards of radio frequency interference suppression in the equipment it supplies to customers interested in communications security. Components utilized in large quantities in the equipment supplied to such customers have been specially designed so that they emit little if any radio frequency interference. Some components, however, are not utilized in sufficient quantity to warrant the type of complete redesign necessary to bring standard components within necessary radio frequency interference limits. Accordingly, a need exists for an enclosure for standard electrical components that sufficiently absorbs the radio frequency interference emitted from such components to meet modern radio frequency interference suppression requirements.

SUMMARY OF THE INVENTION

In the preferred embodiment an enclosure for electrical devices is comprised of a closed container having a layer of electrical shielding covering its entire inner surface and an electrically separate layer of electrical shielding covering its entire outer surface. Preferably, signals are conveyed to and from the enclosure by a double shielded cable, the inner shield of which is connected to the layer of shielding on the inner surface of the container and the outer shield of which is connected to the layer of shielding on the outer surface of the container.

DESCRIPTION OF THE DRAWING

A more complete understanding of the invention may be had by referring to the following detailed description when taken in conjunction with the drawings wherein:

FIG. 1 is a perspective view of a shielded enclosure employing the present invention in which certain parts have been broken away more clearly to illustrate certain features of the invention;

FIG. 2 is a sectional view taken generally along the line 2—2 in FIG. 1 in the direction of the arrows;

FIG. 3 is an enlarged view of a portion of the saw-toothed butt joint employed in the device shown in FIG. 1 in which the component parts are shown separated, more clearly to illustrate certain features of the invention, and

FIG. 4 is a sectional view taken along the line 4—4 in FIG. 3 in the direction of the arrows.

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DETAILED DESCRIPTION

Referring now to the drawings, wherein like reference numerals designate like parts throughout the several views, and referring particularly to FIG. 1 thereof, there is shown a shielded enclosure 10 comprised of a container member 11 formed from an insulative material and a cover member 12, also formed from an insulative material, that is joined to the container member 11 by a saw-toothed butt joint 13 to form a completely enclosed container. The container member 11 is covered by two electrically separate layers of shielding formed from electrically conductive plating, the first covering its entire inner surface and the second covering its entire outer surface. Likewise, the cover member 12 bears two electrically disconnected layers of shielding formed from electrically conductive plating, one covering its entire inner surface and the other covering its entire outer surface. The saw-toothed butt joint 13 connects the layer of shielding on the outer surface of the container member 11 to the layer of shielding on the outer surface of the cover member 12, and also connects the layer of shielding on the inner surface of the container member 11 to the layer of shielding on the inner surface of the cover member 12.

A double shielded cable 14 extends into the interior of the enclosure 10 and serves to convey electrical signals into and out of the enclosure. A pair of connectors 15 and 16 connect the outer shield of the double shielded cable to the layer of plating on the outer surface of the enclosure 10, and connect the inner shield of the double shielded cable to the layer of plating on the inner surface of the enclosure 10, respectively. Thus, components housed within the enclosure 10 and the leads extending thereto are completely surrounded by a double layer of electrical shielding, a technique that has been found to be the only reliable way of achieving radio frequency interference suppression.

The details of the saw-toothed butt joint 13 are illustrated in FIGS. 3 and 4 wherein the container member 11 and the cover member 12 are shown separated, more clearly to illustrate the details of the joint 13. As is shown in FIG. 3, the joint 13 is comprised of two rows of saw-toothed shaped projections, one of which is offset with respect to the other, so that the peaks of each row of projections are positioned in alignment with the valleys of the other row. This construction prevents the joint between the container member 11 and the cover member 12 from acting as a slot antenna that radiates signals generated by devices contained within the enclosure 10.

As is shown in FIG. 4, the layers of plating on the inner and outer surfaces of the container member 11 and the cover member 12, which are designated 17 and 18, respectively, extend onto the end surfaces 19 of the projections which comprise the joint 13. Therefore, whenever the cover member 12 is joined with the container member 11 to form the enclosure 10, the plating on the surfaces 19 operates to connect the layer of plating 17 on the interior of the container member 11 to the layer of plating 17 on the interior of the cover member 12 and, similarly, to connect the layer of plating 18 on the exterior of the container member 11 to the layer of plating 18 on the exterior of the cover member 12. Electrical separation between layers of plating 17 and 18 is assured by the absence of plating on the lateral surfaces 20 adjacent the end surfaces 19 of the projection comprising the joint 13.

Referring now to FIG. 2, the details of the double shielded cable 14 and of the connectors 15 and 16 are illustrated. The double shielded cable 14 includes a pair of insulated wires 25 which extend into the interior of

the enclosure 10 and operate to convey electrical signals into and out of the enclosure. The pair of wires 25 is surrounded by an inner insulative coating 26 which is in turn surrounded by an inner shield 27. The inner shield 27 is surrounded by an intermediate insulative coating 28 which is in turn surrounded by an outer shield 29. The outer shield 29 is surrounded by an outer insulative coating 30.

The pair of insulated wires 25 extend through a tubular member 35 which in turn extends through an aperture 36 formed through a finger 37 that extends from the interior of the cover member 12 and that is completely covered by the layer of plating extending over the interior of the cover member 12. The tubular member 35 is also completely covered by a layer of plating and is secured to the finger 37 by the cooperation of a shoulder 38 on the body 35 and a nut 39 that is threadably engaged with the tubular body 35. Thus, the layer of plating on the tubular body 35 is connected to the layer of plating on the interior of the cover member 12.

A first ring of deformable metal 40 is positioned within a tapered collar 41 of the tubular body 35 and is mounted on the double shielded cable 14 between the inner insulative coating 26 and the inner shield 27. A second ring of deformable metal 42 extends into the tapered collar 41 and is positioned on the double shielded cable 14 around the inner shield 27 and around the intermediate insulative coating 28 which is cut away from the inner shield 27 at point of entry on the double shield cable 14 into the tubular body 35. A jam nut 43 is threadably engaged with the tubular body 35 and operates to force the tapered collar 41 of the tubular body 45 into crushing engagement with the second ring of deformable metal 42, thereby forming an electrical connection between the layer of shielding on the tubular body 35 and the inner shield 27 of the double shielded cable 14. Since the layer of shielding on the tubular body 35 is electrically connected to the layer of shielding on the interior of the cover member 12, and since the layer of shielding on the interior of the cover member 12 is connected to the layer of shielding on the interior of the container 11 by the saw-toothed butt joint 13, the connection of the inner shield 27 to the layer of plating on the tubular body 35 operates in combination with the plating on the end surfaces 19 of the toothed projections comprising the joint 13 to join the inner shield 27, the layer of plating on the interior of the cover member 12 and the layer of plating on the interior of the plating member 11 into an integral electrical shield surrounding the entire interior of the enclosure 10.

The connector 15 is virtually identical to the connector 16 in that it is constructed around a tubular body 45 similar to the tubular body 35. A first ring of deformable metal 50 is positioned within a tapered collar 51 of the tubular body 45 and mounted on the double shielded cable 14 between the intermediate insulative coating 28 and the outer shield 29. A second ring of deformable metal 52 extends into the tapered collar 51 of the tubular body 45 and is positioned around the outer shield 29 and the outer insulative coating 30 which is cut away from the outer shield 29 at the point of entry of the double shielded cable into the connector 15. A jam nut 53 is threadably engaged with the tubular member 45 and operates to crushably engage the tapered collar 51 with the second ring of deformable metal 52.

The tubular body 45 of the connector 15 differs from the tubular body 35 of the connector 16 in that, rather than comprising a separate piece, it is comprised of two halves, one of which is formed integrally with the cover member 12 and the other of which is formed integrally with the container member 11. The two halves of the body 45 are joined together by a portion of the saw-toothed butt joint 13, and the interior of both halves of the tubular body 45 are coated with the electrical coating extending over the exterior of both the container member 11 and

the cover member 12. Therefore, the connector 15 cooperates with the shielding on the end surfaces 19 of the projections forming the saw-toothed butt joint 13 to connect the outer shield 29, the layer of shielding on the exterior of the container member 11 and the layer of shielding on the exterior of the cover member 12 into an integral electrical shield. The layer of shielding on the interior of the tubular body 45 does not extend onto the walls of an aperture 54 formed between the container member 11 and the cover member 12 and comprising a passageway for the double shielded cable 14 and, accordingly, does not form an electrical connection between the layer of shielding on the exterior of the enclosure 10 and the layer of shielding on the interior thereof.

Although only one embodiment of the invention is shown in the drawings and described in the foregoing specification, it will be understood that the invention is not limited to the specific embodiment shown but is capable of modification, rearrangement and substitution of parts and elements without departing from the spirit of the invention.

What is claimed is:

1. A shielded enclosure having two sections, which comprises:

a first section having inner and outer surfaces and an edge formed between the perimeters of the inner and the outer surfaces, and having two rows of saw-toothed shaped projections around the edge, one of which is offset with respect to the other;

first and second isolated electrical shields, the first electrical shield covering the entire inner surface, and the saw-toothed projections adjacent the inner surface, of the first section, and the second electrical shield covering the entire outer surface, and the saw-toothed projections adjacent the outer surface, of the first section;

a second section of the enclosure, which together with the first section forms a closed enclosure, having inner and outer surfaces and an edge formed between the perimeters of the inner and outer surfaces, and having two rows of saw-toothed shaped projections around the edge, one of which is offset with respect to the other and which are shaped to mate with the saw-toothed projections of the first enclosure section;

third and fourth isolated electrical shields, the third electrical shield covering the entire inner surface, and the saw-toothed projections adjacent the inner surface, of the second section, and the fourth electrical shield covering the entire outer surface, and the saw-toothed projections adjacent the outer surface, of the second section; and

means for maintaining the first and second sections in a closed relationship with each other so that the saw-toothed projections on each section contact each other and cooperate to form a joint between the sections to form a closed enclosure and to electrically interconnect the first and the third electrical shields and to electrically interconnect the second and the fourth electrical shields, so that the outer surface of the closed enclosure is a continuous electrical shield and so that the inner surface of the closed enclosure is a separate and continuous electrical shield.

2. The shielded enclosure as recited in claim 1, wherein both the first and second sections of the enclosure are formed from an insulating material, and wherein the electrical shields are both formed from electrically conductive plating.

3. The shielded enclosure as recited in claim 1, further comprising:

a length of double shielded cable extending into the enclosure for conveying electrical signals into or out of the enclosure; and

means for connecting the inner shield of the double shielded cable to the layer of shielding on the inner surface of the enclosure and for connecting the outer

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shield of the double shielded cable to the layer of shielding on the outer surface of the enclosure.

4. The shielded enclosure as recited in claim 3, wherein the connecting means comprises:

a tubular member of conductive material fastened to the container in electrical contact with a corresponding shield of an enclosure section, the cable passing loosely through the tubular member;

a ring of deformable metal positioned inside the tubular member and closely surrounding the corresponding shield of the cable, the cable being stripped to expose the corresponding shield at that point; and

means for forcing portions of the tubular member inward into crushing engagement with the deformable ring and the ring into electrical contact with the cable shield to thereby electrically connect the corresponding cable shield with the container shield.

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15 DARRELL L. CLAY, Primary Examiner

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174-65; 220-4; 325-357