

[54] STRAIN RELIEF AND GROUNDING DEVICE FOR SHIELDED ELECTRICAL CABLES

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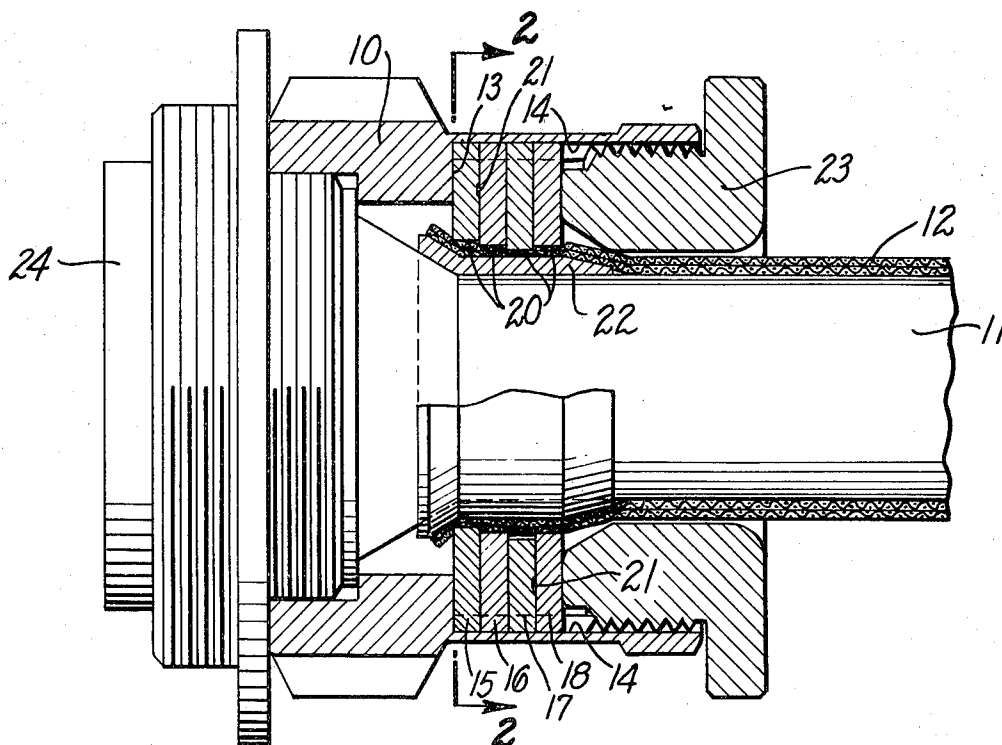
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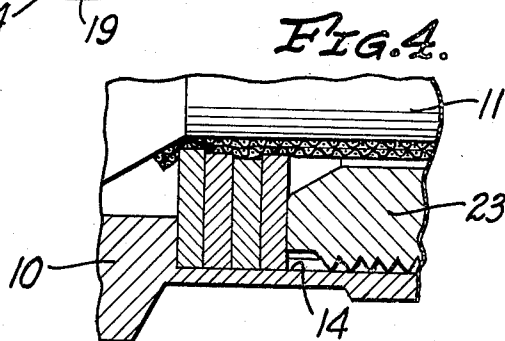
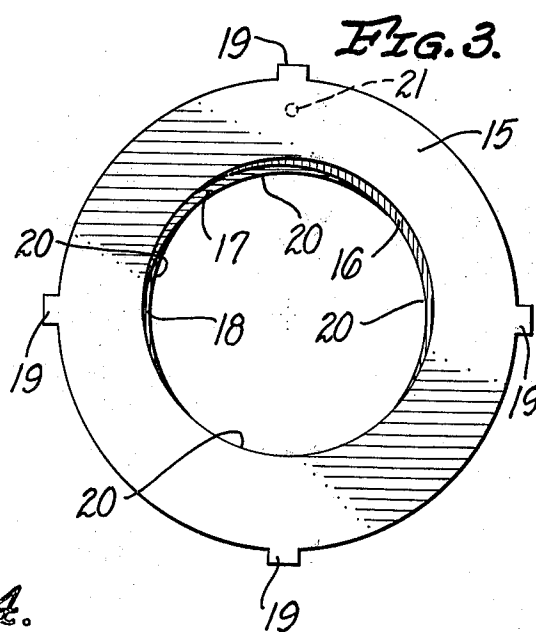
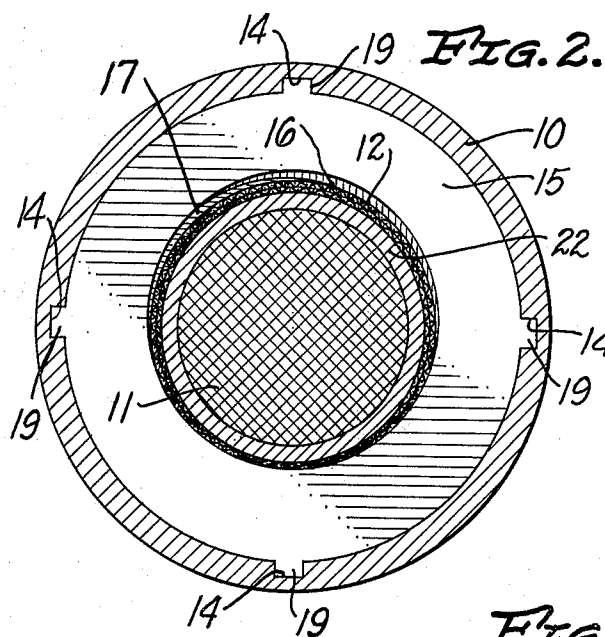
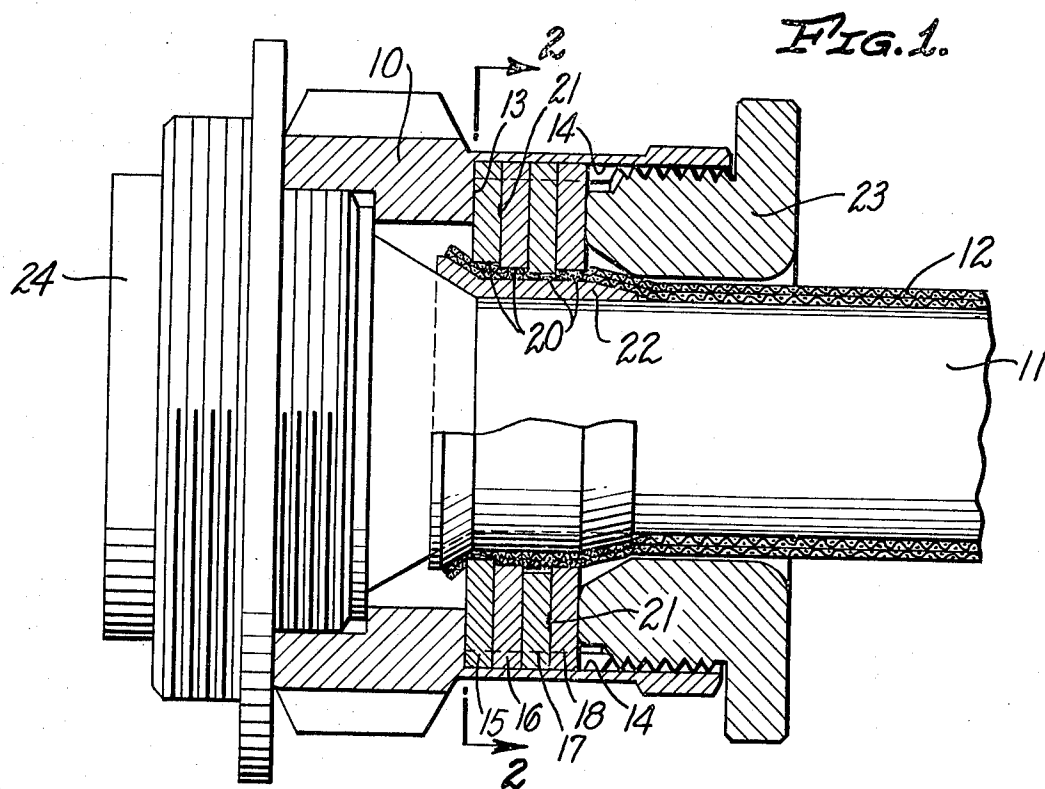
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[57] ABSTRACT

A strain relief and grounding device for shielded electrical cables. Four flat-sided metal rings are mounted within a housing surrounding the cable. Each of the rings has a circular opening therein which is eccentric with respect to its outer periphery. The rings are preferably oriented so that the opening of each ring is 90 degrees offset from the openings in each of the next adjacent rings. Four projections extending from the outer periphery of each ring are slidably mounted in slots formed in the housing to prevent rotation of the rings within the housing. The openings in the rings are sufficiently large to permit the cable to snake through them when the rings are loose. When the rings are tightened longitudinally into close proximity with each other, the combined opening extending through the rings is progressively reduced by radial diaphragmatic action of the offset openings, so that the inner peripheries of the rings form a tight locking and grounding engagement with the shielded exterior of the cable.

5 Claims, 4 Drawing Figures





STRAIN RELIEF AND GROUNDING DEVICE FOR SHIELDED ELECTRICAL CABLES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a strain relief and grounding device for shielded electrical cables.

2. Description of the Prior Art

Various types of connectors, adapters and "back-shell" devices are now in use for terminating and/or grounding shielded electrical cables. Many such devices include means for providing strain relief to prevent longitudinal movement of the cable with respect to the connector, adapter or bulkhead. Unless such strain relief is provided, the terminal connections may be broken when longitudinal strain is exerted upon the cable.

Most of the prior art strain relief devices comprise various tightening means which exert inward pressure upon the cable. Such devices customarily include O-rings, bushings, coil springs, etc. Bevelled surfaces are customarily utilized to reduce such springs or bushings diametrically in order to grip the exterior of the cable.

In wire cable harnesses, particularly air frame harnesses, metal braid shielding is used to prevent signals on the inside of the cable from being interfered with by signals on the outside of the cable bundle. It is becoming more difficult to accomplish this shielding effectively due to the sensitivity of current day instrumentation. In addition to the normal types of interference, it is sometimes required that critical lines be shielded from a force called Electro-Magnetic Pulses (EMP). These pluses are generated from nuclear explosions. They precede the shock wave in great magnitude and have been known to reach an excess of several thousand volts. To best shield from these effects, a low DC resistive path is required between the aircraft ground and the shield of the cable run.

Present day means of shielding are inadequate for EMP. A current popular design conforms a metal ring around the braid in an electro-forming process, in which the two metals flow together. Functionally, the design is highly desirable, but does not permit any subsequent changes or modifications.

SUMMARY OF THE INVENTION

The present invention provides a unique type of strain relief and grounding for electrical cables which does not include any resilient means of any kind and which does not employ diametric compression of the type customarily used. There are no bevels and no compressible members involved, with inward pressure on the cable being achieved in an entirely different and novel manner.

The invention contemplates the use of a plurality of rings having central circular openings through which the cable passes. The openings of the rings are offset with respect to each other. When the rings are loosely disposed within the connector assembly, the cable is easily threaded through the rings. When the rings are brought into tight proximity with each other, the combined effect of the eccentric openings being disposed directly adjacent to each other is to effectively reduce the diameter of the cable receiving opening and thereby exert inward pressure on the cable to grip it firmly between the rings and thereby provide the de-

sired strain relief and electrical grounding of the cable shield.

It is accordingly among the objects of the invention to provide a strain relief and grounding assembly for electrical cables having all of the advantages and benefits of the structure set forth above and described in greater detail hereinafter in this disclosure.

Another object of the invention is to provide such a device which utilizes no compressible or resilient members of any kind.

A further object is to provide a device or the class described which utilizes offset or eccentric openings around the cable to provide the desired compressive or gripping effect.

It is another object of the invention to provide a strain relief assembly which is capable of withstanding a larger amount of pull or strain than conventional devices of the type now in use.

Another object of the invention is to provide a device of the type described which is substantially impervious to adverse temperature conditions because it utilizes no non-metallic materials, which are particularly affected by such conditions.

Still another object of the invention is to provide a structure which is simple and economical to manufacture and to use and which may be easily assembled and disassembled for installation, repair and replacement purposes.

The invention also comprises such other objects, advantages and capabilities as will later more fully appear and which are inherently encompassed by the invention.

While I have shown in the accompanying drawings a preferred embodiment of the invention, it should be understood that the same is susceptible to modification and change without departing from the spirit of the invention.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinally sectional view showing the strain relief and grounding assembly in use in a connector;

FIG. 2 is a transverse sectional view of the same taken on line 2—2 of FIG. 1;

FIG. 3 is a transverse sectional view showing the locking rings only;

FIG. 4 is a partial sectional view similar to FIG. 1, with the compression collar omitted.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment which has been selected to illustrate my invention comprises a housing 10 having a central circular opening through which an elongated electrical cable 11 or wire bundle is adapted to extend. The exterior of the cable 11 is customarily provided with a braided wire ground shield 12 for electrical isolation purposes.

The interior of the housing 10 is provided with a radial wall 13, against which the inner sidewall of the innermost compression ring is adapted to be disposed in use. The interior of the housing 10 extending outwardly from the radial wall 13 is provided with four longitudinally directed slots 14, which are spaced 90° apart from each other around the opening which receives the cable 11.

A preferred embodiment of the invention utilizes four compression rings 15, 16, 17 and 18 respectively. The compression rings 15-18 are all identical in construction and are shown separately in FIG. 3 of the drawings. Each of the compression rings preferably has four tabs 19 which are disposed 90° apart from each other around its periphery. The tabs 19 are formed complementarily to and are adapted to slidably extend within the slots 14 in the housing 10.

Each of the compression rings 15-18 also has a circular opening 20, which is slightly eccentric or offset with respect to the center of the ring. Each ring also has an index mark such as a dot 21 or a color or other suitable means for indicating the orientation of the opening 20.

A tubular metallic compression collar 22 may be used and is adapted to be mounted between the end portion of the ground shield 12 and the cable 11. The collar 22 provides a rigid surface for the compression rings 15-18 to grip against. A jam nut 23 is threadedly mounted on the end of the housing 10 and has its inner end bearing against the side wall of the outermost compression ring 18.

In use on a connector, before the wires are terminated, the ground shield 12 of the cable is cut approximately 1/2 inch back from the wire ends. The jam nut 23 is the first part to be slipped over the cable 11. The compression rings 15-18 are then slipped on the cable 11. The last part to be slipped over the cable 11 is the housing 10. The wires of the cable assembly are then passed through the compression collar 22, with the ground shield 12 being slid over the outside of the collar 22.

Everything is now ready for completion of the final assembly. The wires are inserted into the terminating connector 24. The housing 10 is then threadedly attached to the connector 24. The compression rings 15-18 are then sequentially moved into place within the housing 10, with their projections 19 being slidably disposed of within the slots 14. The rings 15-18 are spaced slightly apart from each other before longitudinal pressure is exerted against them by the jam nut 23.

The innermost compression ring 15 is preferably oriented so that its dot 21 is disposed upwardly at a 12 o'clock position. The second ring 16 preferably has its dot 21 at a 9 o'clock position. The third ring 17 has its dot 21 at 6 o'clock and the fourth ring 18 at 3 o'clock. When the rings 15-18 are so disposed, their central circular openings 20 are 90° eccentric or offset with respect to the openings in each of the next adjacent rings. Each opening 20 is 90° offset from two of the other openings and 180° offset from the remaining opening.

As the rings 15-18 are moved into place within the housing 10, the compression collar 22 is free to tip or cant in one direction or the other in order to accommodate the eccentricity of the openings 20.

The jam nut 23 is then tightened on the housing 10, exerting longitudinal pressure against the sides of the compression rings 15-18, the side walls of which are moved tightly against each other and gripped between the inner end of the jam nut 23 and the radial wall 13 of the housing 10. This reduces the overall diametric size of the cable receiving opening in what may be termed a diaphragm action. Each of the compression rings 15-18 partially reduces the diameter of the cable opening along one quadrant and the overall effect is to reduce the size of the opening along all four quadrants.

It should be noted that the compression is spaced equally throughout the four compression rings 15-18. The cable shield 12 is squeezed between the compression collar 22 and the inner peripheral edges of the rings 15-18. The outer peripheral edges of the rings 15-18 are at the same time forced outwardly against the housing 10. This results in an extremely low electrical impedance or resistance path being formed between the ground shield 12 and the housing 10.

Because all of the parts of the strain relief assembly are formed of rigid metallic material, rather than resilient materials, it provides a stronger and more secure grip on the cable 11 and is capable of resisting a large amount of longitudinally directed pulling pressure exerted on the cable 11.

It should further be noted that there is no problem of failure of a resilient member in adverse temperature or other ambient conditions, as is likely to occur with O-rings and other resilient materials. In extreme temperature conditions, the compression rings will not deteriorate and all parts of the assembly will expand or contract substantially simultaneously.

The strain relief and grounding structure may be disassembled as required for repair and replacement purposes. It causes no damage to the cable 11 or ground shield 12 and the re-assembly process shows no degenerating effects.

The structure shown and described comprises a preferred embodiment of the invention because of its balanced and uniform gripping action. It is quite possible, however, to practice the invention with a smaller or larger number of compression rings. It is also possible to vary the size, shapes and relationships of the openings in the rings. It is essential that only two or more openings be provided in rings or any other suitable members and that such openings be eccentric or offset with respect to each other so that when they are disposed adjacent to each other they present a combined opening of smaller diameter which exerts a gripping action upon the periphery of the cable.

It should also be noted that a lesser number of slots 14 and tabs 19 may be used. In fact, one slot and tab would be sufficient to maintain the orientation of the compression rings.

I claim:

1. A strain relief and grounding assembly in combination with a shielded electrical cable, said assembly comprising a substantially cylindrical housing having an electrically conductive inner wall, four electrically conductive rings having equal outer diameters substantially corresponding to the inner diameter of said housing, said rings being mounted for longitudinal movement within said housing, stop means within said housing for limiting the longitudinal movement of said rings within said housing, said rings having openings therein of equal diameter which are slightly larger than the outer diameter of said cable, the opening in each of said rings being out of alignment with the openings in all of the other rings when said rings are mounted in said housing, said cable being movable through the openings in said rings when said rings are spaced apart from each other within said housing, and means exerting pressure against the opposite sides of said rings to move said rings into substantially adjacent relationship with each other so that the openings of said rings form a single combined opening of smaller diameter than the outer diameter of said cable, the inner peripheries of

said rings being thereby held in tight engagement with the shielding of said cable at four different places spaced around the periphery of said shielding to provide simultaneous strain relief and electrical grounding of said cable, the compressive and strain relief force being divided between all of said rings.

2. The structure described in claim 1, the opening in each of said rings being 90° offset from the openings in two of said other rings and 180° offset from the opening in the third of said other rings, whereby said rings engage the periphery of said cable along four areas disposed 90° apart from each other, so that the compressive and strain relief force is equally divided between

all four of said rings.

3. The structure described in claim 2, the opening in each of said rings being offset 90° from the openings in each of the next adjacent rings.

4. The structure described in claim 3, and means for holding said rings in proper orientation with respect to each other, said means comprising tabs and notches interengaged between said rings and said housing.

5. The structure described in claim 2, and indicia carried by each of said rings for indicating the positioning of the opening in said rings, so that said rings can be properly oriented in said assembly.

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