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COAXIAL CABLE CONNECTOR

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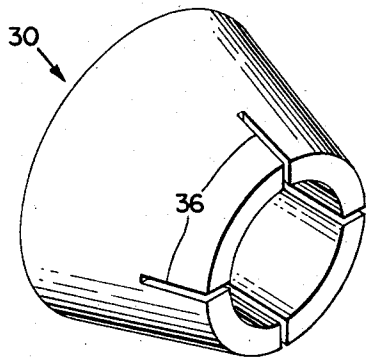


Fig. 2

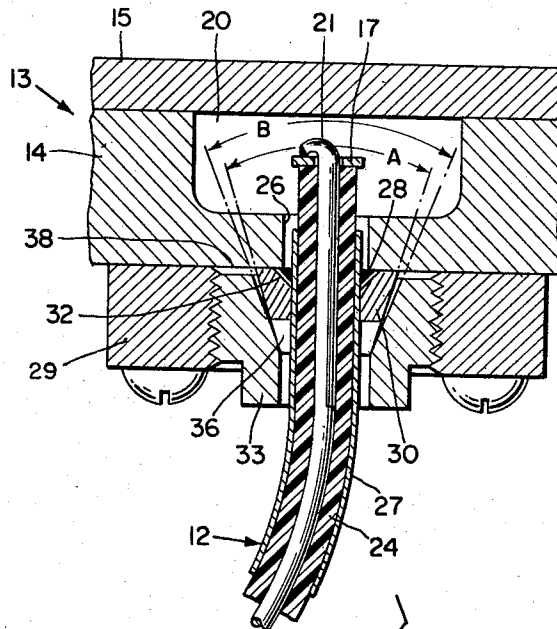
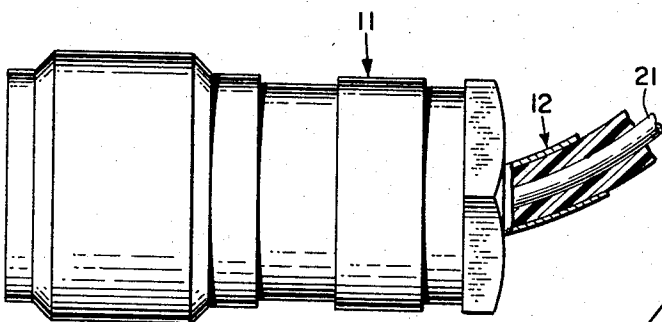


Fig. 1



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COAXIAL CABLE CONNECTOR

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ABSTRACT OF THE DISCLOSURE

This is an apparatus for electrically connecting a coaxial cable to a strip transmission line located within a hollow casing composed of electrically conductive material. The cable is secured to the casing by a split conical clamping ring forced against the outer conductor of the cable by a nut having a threaded exterior and a conical interior recess.

The present invention relates in general to electrical cable connectors and more particularly to a method and means for connecting coaxial cable directly to stripline circuitry.

In applications making use of waveguides, such as in radar systems which may or may not incorporate a harmonic generator, it is frequently desirable and perhaps necessary to directly connect coaxial cables to members in a waveguide and to do so in closely confined areas. Such members may take the form of striplines or microstrips which are a special form of microwave transmission line and can replace conventional waveguide lines in certain applications. The microstrip or stripline principle would involve the use of a conductor substantially centrally positioned in a waveguide, and the conductor may be circular, tubular, flat or of other conventional shape.

Mechanical problems of alignment of such a strip and support thereof are encountered and have to a somewhat less than satisfactory degree been accommodated by inserting a flat dielectric between a flat stripline and the ground plane conductor of the waveguide or supporting a conductor above the ground plane by spaced posts and using air as a dielectric. Present devices and methods for connecting a conductor to such internally disposed strips through the use of conventional coaxial connectors are extremely cumbersome, and awkward and usually result in distortion of the coaxial cable among other deficiencies.

The present invention overcomes the deficiencies and disadvantages of prior devices and provides a simplified but reliable method and device for attaching coaxial or similarly constructed cable to a case such as that of a frequency doubler within which the inner conductor of the coaxial cable may also be attached. Although the present invention as shown in the drawing and described is referred specifically to a direct coaxial connection to a stripline in a distributed constants circuit such as in a harmonic generator for a radar, it will be appreciated that the teaching will find application in other similar electrical work areas. The connection between cable and cases provided by the present invention is sturdy and firm utilizing a minimum space and equipment and eliminating the impedance of ordinary connectors.

Accordingly, it is an object of the present invention to provide a method and device for connecting a coaxial cable to an internally disposed strip member wherein a sturdy mechanical and electrical connection is effected so as to resist separation due to mechanical stress and vibration.

It is another object of the present invention to provide a method of and means for connecting a coaxial cable

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to stripline circuitry without the need for additional support members.

It is a further object of the present invention to provide a coupling for coaxial cables and stripline circuitry which eliminates the impedance of conventional connectors.

It is a still further object of the present invention to provide a coupling for coaxial cables and stripline circuitry in which distortion to any significant degree is avoided.

Other objects and many of the attendant advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing in which:

FIG. 1 is a side elevation partially in section of one embodiment of the present invention; and

FIG. 2 is an enlarged perspective view of the cable engaging clamp ring illustrated in FIG. 1.

Referring now to the drawings, FIG. 1 shows a conventional coaxial connector 11 from which projects a coaxial cable 12 for attachment in some applications to equipment located in confined spaces. Such equipment may be a frequency doubler as is generally indicated at 13 comprising a casing 14 and a cover 15, although it will be appreciated that the connection may be to any of a variety of electrical equipment, terminals, sockets, etc. and especially where these items are located in crowded environments. In the frequency doubler 13 shown, there may be located a centrally disposed longitudinally extending member such as strip or stripline 17 extending perpendicular to the plane of the drawing in cavity or chamber 20, such a strip alternately being referred to as a microstrip. Frequency doubler 13 is shown in transverse section with the section being taken at the center of an opening in the base of casing 14 through which a cable such as 12 may be inserted. The cable 12 shown is sectioned to its inner conductor 21 which inner conductor may traverse stripline 17 and be attached to the remote side thereof by such means as soldering, spot welding or other affixing means. In the present embodiment conductor 21 traverses a hole in the stripline, however, it should be realized that the conductor could extend through a longitudinal or transverse slot in the stripline or be disposed over the edge thereof within the concept of the invention.

The coax dielectric 24 of cable 12 performs a unique function in the present invention, that of providing support or at least partial support for stripline 17 in addition to its function as electrical insulation. To provide such support, dielectric 24 is selectively removed from conductor 21 near the end thereof so that a desired length of the dielectric extends within chamber 20 when cable 12 is held in place. The portion of dielectric 24 removed is selected so as to present a surface against which stripline 17 may abut thereby supporting the stripline to the maximum extent. When the end of conductor 21 extending beyond stripline 17 has been soldered or otherwise affixed to the surface of the stripline opposite that against which dielectric 24 abuts, stripline 17 is not only provided with support but is held in position in a generally secure manner. The generally secure manner may be enhanced by applying pressure to stripline 17 at the time conductor 21 is affixed to it thereby causing dielectric 24 to bind against one surface of stripline 17.

Stripline 17 may, or may not be supported at additional spaces longitudinally displaced from the point of support of dielectric 24 either by the dielectric of other cables, not shown, or by conductive or nonconductive supports, not shown, disposed within chamber 20 and connected to or through the walls of chamber 20.

Opening 26 is provided in casing 14 to accommodate cable 12 which comprises conductor 21, dielectric 24 and

conductive sheath or outer conductor 27. With cable 12 properly centered in opening 26, sheath 27 is affixed to casing 14 preferably by welding as shown at 28 although other means such as soldering may be utilized within the concept of the invention. With cable 12 affixed to casing 14, a fitting such as collar 29 is secured to casing 14 to provide means for firmly securing the cable to the casing. To provide for both a firm and compact assemblage, a fitting such as clamp ring or wedge member 30 shown in FIG. 2 is used and preferably is positioned over cable 12 before the cable end is inserted through opening 26. Clamp ring 30 has an inner diameter substantially equal to the outer diameter of sheath 27 and preferably is chamfered or otherwise cutaway as indicated at 32 so as to clear the fillet of weld or solder 28 when the upper surface of clamp ring 30 abuts against casing 14. The assemblage components further include means for compressing wedge member 30 against cable 12, without undesirable deformation of the cable, which means may be in the form of nut 33 which is turned into collar 29 or other similar means for tightening wedge member 30 against cable 12. Nut 33 and wedge member 30 form a collet which serves to secure the joint or assemblage against loosening by vibration or mechanical stress. Wedge member 30 may be notched as indicated at 36 to permit it to bend inward and grip cable 12 upon tightening of nut 33. Gripping of cable 12 is enhanced by having the taper angle A of the outer surface of wedge member 30 smaller than a complementary taper B of the inner surface of nut 33.

Wedge member 30 may be of any material suitable to the purpose to be served, and in the present embodiment is of stainless steel since the outer sheath 27 of cable 12 is made of metal. In other applications wedge member 30 may be made of rubber or plastic or similar materials, but in each instance cutting or notching as indicated at 36 will enhance yet control the amount of compression of cable 12. Such control is achieved also by configuring nut 33 to a selected length axially so that it will bottom against flange 38 of casing 14 before cable 12 is distorted to such an extent as to possibly cause malfunctioning.

The taper angles A and B thus provide for a desired, limited extent of gripping of cable 12 by wedge member 30 since, when nut 33 is tightened, it will bear upon the smaller cone of wedge member 30 causing the slots 36 to be closed and forming a virtually complete circle of contact between the two members. It is apparent that other similar methods may be used to accomplish this result, such as having the smaller half of the cone of wedge member 30 formed of a less rigid substance than the larger half of the cone or weakening the smaller half cone along selected lines or other such means and methods within the scope of the invention. Where the smaller half of the cone of wedge member 30 is compressed by nut 33 there will remain a separation between these components at their bases due to the difference in conical angle of the respective surfaces. Such separation decreases linearly to the point of contact of the inner surface of nut 33 and the outer surface of wedge member 30. By having the smaller half of the cone of wedge member 30 compressible or reducible in diameter, the action of nut 33 in being tightened is to displace the smaller cone half laterally with respect to the direction of travel of nut 33 thereby providing the gripping heretofore described without a consequent or related movement of cable 12. Such a movement of cable 12 would be undesired in the present embodiment since, among other reasons, it would cause a displacement of stripline 17 which could appreciably affect the functioning of the frequency doubler.

It will therefore be appreciated that the present invention provides a novel means and method for connecting coaxial members with casings where in the end of the coaxial member is to be disposed in a selected position within the casing. The teaching provides for a firm attachment between cable and casing so as to resist loosening or weakening of the juncture and yet not undesirably

distort the cable. Of special significance are the compactness and relative simplicity of the components of the invention which render it particularly useful in restricted areas.

It will be recognized that many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

We claim:

1. Apparatus for electrically connecting a coaxial cable to a strip transmission line located within a hollow casing composed of electrically-conductive material, the connection of said cable and said transmission line being such that the latter is at least in part supported and positioned by abutting the dielectric material of said cable after the connection is made, said casing having an opening therein through which a terminal portion of said cable extends, the outer conductor of said coaxial cable being securely affixed by welding to the material of said casing in the region where said cable extends through said opening so as to establish an electrical connection therebetween, such terminal cable portion being bared to expose the inner conductor thereof and with the latter projecting beyond the region of abutment of said transmission line on said cable dielectric material and being electrically connected to said transmission line, said apparatus comprising:

a threaded collar secured to the exterior of said casing and aligned with said opening;

an externally-tapered one-piece clamping ring encircling said cable, said ring having an inner diameter substantially equal to the outer diameter of said cable and being positioned so that the larger conical end thereof rests against the exterior of said casing, the larger conical end only of said one-piece ring being formed with an annular recessed interior edge portion designed to receive the annular welding bead formed when the outer conductor of said cable is securely affixed to the material of said casing in the region of said opening, the smaller conical end only of said one-piece ring being slotted axially to permit an inward compression of the material of which said ring is composed, said ring being generally located within the region enclosed by said collar but spaced apart therefrom;

a threaded nut of annular form receivable in the region between said ring and said collar for threaded engagement with the latter, said nut encircling said one-piece ring and acting, when tightened, to compress said ring against the outer conductor of said cable by tending to close the axial slots in the smaller conical end of the ring, thereby effecting electrical engagement between said casing and the outer conductor of said cable through the material of which said ring is composed.

2. Apparatus in accordance with claim 1, in which said nut has an inner surface area at least a portion of which is tapered for engagement with the said externally-tapered clamping ring, the taper angle of the nut surface being larger than the taper angle of the complementary surface of the clamping ring.

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