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ELECTRICAL CONNECTORS FOR COAXIAL CABLES

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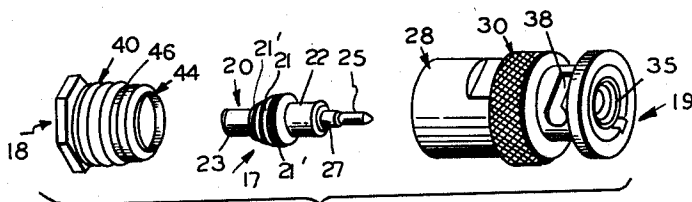


FIG. 1

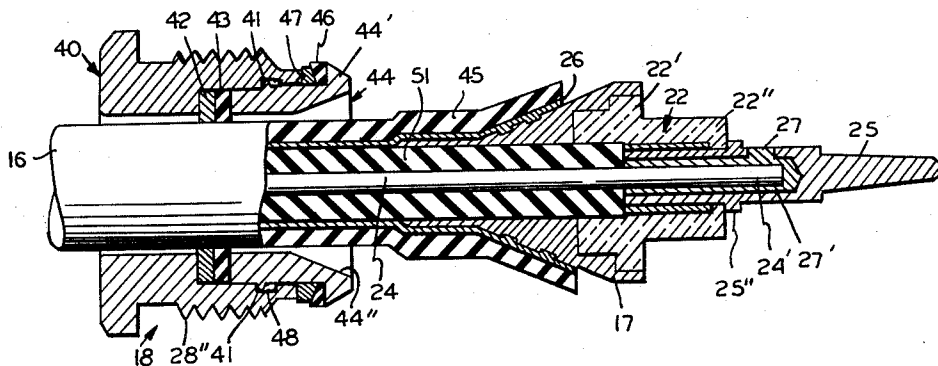


FIG. 2

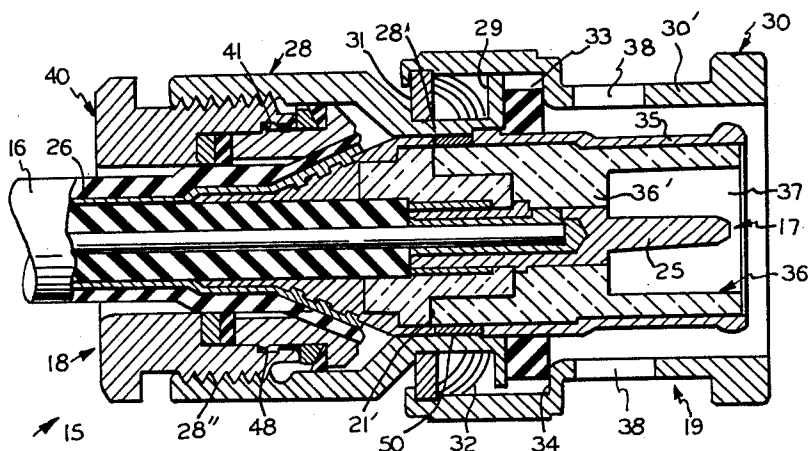


FIG. 3

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ELECTRICAL CONNECTORS FOR COAXIAL CABLES

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The present invention relates to electrical connectors for solid dielectric-filled coaxial cables and more particularly to the connector to be carried by an end of such cable for detachable connection to a mating terminal on a wave signal apparatus or another cable end.

An object of this invention is to provide a novel and improved connector of the class mentioned, which securely clamps the cable without indentation of the cable dielectric and hence without disturbance of the cables impedance characteristic. As to strength of the joint, that afforded by this connector when cable diameter is up to about one-quarter inch, is sufficient to withstand a pull on the cable greater than the inherent cable strength.

Another object thereof is to provide a novel and improved connector construction of the character set forth, affording an effective seal against liquid and gas seepage at the clamping end. This is accomplished by gaskets associated with means whereby their compression is controllable, and further, the structure is such that said gaskets automatically effect a lock-nut action thereby avoiding any loosening of the locking member of the connector.

A further object thereof is to provide a connector of the type described, which requires no special tools for assembly, which can be removed and its clamping parts reused and which needs no combing, trimming or removal of the braid outer conductor or of the dielectric therewithin, in preparation to mount the conductor onto the cable end.

Still a further object of this invention is to provide a novel and improved connector of the kind described, having the mentioned attributes and which is reasonable in cost, simple and easy to manipulate in mounting it or removing it and efficient in carrying out the purposes for which it is designed.

Other objects and advantages will become apparent as this disclosure proceeds.

For the practice of this invention, my new connector consists of three unitary parts, namely a body assembly, a contact wedge assembly and a clamp and seal assembly. I may here mention that the cable end on which the connector is to be mounted, is trimmed to expose a short extending length of its axial conductor. Also that the clamp and seal assembly is set as a sleeve on the cable away from its trimmed end. The contact wedge assembly is forced onto the cable end and includes a metal funnel-shaped part which enters into the tubular braid conductor of the cable while the exposed axial conductor piece is received into the end of a hollow metal pin insulatively carried within said funnel-shape, thus effecting electrical connection with the cable's conductors. The clamp and seal assembly is brought to receive said funnel-shape inside of it whereby a part of the last mentioned assembly cooperates with said funnel-shape to act as a clamp; such part also offering a stop to limit the extent sealing gaskets are compressed so as to avoid indentation in the cable. The body assembly receives said contact pin to extend axially within a tubular terminal and the clamp and seal assembly is threadedly coupled to said body assembly to form the connector into one structure. Other incidents of structure and a more detailed description of a preferred embodiment of this invention will now be set forth.

In the accompanying drawing forming part of this specification, similar characters of reference indicate corresponding parts in all the views.

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FIG. 1 is an "exploded" view showing the three assemblies which comprise a preferred embodiment of this invention, drawn in perspective.

FIG. 2 is an enlarged central section showing the contact wedge assembly mounted on the end of a cable which already carries the clamp and seal assembly.

FIG. 3 is a section like FIG. 2, showing the connector mounted for use.

In the drawing, the numeral 15 designates generally the connector mounted at the end of a coaxial cable denoted generally by the numeral 16. The three principal parts of said connector are a contact wedge assembly indicated generally by the numeral 17, a clamp and seal assembly denoted generally by the numeral 18 and a body assembly shown generally by the numeral 19.

The contact wedge assembly 17 here shown, consists of a metal funnel-shaped element designated generally by the numeral 20, whose stem is empty, but its frusto-conical tubular part 21 fixedly holds a dielectric piece 22 through which is axially mounted a metal pin 25 extending outwardly of part 21, the supported portion of said pin being hollow and open at pin end which faces the stem 23 of said funnel-form. Let us consider for a moment that the clamp and seal assembly 18 which is a tubular structure, is set as a sleeve on the cable 16 away from the cable's end, where the cable has been trimmed to present a short length 24' of its axial conductor 24. Now, admit the cable's end into the hollow tubular stem 23 of the funnel-form so that the bare central wire piece 24' enters the hollow in said pin 25 and the funnel stem 23 shall enter the outer tubular braided conductor 26 of the cable until nearly the entire frusto-conical part 21 is within said hollow conductor to contact same. The bore in the pin 25 is somewhat of greater diameter than that of the conductor 24 away from the entrance to said bore, so that the resulting interior space can be filled with solder 27' applied through the gate hole 27 in the exposed pin body. Thus the contact wedge assembly is firmly secured to the cable and electrical connection is made with the respective conductors 24 and 26 to the insulated parts 25 and 20 of the said contact wedge assembly.

The body assembly 19 here shown, includes a tubular member 28 having a reduced end 28' which terminates in an outward flange 29. The larger portion of said tubular member 28 is interiorly threaded as indicated at 28". Said body assembly has another tubular member 30 having a reduced end 30'. The larger end of member 30 is provided with an inner flange 31. Said tubular members 28 and 30 are telescopically associated and relatively turnable; the flange 29 being within the larger portion of the tubular member 30. Resilient ring means 32 between said flanges, contact the same and acts to keep them apart whereby the flange 29 acts against a rubber sealing ring 33 which is against the step 34 within the tubular member 30. The rim region 21' of the funnel-shape 20 is cylindrical and is in fitting contact with the interior surface of the reduced portion 28' of the tubular member 28. There is a tubular extension 35 fixed at the flanged end of the tubular member 28 and is an extension thereof extending to near the open end of the tubular member 30. The sealing ring 33 fits on said tubular extension and such extension 35 is lined with a dielectric sleeve 36 having an integral partition 36' therein which creates the socket 37; said partition having a central opening therethrough in and through which the pin 25 fits when the body assembly 19 is set to receive the contact wedge assembly 17. It is evident that said metal pin 25 serves as the connector's terminal of the axial conductor 24 and that the metal tube 35 is the terminal of the tubular conductor 26 of the coaxial cable 16. L-slots 38 in the tubular part 30 which swivels, are

for bayonet joint connection of the connector 15 to its mating part on apparatus or wire end to which the cable 16 is to be electrically connected to.

The clamp and seal assembly 18 here shown, includes a tubular screw 40 for engagement with the thread 28" of the tubular member 28 whereby the connector 15 is made an assembled unit as shown in FIG. 3. This tubular screw fits loose on the cable 16 and is counter-bored from the end thereof which enters said member 28. The interior wall of such counter-bore is provided with an annular groove 41, away from the seat of such counter-bore. A washer 42 rests against such seat and there is a ring gasket 43 resting against said washer, away from said groove 41. Said clamp and seal assembly also includes a ring 44 which extends part of its length into said counterbore in the tubular screw 40, rests against said ring gasket 43 and extends out of such counterbore and terminates here in an outward flange 44'. The flanged end of this ring 44 is flared at 44" to cooperate with the frusto-conical part 21 to clamp the cable's tubular conductor 26 and the outer insulation covering 45 between them. The surface of said part 21 may be serrated as shown at 21' to aid the clamping action which occurs upon the assembly of the connector 15 on the cable's end as shown in FIG. 3. Against the back of the flange 44' there is a gasket ring 46 and against such gasket there is a washer 47 adapted to be contacted by the inner end ring face of the tubular screw 40. A protuberance 48 which may be an outward bead on said clamping ring 44, extends into the annular groove 41 to maintain the assembly of the components of the clamp and seal assembly 18 and limit the relative sliding movement of the parts 40 and 44. The gasket rings 43 and 46 are under compression, in FIG. 3.

The manner of mounting the connector parts 18 and then 17 onto the cable 16 as shown in FIG. 2, has already been set forth. Now take the body assembly 19 set it to house the contact wedge assembly 17 whereupon the contact pin 25 will slide fit in the central hole through the dielectric partition 36' and extend into the socket 37. Then bring the lock and seal assembly 18 towards the body assembly 19 and turn the tubular screw 40 to engage the threads 28" thereby drawing said lock and seal assembly 18 into said body assembly 19 which will cause the flared end of the tubular conductor 26 and its outer insulation covering 14 to be securely clamped and will cause further compression of the ring gaskets 43 and 46 to effect seals. It is important to note that during such screw-in of the tubular screw 40, the side wall 41' of the groove 41 will intercept the bead 48 on the clamping ring 44, after which upon further movement of said tubular screw into the body assembly member 28, clamping action by the clamping ring 44 will increase, but there will be no further increase in the compression of the gasket rings 43 and 46. This provision is made particularly so that the gasket ring 43 shall not press so hard against the cable 16 as would cause indentation of the dielectric 12 which is to be avoided in order not to impair the impedance characteristic of the cable 16. Further note that said gasket ring 43 is about the stem 23 which shields the dielectric 12 from being dented and that the smallest diameter of the hole in said gasket ring permitted is controlled because of the limited movement of the clamping ring towards said gasket ring as is afforded by the stop bead 48. Also to be noted is that the compressed gaskets 43, 46 also act to eliminate all play in the thread joint at 28", thereby creating good frictional hold against the loosening of the tubular screw 40 from the assembled connector 15.

To position the contact wedge assembly 17 into the body assembly 19, the end boss 22" of the piece 22 which holds the terminal pin 25 therethrough, fits in the inner socket in the sleeve 36. To limit the movement of the contact wedge assembly 17 into said body assembly 19, a metal ring 50 fits tightly on and about the sleeve 36,

contacts the tubular member 35 and said ring serves as the stop against the rim of the part 21. A flange 25" on the pin 25, located said pin in the contact wedge assembly 17, by serving as a stop against the dielectric piece 22.

The continuity of contact from the tubular conductor 26 to the frusto-conical member 20, to either or both the tubular member 28 and said ring 50 and then to the end member 35, makes the latter the terminal of the connector 15 which is for the tubular conductor 26 of the coaxial cable 16. The size of the connector 15 is primarily determined by the diameter of the cable 16 and of course, the inside diameter of the stem 23 shall allow a slide fit thereto for the dielectric 51 of the cable.

This invention is capable of numerous forms and various applications without departing from the essential features herein disclosed. It is therefore intended and desired that the embodiment herein shall be deemed merely illustrative and not restrictive and that the patent shall cover all patentable novelty herein set forth; reference being had to the following claims rather than to the specific description herein to indicate the scope of this invention.

I claim:

1. In an electrical connector for a coaxial cable of the type including a solid tubular dielectric having an inner conductor fitting therethrough and at least an outer tubular conductor covering along said dielectric, an electrically conductive tapered funnel element for slidably receiving therein the end portion of the tubular dielectric of the cable whereby said element shall lie between said dielectric and the outer tubular conductor of the cable and shall contact said outer conductor, the extending bare end of the inner conductor extending out of said element, a conductive tubular assembly including a tubular member positioned about and electrically connected to said element means within said tubular member acting as a stop to limit the movement of said element into said tubular member and a clamp and seal assembly comprising a sleeve to receive the cable, having a counterbore therein in the end thereof facing the end of the cable, a clamping ring extending part way into said counterbore, said ring having an outward flange around the end thereof which is outside of said counterbore, said sleeve and ring being in slidable relation, said ring serving when shifted towards the end of the cable when the cable is associated with said tapered element, to cooperate with said tapered element to clamp the outer tubular conductor of the cable between them, a sealing gasket ring within said counterbore between said ring and the seat of said counterbore, adapted when compressed to contact the outside of the cable, another sealing gasket ring about said clamping ring between the sleeve and the flange on the clamping ring, adapted when compressed, to seal the space between said sleeve and said conductive tubular member, said tubular member having part of the sleeve therein and in telescopic relation therewith, cooperative means on said sleeve and said tubular member to hold them together to maintain said grip effectively and cooperative means on said sleeve and clamping ring to limit the extent of their relative sliding movement thereby limiting the compression of said sealing gaskets.

2. An electrical connector as defined in claim 1, wherein said cooperative means on the sleeve and tubular member to hold them together is afforded by having said sleeve and associated tubular member in threaded engagement.

3. An electrical connector as defined in claim 1, wherein the cooperative means on said sleeve and clamping ring to limit their relative sliding movement is afforded by providing one of them with an annular groove of predetermined width and the other with a protuberance extending into said groove.

4. An electrical connector as defined in claim 3, wherein said protuberance is an annular bead.

5. In an electrical connector for a coaxial cable of the

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type including a solid tubular dielectric having an inner conductor fitting therethrough and at least an outer tubular conductor covering along said dielectric, a contact wedge assembly comprising an electrically conductive tapered funnel element having a hollow stem for slidably receiving therein the end portion of the tubular dielectric of the cable when said stem is slid onto an end of the cable to lie between said dielectric and the outer tubular conductor of the cable to an extent that the tapered funnel part of said element is within and in contact with the outer conductor of the cable, a dielectric element mounted in said funnel part and carrying a conductive pin there-through coaxially with said funnel element and extending away from out of the mouth of said funnel element; said pin being hollow and open at its end which is towards the stem of the funnel element wherein it is adapted to receive into such hollow, the extending bare end of the inner conductor of the cable when said dielectric of the cable is entered into said stem, a tubular assembly including a conductive tubular member positioned about said contact wedge assembly, said tubular member being electrically connected to said funnel element, means within said tubular member acting as a stop to limit the movement of said contact wedge assembly into said tubular member and a clamp and seal assembly comprising a sleeve on the cable having a counterbore therein in the end thereof facing the end of the cable, a clamping ring extending part way into said counterbore, said ring having an outward flange around the end thereof which is outside of said counterbore, said sleeve and ring being in slidable relation, said ring serving when shifted towards the end of the cable to cooperate with said tapered element to clamp the outer tubular conductor of the cable between them when the cable is associated with said tapered element, a sealing gasket ring within said counterbore between said ring and seat of said counterbore, adapted when compressed to contact the outside of the cable, said gasket sealing ring encircling the stem of the funnel element, another sealing gasket ring about said clamping ring between the sleeve and the flange on the clamping ring, adapted when compressed, to seal the space between

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said sleeve and said conductive tubular member, said tubular member having part of the sleeve therein and in telescopic relation therewith, cooperative means on said sleeve and said tubular member to hold them together to maintain said grip effectively and cooperative means on said sleeve and clamping ring to limit the extent of their relative sliding movement thereby limiting the compression of said sealing gaskets.

6. An electrical connector as defined in claim 5, wherein said cooperative means on the sleeve and tubular member to hold them together is afforded by having said sleeve and associated tubular member in threaded engagement.

7. An electrical connector as defined in claim 5, wherein the cooperative means on said sleeve and clamping ring to limit their relative sliding movement is afforded by providing one of them with an annular groove of predetermined width and the other with a protuberance extending into said groove.

8. An electrical connector as defined in claim 7, wherein the protuberance is an annular bead.

9. An electrical connector as defined in claim 5, wherein the surface of said tapered funnel part is serrated.

10. An electrical connector as defined in claim 5, including a dielectric liner in said tubular member; said liner having a partition therein intermediate its ends, said partition having a central hole through which said pin is positioned and extends therefrom, the dielectric element carried within said funnel part extending into said liner and substantially fitted therein and a metal ring tightly on and about said liner, contacting said tubular member and serving as a stop for the rim of said funnel part.

References Cited in the file of this patent

UNITED STATES PATENTS

2,443,635	Norris et al.	June 22, 1948
2,615,953	Waite	Oct. 28, 1952
2,761,110	Edlen et al.	Aug. 28, 1956
2,870,420	Malek	Jan. 20, 1959
2,986,720	Chess	May 30, 1961
3,054,981	Malek et al.	Sept. 18, 1962