United States Patent [19]

Winn

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[54] **SLIDE-ON RF CONNECTOR**

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[73] Assignee: **Phelps Dodge Industries, Inc.**, New York, N.Y.

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[52] **U.S. Cl.** ..... **339/177 R**

[51] **Int. Cl.** **H01r 17/06**

[58] **Field of Search** ..... 24/106–108, 24/213, 208 A, 216 R, 216 B, 216 CS; 339/177, 252, 256, 258

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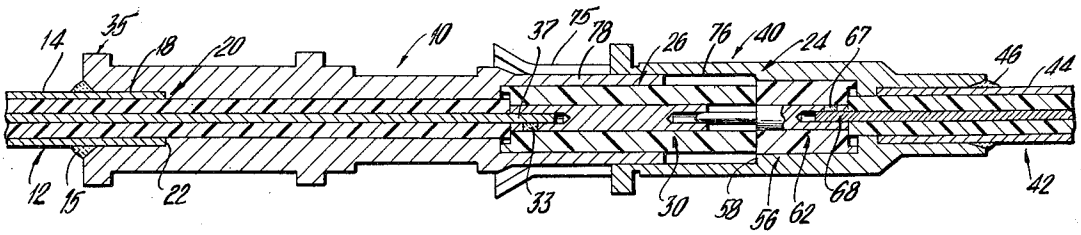
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Assistant Examiner—Lawrence J. Staab
Attorney, Agent, or Firm—Davis, Hoxie, Faithfull & Hapgood

[57] **ABSTRACT**

A slide-on connector including a plug and jack for electrically connecting the ends of two radio frequency coaxial cables to minimize radio frequency (RF) current leakage when fully butted and slightly unbutted.

2 Claims, 6 Drawing Figures



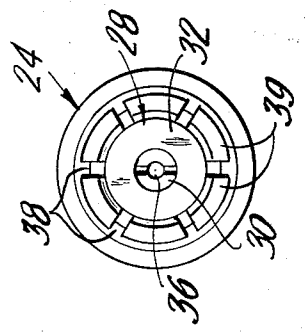


FIG. 2

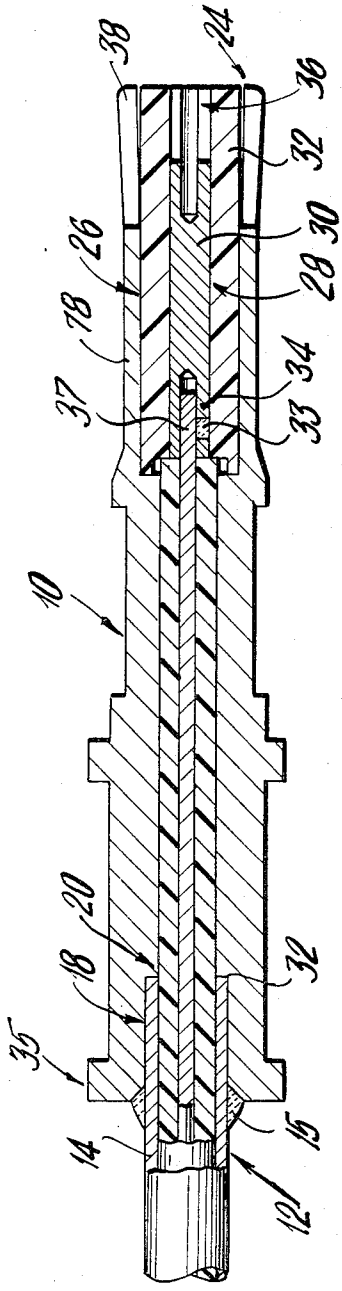


FIG. 1

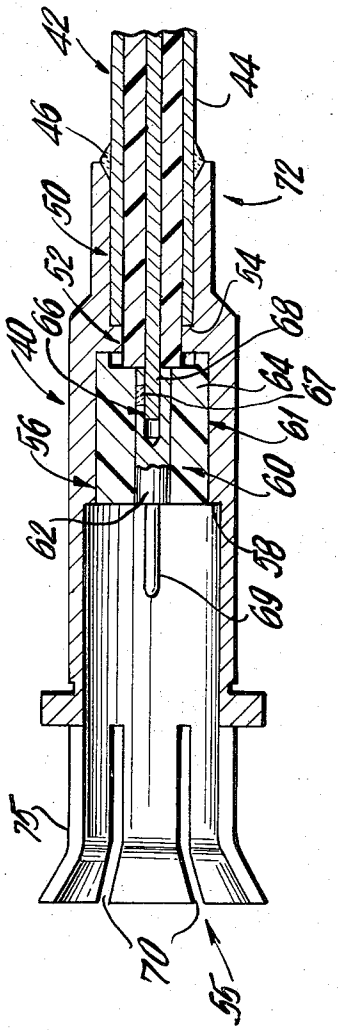


FIG. 3

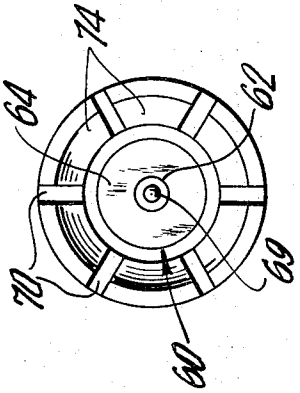


FIG. 4

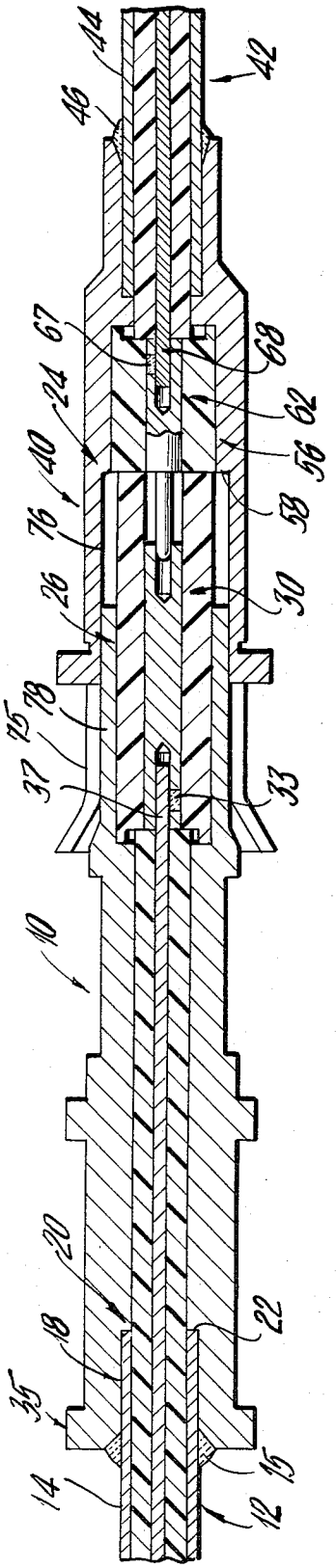

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FIG.5

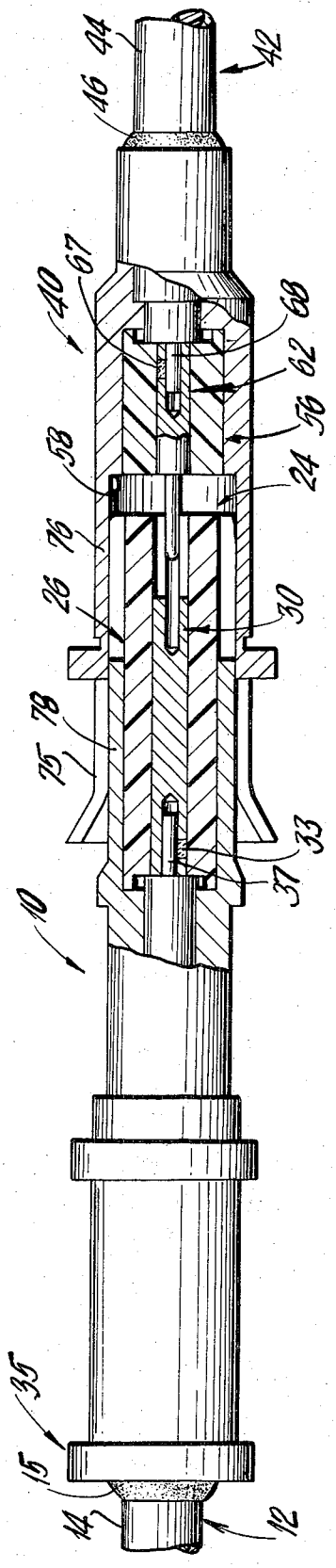

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FIG.6

SLIDE-ON RF CONNECTOR

The present invention relates to coaxial cable connectors, and more particularly to slide-on RF connectors which shield against radio frequency current leakage.

Various RF connectors are known in the art. These known connectors generally require that the mating elements be fully butted to obtain the desired electrical performance. However, even when fully butted, these mating elements are often loose fitting resulting in several paths for RF current leakage.

It is an object of the present invention to provide a slide-on RF connector which overcomes the deficiencies of the prior art connectors and provides high electrical performance.

It is a further object to provide a slide-on RF connector which minimizes RF current leakage when the mating elements are fully butted and slightly unbutted.

It is a further object of the present invention to provide a slide-on RF connector whose mating elements are tight fitting, even when slightly unbutted, to minimize RF current leakage.

It is a further object of the present invention to provide a slide-on RF connector whose mating elements are capable of rapid and positive connection.

It is still a further object of the present invention to provide a slide-on RF connector suitable for printed circuit and computer applications.

Other objects, aspects and advantages of the present invention will be more apparent when the detailed description is considered with the drawing.

Briefly, the connector of the present invention includes a jack having a bore extending therethrough, the jack is mounted on one end of a first coaxial cable and electrically coupled to the outer conductor, the free end of the jack is slightly divergent and slotted, a plug having a bore extending therethrough is mounted on one end of a second coaxial cable and electrically coupled to the outer conductor, the free end of the plug is slotted, flared, and crimped to receive and retain the jack, the diameter of the plug bore is slightly less than the diameter of the divergent slotted end of the jack for tight-fitting of the jack within the bore of the plug, the plug includes a stop surface formed by reduced diameter portion against which the free end of the jack abuts in a fully mated position, the jack and plug maintain high electrical performance characteristics even when the jack and plug are slightly unmated, and means within the plug and jack for electrically coupling the inner conductors of the two coaxial cables.

The present invention is illustrated with the following drawing in which:

FIG. 1 is a sectional view of the jack, female contact and jack insulator coupled to a first coaxial cable end;

FIG. 2 is an end view of the jack, female contact and jack insulator of FIG. 1;

FIG. 3 is a sectional view of the plug, male contact and plug insulator coupled to a second coaxial cable end;

FIG. 4 is an end view of the plug, male contact and plug insulator of FIG. 3;

FIG. 5 is a sectional view of the jack and plug assembled in a fully butted position; and

FIG. 6 is a partial sectional view of the jack and plug assembled in a slightly unbutted position.

Referring to FIG. 1, a generally cylindrical hollow jack 10 is mounted at the end of a first coaxial cable 12 and electrically coupled to the outer conductor 14 with solder 15. (When using flexible RF cables the jack 10 may be crimped or clamped to the cable.) The hollow jack 10 includes an axial bore 18 to receive the cable 12 with a reduced diameter portion or flange 20 which abuts against the end 22 of the outer conductor 14 of the cable 12. Axially aligned with the bore 18 and extending from the reduced diameter portion 20 to the uncoupled or free end 24 of the jack 10 is an enlarged bore portion 26. A cylindrical jack insulator 28 is dimensioned to snugly fit within the enlarged bore portion 26. The jack insulator 28 includes a central conductor or female contact 30 surrounded by an insulating cylinder 32. The female contact 30 includes two end receptacles 34 and 36. Receptacle 34 receives the inner conductor 37 of the cable 12 and is soldered thereto at 33. The cable 12 is then inserted into the jack 10 so that the female contact 37 is positioned within the enlarged bore portion 26 of the jack 10. The insulating cylinder 32 is then positioned over the female contact 37 within enlarged bore portion 26.

The free end 24 of the jack 10 diverges slightly from the remainder of the jack 10 and includes a plurality of equally spaced slots 38, six as shown in FIG. 2, forming a plurality of slightly divergent tines 39 at the free end 24. The tines 39 extend from the free end 24 and terminate at a point intermediate the free end 24 and the coupled end 35.

Referring to FIG. 3, a generally cylindrical hollow plug 40 is mounted on the end of a second coaxial cable 42 and electrically coupled to the outer conductor 44 with solder 46. (When using flexible RF cables the plug 40 may be crimped or clamped to the cable.) The hollow plug 40 includes an axial bore 50 to receive the cable 42 with a reduced diameter portion or flange 52 which abuts against the end 54 of the outer conductor 44 of the cable 42. Axially aligned with the bore 50 and extending from the reduced diameter portion 52 to the uncoupled or free end 55 of the plug 40 is an enlarged bore portion 56. The enlarged bore portion 56 is in the shape of a stepped cylinder having a flange or annular stop 58 against which the free end 24 of the jack 10 abuts when the jack 10 and plug 40 are in a fully butted position, see FIG. 5.

A cylindrical plug insulator 60 is dimensioned to snugly fit within the smaller diameter portion 61 of the enlarged bore portion 56. The plug insulator 60 includes a central conductor or male contact 62 surrounded by an insulating cylinder 64. The male contact 62 includes an end receptacle 66 to receive the inner conductor 68 of the cable 42 and is soldered thereto at 67. The cable 42 is then inserted into the plug 40 so that the male contact 62 is positioned within the smaller diameter portion 61 of the enlarged bore portion 56 of the plug 40. The insulating cylinder 64 is then positioned over the male contact 62 within the smaller diameter portion 56 of the enlarged bore portion 56 of the plug 40. The male contact 62 includes at its opposite end, a pin member 69 which is received in receptacle 36 of the female contact 30 when the jack 10 and plug 40 are assembled.

The free end 55 of the plug 40 is flared outwardly to facilitate reception of the jack 10 and has a plurality of slots 70, six as shown in FIG. 4, forming a plurality of tines 74 at the free end 55. The tines 74 extend from

the free end **55** and terminate at a point intermediate the free end **55** and the coupled end **72.** The non-flared or horizontal portion **75** of the plug **40** adjacent the free end **55** is crimped slightly to firmly retain the jack **10** within the plug **40** and increase the shielding effect against RF current leakage.

Referring to FIG. **5,** the jack **10** and plug **40** are shown in a fully butted position with the free end **24** of the jack **10** abutting against the flange **58** of the plug **40.** The jack **10** and plug **40** are tightly held in this position by the compressive action of the solid sidewall **76** of the enlarged bore portion **56** of the plug **40** against the divergent tines **39** of the jack **10,** which provides adequate grounding even when the jack **10** and plug **40** are slightly unmated, and by the action of the crimped portion **75** of the plug **40** (horizontal tine portion) against the sidewall **78** of the enlarged bore portion **26** of the jack **10.** The solid sidewall **76** of the enlarged bore portion **56** of the plug **40** surrounds or overlies the free end **24** of the jack **10** and extends beyond the point of termination of the slots **38** and tines **39.** The inner conductors **37** and **68** of the cables **12** and **42** are electrically connected through female contact **30** and male contact **62.** The outer conductors **14** and **44** of the cables **12** and **42,** respectively, are electrically connected through the jack **10** and plug **40.**

Referring to FIG. **6,** the jack **10** and plug **40** are shown tightly held in a slightly unmated assembled position with the free end **24** of the jack **10** not abutting the flange **58** of the plug **40.** The solid sidewall **76** of the enlarged bore portion **56** of the plug **40** surrounds or overlies the free end **24** of the jack **10** and extends beyond the point of termination of the tines **39.** The tines **39** of the jack **10** coact with the sidewall **76** of the plug **40** and the crimped portion **75** of the plug **40** coacts against the sidewall **78** of the enlarged bore portion **26** of the jack **10** to effectively shield against RF current leakage when the jack **10** and plug **40** are slightly abutted.

The connector of the present invention has a characteristic impedance of 50Ω and an RF current leakage of −120db minimum at 1 GHz. Tests on the connector of the present invention indicate that a 1 GHz signal at a level of −125db, with the jack **10** and plug **40** fully butted, showed no deterioration when unmated up to .050 inch. Thus, the connector of the present invention is capable of maintaining its high electrical performance when the jack **10** and plug **40** are unmated (includes an air gap) of up to about .050 inch.

The connector of the present invention provides a slide-on RF connector in which the jack **10** and plug **40** are held tightly together to minimize RF current leakage when fully butted and slightly unbutted. The connector of the present invention advantageously does not require complete abutment to maintain high electrical performance, particularly shielding against RF current leakage.

It should be apparent to those skilled in the art that various modifications may be made in the present invention without departing from the spirit and scope thereof as described in the specification and defined in the appended claims.

What is claimed is:

1. A connector for electrically coupling the ends of two RF coaxial cables, comprising:

a tubular conductive jack having one end for connection to the outer conductor of the first coaxial cable, a slightly diverging free end opposite the connecting end, the free end including a plurality of axially extending slots forming a plurality of resilient tines, and a tubular intermediate section;

a tubular conductive plug for receiving said jack and having one end for connection to the outer conductor of the second coaxial cable, a free end opposite the connecting end, the free end including a plurality of axially extending slots forming a plurality of resilient tines, and a tubular intermediate section;

the external diameter of the tubular intermediate section of the jack being substantially equal to the internal diameter of the tubular intermediate section of the plug;

the divergence of the free end of the jack being such that the circle described by the outermost ends of the resilient jack tines before the jack is received into the plug has a diameter larger than the internal diameter of the tubular intermediate section of the plug;

a section of the plug tines spaced from the unattached ends of said tines having an internal diameter before receipt of the jack smaller than the external diameter of the tubular intermediate section of the jack;

the length of the axially extending slots in the plug and the jack being such that the jack tines extend into the plug beyond the beginning of the plug tines and the plug tines extend along the outside of the jack beyond the beginning of the jack tines when the jack is fully received by the plug; and

means within the plug and the jack for electrically connecting the inner conductors of the two coaxial cables when the jack is received by the plug.

2. The connector of claim **1** wherein the unattached ends of the plug tines are flared outwardly.

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