SUBMINIATURE COAXIAL CONTACT


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ABSTRACT

A subminiature coaxial contact is provided with a cavity in one end for receiving a center conductor of a small-size coaxial cable and has a dielectric sleeve movably positioned thereon being initially disposed intermediate the ends thereof. The contact is insertable into one end of a connector housing having a shoulder stop therein against which the dielectric sleeve registers so that upon continued insertion the dielectric sleeve is caused to slidably traverse the contact until it is positioned against the end of the coaxial cable insulating sheath. The dielectric sleeve thus may serve as a positioner or stop for use with a crimping tool so that crimping occurs on the extreme end of the contact whereby bending is at a minimum and also is operative to positively locate the contact in a predictably fixed position in the housing while simultaneously aligning the same diametrically in spaced relation within a small bore therein.

2 Claims, 9 Drawing Figures
SUBMINIATURE COAXIAL CONTACT

BACKGROUND OF THE INVENTION

The present invention relates generally to coaxial cable connectors and more particularly to an improved method and apparatus for connecting subminiature coaxial cables.

Among the problems in meeting the high density requirements of today's electrical connectors suitable for use in the new rack and panel types as well as in readily available manually disconnectable connector housings is that of providing a satisfactory subminiature shield wire, or coaxial, contact, such as one designed for a size 16 cavity with a mated electrical length only slightly over one-half inch. Generally, such contacts heretofore available have been readily subject to bending during crimping, which results in extreme difficulty being encountered in precisely aligning the contact within an encircling small bore in a connector housing. Further, because of their size, no satisfactory method has heretofore been provided for accurately positioning the contact in a definite axial location within the connector housing.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a new and improved coaxial contact for connecting subminiature cables in high density connectors.

Another object of the present invention is to provide a novel apparatus for connecting subminiature coaxial cables having a connector housing and a coaxial contact which is readily alignable in spaced relation within a small axial bore of the housing.

Still another object of this invention is to provide a novel apparatus for connecting subminiature coaxial cables having a connector housing and a coaxial contact which is accurately positionable in a fixed location within the housing.

Yet another object of this invention is the provision of a connector housing and a subminiature coaxial contact which are so cooperatively constructed as to facilitate ready disposition of the contact within a bore in the housing at a fixed location therein and in axial alignment in spaced relation with the wall defining the housing bore.

It is a further object of this invention to provide a subminiature coaxial contact which is subject to minimum bending during crimping and accordingly is more readily alignable in spaced relation within a small-sized encircling bore of a connector housing.

A still further object of this invention is to provide an improved method of connecting subminiature coaxial cables in high density connectors.

Yet another object of the present invention is the provision of an improved method of connecting subminiature coaxial cables which insures alignability and accurate positioning of the cable contact within a bore of a connector housing.

Aforegoing and other objects are attained in accordance with one aspect of the present invention by a subminiature coaxial contact having a cavity in one end for receiving a stripped center conductor of a small-size coaxial cable and being provided with a dielectric sleeve movably positioned thereon and initially disposed intermediate the ends thereof. The subminiature contact is insertable into one end of a connector housing having a shoulder stop therein against which the dielectric sleeve registers so that upon continued insertion the dielectric sleeve is caused to slidably traverse the inwardly moving contact until it is positioned against the end of the insulating sheath disposed about the unstripped portion of the center conductor of the coaxial cable. The dielectric sleeve thus may serve as a positioner or stop for use with a crimping tool prior to inserting the contact into the connector housing so that crimping occurs on the extreme end of the contact whereby bending is at a minimum and it is also operative during insertion into the connector housing to positively locate the contact in a predictable fixed position therein while simultaneously aligning the same diametrically in spaced relation within a small bore of the connector housing. The subminiature coaxial contact may have a pin contact on the end opposite the center conductor-receiving cavity or a socket contact, so that when used together, the respective connector housings of the subminiature pin contact assembly and the subminiature socket contact assembly are cooperatively engageable to readily permit the maintenance of alignment of the pin and socket contacts and to obtain the shortest possible mating electrical length.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features and attendant advantages of the present invention will be more fully appreciated as the same becomes better understood from the following detailed description when considered in connection with the accompanying drawings, in which like reference numerals designate like or corresponding parts throughout the several views, and wherein:

FIG. 1 is a perspective view of a subminiature pin center contact having a pair of dielectric sleeves positioned thereon and a connector housing for receiving the contact being formed in accordance with the present invention;

FIG. 2 is a longitudinal cross-section of the connector housing and the pin center contact shown in FIG. 1 having a stripped center conductor of a subminiature coaxial cable secured within the contact and illustrating in part a crimping tool for crimping the one end of the contact;

FIG. 3 is another cross-sectional view of the apparatus of FIG. 1 showing the contact being inserted into the connector housing with the one dielectric sleeve registering with a stop therein;

FIG. 4 is another cross-sectional view of the fully assembled apparatus illustrated in FIG. 1;

FIG. 5 is a perspective view of a socket, or female center contact having a movable dielectric sleeve disposed thereon and a connector housing for receiving the contact being formed in accordance with the present invention;

FIG. 6 is a longitudinal cross-section view of the connector housing and the socket contact shown in FIG. 5 and illustrating in part a crimping tool for crimping one end of the socket contact when a center conductor of a subminiature coaxial cable is received therein;

FIG. 7 is a cross-sectional view of the apparatus illustrated in FIG. 5 showing the socket contact being inserted into the connector housing with the dielectric sleeve registering against a stop therein;

FIG. 8 is another cross-sectional view of the apparatus shown in FIG. 5 when fully assembled; and

FIG. 9 is a cross-sectional view of the pin contact assembly shown in FIG. 4 and the socket contact assem-
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bly shown in FIG. 8 being inter-engaged for connecting the respective subminiature cables thereof.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings, and more particularly to FIGS. 1 and 2 thereof, there is shown a male center contact generally indicated by the reference numeral 10 being formed with one cylindrical end portion 11 having an axially-extending cavity 12 therein and another end portion 13 being an elongate pin contact of a smaller diameter than end portion 11 and extending coaxially from the end thereof opposite the cavity 12. A dielectric sleeve 14 is slidably positioned on the end portion 11 of the contact 10 being initially disposed at the end thereof connected with the pin contact 13 and another dielectric sleeve 15 is slidably positioned on the pin contact 13 being initially disposed at the end thereof connected with the end portion 11 so that the dielectric sleeves 14 and 15 are initially positioned with respective end faces thereof contacting one another. The dielectric sleeve 14, as shown, has a larger diameter than that of dielectric sleeve 15. Preferably the sleeves 14 and 15 are constructed of Teflon, although it is to be understood that other suitable materials may be employed. A screw 16 is shown being threadably engaged radially into the end portion 11 of the male contact 10 at a longitudinal location thereon which is initially not covered by the dielectric sleeve 14 for the purpose of permitting a center conductor of a subminiature coaxial cable to be fixedly secured within the cavity 12.

The reference numeral 18 generally designates a connector housing for the male center contact 10 having stepped bores 19, 20 and 21 coaxially formed therein which provide shoulders 22 and 23 at the points of the respective diameter changes. The periphery of the end portion of connector housing 18 in which the larger bore 21 is formed has a plurality of rolled V-shaped serrations 24 formed therein, the purpose of which will be set forth hereinbelow. At the other end of the connector housing 18, an integral tubular portion 25 is provided with a plurality of longitudinal slots 26, preferably being four in number spaced at 90° intervals, so that the end portion 25 provides a shoulder portion 27 internally thereof at the juncture with the bore 19 and provides a set of contact springs, the operation of which will be described in greater detail further below. Still referring to FIG. 2, an engaging wall 28 of a crimping tool 29 is shown positioned about one end of the center contact 10. As is well known, it is important to maintain alignment of the inner and outer contacts, especially in small-size coaxial contacts, and any bending caused by crimping of the center contact becomes a critical factor in obtaining such alignment in the dielectric spacer. Thus, in this embodiment, with the dielectric sleeve 14 being located forcibly on the end portion 11 of contact 10, it acts as a positioner or stop in the crimping tool so that the initial location thereof permits the crimp to occur on the extreme end of the contact. Thus, should any bending action occur in the crimp area, the effect is at an absolute minimum as compared to a crimp centered in the contact length.

Referring now to FIG. 3, the inner, or center, conductor of a subminiature coaxial cable 31 is stripped of its various protective and insulative jackets and is inserted and fixedly secured within the cavity 12 of the center contact 10 by screw member 16. Thereafter, the end portion 11 of the center contact 10 is crimped to the center conductor and the center contact 10 is inserted into the connector housing 18. Upon insertion therein, the dielectric sleeve 14 which snugly fits within the bore 21, engages the shoulder 23. At this time, the dielectric sleeve 14 is disposed in the bore 20 of connector housing 18. Since the dielectric sleeve 14 is prevented from being further displaced into the connector housing by its engagement with shoulder 23, further insertion of the center contact 10 into the connector housing 18 causes the dielectric sleeve 14 to move to the rear of the end portion 11 of the center contact 10 until, as shown in FIG. 4, it is positioned over the previously crimped area and against the facing annular wall 32 of the cable insulating sheath 33 at the point to which the same had been previously stripped from the center conductor prior to crimping. Thus, in addition to giving axial alignment on the extreme end of the contact, the dielectric sleeve 14 also acts as a stop or positioner for the positive locating of the center contact-cable with respect to the connector housing 18.

Further, the dielectric sleeve 15, during its forced movement through the bore portion 20 of the connector housing 18 effected through its engagement with the annular end of end portion 11, combines with the movable dielectric sleeve 14 being displaced therefrom to provide maximum axial alignment of the center contact 10 within the housing. Movement of the center contact into the connector housing 18 also is limited, of course, as shown in FIG. 4, by the engagement of the dielectric sleeve 15 with the shoulder 22 at the end of bore 20. Thus, the movable dielectric technique permits the shortest possible impedance match and only requires a double stripping of the cable as opposed to the conventional triple strip.

The outer braid 34 of the coaxial cable 31 may then be received over the serrated end portion of the connector housing 18 and electrically secured thereto by a conventional clamping collar 35.

Turning now to FIGS. 5 and 6, a female, or socket, center contact is generally indicated by the reference numeral 40. This female center contact 40 has an end portion 41 having an elongate cavity 42 therein for receiving a center conductor 43 of a coaxial cable which has been stripped of it various protective and insulative jackets. The other end portion 44 of the female center contact 40 has a slotted socket portion 45 on one end which is adapted to receive a corresponding pin contact 13 of a male center contact 10. The end portion 44 of the center contact 40 has a smaller diameter than the end portion 41 and extends axially therefrom. A dielectric sleeve 47 is slidably positioned on the center contact 40, being initially located at the juncture of the end portions 41 and 44. The dielectric sleeve 47 is preferably constructed of Teflon although it is to be understood that other suitable materials may be employed.

The socket portion 45 is designed to offer the maximum frontal opening target area, so that instead of a standard slotted and tapered, or pinched tube configuration, the outer surface thereof is kept straight and inward projections 48, shown in FIG. 6, provide the contact area. This gives the maximum bellmouth opening in the front for the best possible alignment within the dielectric sleeve 47 and the inward projecting surfaces 48 maintain a constant spring length, contact pressure,
as well as consistent location of the electrical contact area.

A connector housing 50 having a bore 51 in one end and a counter bore 52 in the other end forming a tapered shoulder 53 therebetween is provided for receiving the female center contact 40. The periphery of the one end portion of the connector housing 50 in which the counter bore 52 is located is serrated as indicated by reference numeral 54 in the same manner as connector housing 18, for the same purpose, being to provide good electrical contact of the outer braid of a coaxial cable when fastened thereto by a suitable clamping collar. Disposed in the bore 51 in the other end of the connector housing 50 is a collar 55 which is adapted to receive the frontal opening target area of the socket portion 45 of female center contact 40.

As in the earlier description of the male center contact 10, the stripped center conductor 43 is inserted into the cavity 42 and with the dielectric sleeve 47 serving as a positioner for the crimping tool 29, the end portion 41 of the center contact 40 is crimped about the center conductor 43. Then, upon insertion of the crimped center contact 40 into the connector housing 50, the socket portion 45 is positioned in the collar 55 and the dielectric sleeve 47 engages the shoulder 53, as shown in FIG. 7.

Upon further insertion of the center contact 40 into the connector housing 50, the dielectric sleeve 47 is caused to move to the rear of the end portion 41 of the center contact 40 until it is positioned over the previously crimped area and against an end wall 32' of an insulating sheath 33' of a coaxial cable 31', as shown in FIG. 8. As in the case of the male center contact 10 with its dielectric sleeve 14, the dielectric sleeve 47 of the female center contact 40 acts as a stop or positioner for the center contact-cable location within the connector housing 50, as well as providing axial alignment on the extreme end of the contact.

The outer braid 34' about the insulating sheath 33' of coaxial cable 31' is received over the serrated portion 54 of the connector housing 50 and is electrically secured thereto by a clamping collar 35'.

Turning now to FIG. 9, an assembled version of the male center contact assembly 10 and the female center contact assembly 40 is shown. Thus, the end portion of the connector housing 50 having the collar 55 therein is forceably inserted into the set of spring contacts 25 of the connector housing 18, with the collar 55 slightly projecting from the end of the connector housing 50 being received in the bore 19 of connector housing 18 until the end wall of connector housing 50 having bore 51 therein registers against the shoulder 27. During this forceable insertion of the end of connector housing 50 into the spring contact area 25 of connector housing 18, the pin contact 13 of the male center contact 10 is slidably received between the projections 48 on the inner surfaces of the socket portion 45 of the female center contact 40.

Thus, a novel coaxial cable connection technique is provided which utilizes a movable dielectric for insuring alignment of the male and female contacts and for positively locating these contacts in predictable fixed positions within their respective connector housings, and thus permits the use of subminiature coaxial cables in high density connectors with improved results. Another feature of the invention is that a dielectric may be fabricated from low cost dielectric tubing which is cut to length in order to form the movable and fixed encircling dielectrics.

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

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A method of terminating coaxial cable, comprising the steps of:
   - trimming a coaxial cable to expose a predetermined length of a center conductor thereof from one end of a surrounding insulating sheath;
   - inserting said center conductor into a forward end portion of a center conductor contact having a rear end portion of reduced diameter and a slidable dielectric member disposed on the rear end of said forward end portion;
   - crimping the forward end of said forward end portion of said center conductor contact against said center conductor;
   - inserting said crimped center conductor contact and said slidable dielectric member into an electrically conducting connector housing;
   - receiving said dielectric member against a stop inside said connector housing;
   - further inserting said center conductor contact into said connector housing and causing said dielectric member to slidably traverse said forward end portion of said center conductor contact so as to be disposed over said crimped forward end of said forward end portion;
   - stopping said dielectric member against an end of said coaxial cable insulating sheath; and
   - crimping the outer braid of said coaxial cable into electrical contact with the outer periphery of the end of said connector housing receiving said center conductor contact.

2. A coaxial connector comprising:
   - a first elongate center conductor contact having a cavity in one end portion for receiving a center conductor of a coaxial cable and a reduced diameter male contact member on the other end portion, said one end portion being crimpable at one end thereof on said center conductor;
   - a first dielectric sleeve movably disposed on said first center conductor contact and initially being positioned at another end of said one end portion adjacent said male contact member;
   - a connector housing having means therein for defining a series of at least three stepped bores of decreasing diameter from a front end of said connector housing for receiving said center conductor contact, thereby forming at least two spaced shoulder stops therein;
   - said first dielectric sleeve being slidable in the first of said series of stepped bores and engageable with the first of said at least two shoulder stops from said front end of said connector housing upon insertion of said first center conductor contact therein, and upon further insertion being slidably displaced on said one end portion of said first center conductor contact toward the crimpable end thereof;
   - a second dielectric sleeve disposed on said male contact member of said first center conductor contact
being smaller in diameter than said first dielectric sleeve on said one end portion thereof and further being slidable in the second of said series of stepped bores and engageable with the second of said at least two shoulder stops from said front end of said connector housing;
a second elongate center conductor contact having a cavity in one end portion for receiving a center conductor of another coaxial cable and a reduced diameter female contact member on the other end portion, said one end portion being crimpable at one end thereof on said center conductor;
a third dielectric sleeve movably disposed on said second center conductor contact and initially being positioned at another end of said one end portion adjacent said female contact member;
a second connector housing having means for defining at least a pair of stepped bores of decreasing diameter from a front end of said second connector housing for receiving said second center conductor contact, thereby forming at least one shoulder stop therein;
said third dielectric sleeve upon insertion of said second center conductor contact into said second connector housing being engageable with said at least one shoulder stop and upon continued insertion of said second center conductor contact being caused to be displaced on said one end portion toward the crimpable end thereof;
a collar disposed in the rear bore of said second connector housing and projecting slightly therefrom;
spring contact members on the rear end of said first connector housing for engagably receiving the rear end of said second connector housing with said projecting collar being slidable in the rearmost of said series of stepped bores in said first connector housing so as to engage said male contact member in said female contact member; and
stop means in the rear end of said first connector housing for limiting the insertion therein of said second connector housing.

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