

[54] **FILTER CONTACT CONNECTOR
ASSEMBLY WITH CONTACT PINS
HAVING INTEGRALLY
CONSTRUCTED CAPACITORS**

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[22] Filed: Nov. 22, 1971

[21] Appl. No.: 200,946

[52] U.S. Cl. 317/256, 317/257, 333/79,
339/147 P, 339/147 R

[51] Int. Cl. H01g 1/00

[58] Field of Search..... 317/256, 257; 339/147 P,
339/147 R; 333/79

[56]

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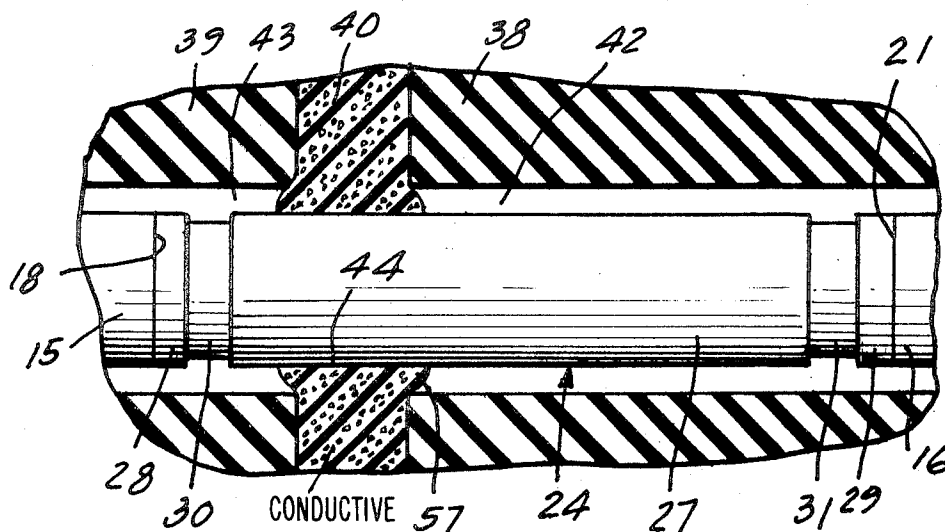
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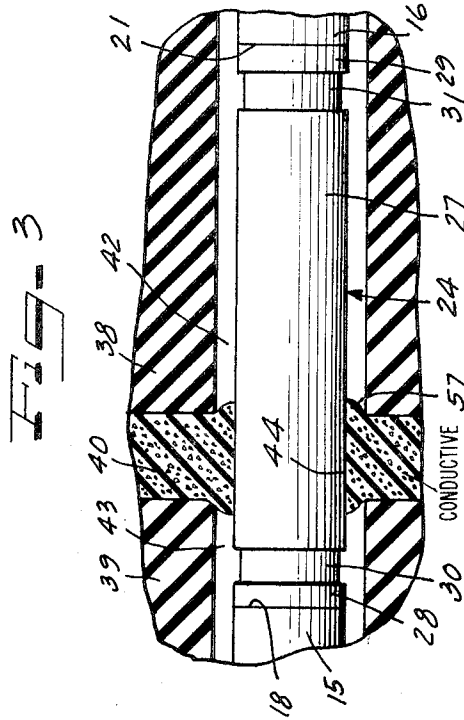
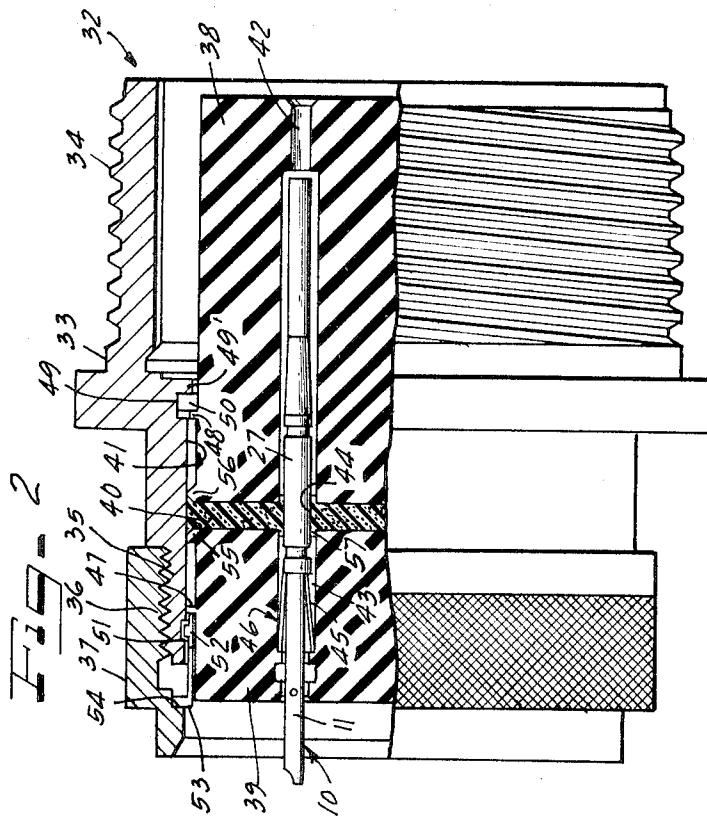
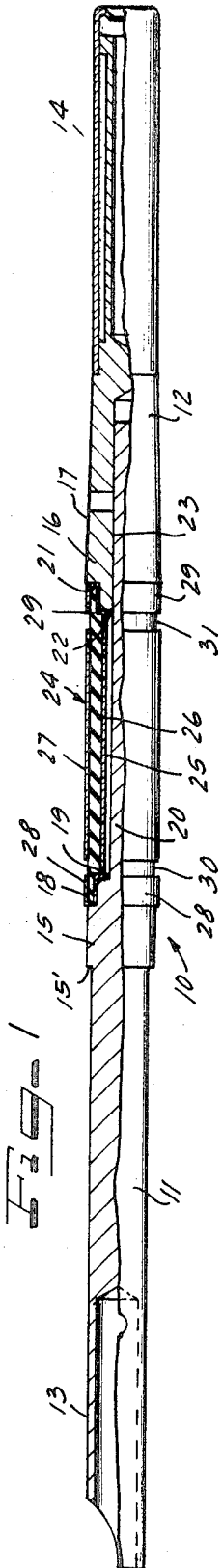
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ABSTRACT

An electrical connector includes resiliently mounted contact pins having integrally constructed capacitors for shunting interference signals to ground by way of an electrically conductive resilient mounting member and the outer shell of the connector.

14 Claims, 3 Drawing Figures





FILTER CONTACT CONNECTOR ASSEMBLY WITH CONTACT PINS HAVING INTEGRALLY CONSTRUCTED CAPACITORS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electrical connectors, and is particularly concerned with electrical connectors having capacitor elements therein for bypassing interference signals.

2. Description of the Prior Art

Electrical connectors equipped with removable filter contacts have found increasing use in applications where interference signals, particularly radio frequency signals, are to be bypassed or shunted to ground. Certain problems have arisen, however, in such connectors including problems involving sealing of the connector and damage of the capacitors due to shock and vibration forces. These problems have caused frequent replacement of the filter contacts.

SUMMARY OF THE INVENTION

It is therefore the primary object of the present invention to provide an electrical connector with filter contacts which are individually sealed and isolated so that the forces of shock and vibration transmitted to the capacitors are greatly reduced.

According to the invention, the foregoing objective is realized through the provision of an elongate filter contact assembly which includes an integral capacitor at approximately the middle portion thereof and the provision of means for resiliently mounting and electrically connecting the capacitor to the outer shell of the connector.

The filter contact assembly includes a front contact assembly for engagement with a corresponding contact of a mating connector, a rear contact portion for termination of a conductor by well known means such as crimp or solder connection, and a capacitor disposed between the front and rear portions of the assembly. The capacitor is advantageously a tubular construction including a dielectric sandwiched between inner and outer conductive tubes which serve as the electrodes and contacts of the capacitor. The inner electrode embraces and is electrically connected to the front and rear portions of the contact assembly, while the other electrode is utilized as the ground connecting terminal.

The contact assembly, or a plurality of such assemblies, is resiliently mounted in an electrical connector assembly wherein a conductive rubber seal engages the outer electrode of the capacitor and connects such electrode to the outer shell of the connector.

A pair of rigid insulators having aligned bores therethrough and the conductive rubber member sandwiched therebetween are urged toward each other to deform the conductive rubber member and increase the contact area thereof at the ground terminal of the capacitor and at the outer shell by means of a circumferential flange about each of the insulators which is respectively engaged by the outer shell and a nut-type clamp assembly threaded on the outer shell for advancement axially thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention, its organization, construction and operation will best be understood from the following detailed description of a preferred embodiment thereof taken in conjunction with the accompanying drawing, in which:

FIG. 1 is an elevational view, partially in section, of a contact pin assembly constructed in accordance with the principles of the invention;

FIG. 2 is an elevational view, partially in section, of an electrical connector illustrating how the apparatus of FIG. 1 is mounted therein; and

FIG. 3 is an enlarged view of a sectioned portion of the electrical connector illustrated in FIG. 2 showing the relationship between the contact pin assembly and the resilient deformable conductive sealing means.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a pin contact assembly is illustrated generally at 10 as comprising a first conductive pin member 11 and a second conductive pin member 12. The first conductive pin member 11 includes an end portion 13 for termination of a conductor by crimp, solder or other known techniques. The second conductive pin member 12 includes an end portion 14 adapted for engagement with a corresponding portion of a mating conductor assembly. The first conductive pin member 11 is substantially cylindrical in shape and includes a cylindrical portion 15 adjacent a stepdown portion defined by a pair of adjacent shoulders 18, 19 from which a portion 20 of lesser diameter projects for engagement with the second conductive pin member 12. A similar cylindrical construction is provided at 16 and the adjacent shoulders 21, 22 of the second pin member 12; however, the member 12 includes a tapered portion 17 extending from the portion 16 toward the end 14. The second conductive pin member 12 also includes a bore 23 for receiving the end projecting portion 20 of the first conductive pin member 11 in an electrically conductive contact relationship.

A tubular capacitor 24 is disposed about that part of the end portion 20 of the first conductive pin member 11 which is not within the bore 23 of the second conductive pin member 12. The capacitor 24 comprises an inner tubular member 25 including end portions 28, 29 which conform to the shape of the respective shoulders 18, 19 and 21, 22 of the conductive pin members 11, 12 and wrap around to embrace corresponding ends of a dielectric 26. An outer tubular member 27 is disposed about the dielectric 26 and spaced from the portions 28, 29 of the inner tubular member 25 to provide respective insulator bands (gaps) 30, 31 therebetween. The inner tubular member 25 therefore electrically contacts the first conductive pin member at the shoulders 18, 19 and the second conductive pin member at the shoulders 21, 22 and the first and second conductive pin members are further electrically connected by the contact between their respective end portion 20 and bore 23. The inner tubular member 25 is therefore electrically connected in circuit with the circuit to be completed by the contact pin assembly; whereas, the outer tubular member serves for connection to a

reference point, particularly ground. Therefore, interference signals may be shunted to ground from the associated circuit by way of the capacitor 24.

Referring to FIG. 2, an electrical connector assembly, generally referenced 32, is illustrated as comprising means for resiliently mounting the pin contact assembly 10, or a plurality of such assemblies, and electrically connecting the outer tubular member or electrode 27 of the capacitor 24 to ground. The electrical connector assembly 32 comprises an outer conductive shell 33 having a threaded portion 34 for mechanical securement to a mating connector assembly. The conductive shell 33 also comprises a second threaded portion 35 for engaging a corresponding threaded portion 36 of a nut-type clamped assembly 37. The nut-type clamp assembly could also take the form of a cable adapter as is well known in the art.

The outer conductive shell 33 is a hollow construction and includes a pair of rigid insulators 38, 39 disposed therein and a deformable resilient electrically conductive member, preferably conductive rubber, disposed therein between the insulators 38, 39 and in contact with the inner shell surface 41. The insulator 38 includes a bore 42 therethrough parallel to the axis of the connector assembly. The insulator 39 also includes a bore 43 therethrough which is aligned with the bore 42 in the insulator 38. In addition, the deformable resilient electrically conductive member 40 includes an aperture or bore 44 therethrough which is aligned with the bores 42, 43. The contact pin assembly 10 may be secured in one of the insulators, say the insulator 39, by a contact retention mechanism, such as the collet retention means disclosed by Joseph A. Nava and Alvin R. Burton in their U.S. Pat. No. 3,335,396, issued Aug. 8, 1967, which prevents the contact pin assembly from being pulled out (to the left in FIG. 2) after insertion in the opposite direction in that tines 45 bear against a shoulder 15' of the cylindrical portion 15 of the first conductive pin member 11.

The insulator 39 includes a circumferential flange 47 and the insulator 38 includes a circumferential flange 48 which are utilized for urging the insulators 38, 39 toward each other. The outer shell 33 includes a circumferential groove 49 which receives a sealing ring 50, which bears against a flange 49' and the flange 48. The outer shell 33 also includes a circumferential groove 51 for receiving a leg portion of a T-shaped retaining ring 52 which is disposed about the insulator 39 and abuts the flange 47. A second ring 53 abuts the ring 52 and a shoulder 54 of the clamp nut 37 whereby advancement of the clamp nut 37 (toward the right as viewed in the drawing) causes the elements 51-54 via the flange 47 to urge the insulator 39 toward the insulator 38, while the sealing ring 50 and the flange 49' via the flange 48 urge the insulator 38 toward the insulator 39. The movement of the insulators 38, 39 toward each other compresses the conductive sealing member 40 and deforms the member for increased contact area between a pair of flanges 55, 56 carried at respective facing ends of the insulators 39, 38. The same action is effected about the capacitor 44 to form a "donut" ring seal 57 about the outer tubular member 27. The contact pin assembly 10, or each such contact pin assembly of a multi-pin connector, is resiliently mounted within, and the capacitor 24 thereof is electrically connected

to, the outer conductive shell 33. The shell 33 may, of course, be connected to ground potential by any of several well-known techniques.

As illustrated in the drawing, sealing has been accomplished through the utilization of the conductive rubber member which also functions as a shunt to ground out unwanted RF signals. In addition, shock and vibration forces are greatly reduced due to the absorption of these forces through the conductive rubber member and the flexible tines of the contact retention mechanism.

Many changes and modifications of my invention may become apparent to those skilled in the art without departing from the spirit and scope of the invention and it should be understood that I intend to include within the patent warranted hereon all such changes and modifications as may reasonably and properly be included within the scope of my contribution to the art.

I claim:

1. An electrical connector assembly comprising: first and second insulator means each having at least one bore therethrough axially aligned with the bore of the other insulator means;
- deformable resilient conductive sealing means between said first and second insulator means and having an aperture aligned with the axially aligned bores of said first and second insulator means;
- electrical contact means secured to one of said insulator means and extending through said aligned bores and aperture, said contact means including conductor means and capacitor means connected to said conductor means and contacting said deformable sealing means;
- a conductive shell disposed about said first and second insulator means and contacting said deformable sealing means; and
- means urging said first and second insulator means toward each other to deform said deformable sealing means at its contacts with said capacitor and said conductive shell to increase the contact areas and to insure such contacts.

2. An electrical connector assembly according to claim 1, wherein said means urging said first and second insulator means toward each other comprises first means on said shell for engaging said first insulator means, second means engaging said second insulator means, and axially movable member carried on said shell and coupled to said second means.

3. An electrical connector assembly according to claim 2, wherein said first means includes an inwardly projecting flange and a sealing member adjacent said flange, and said first insulator means includes a flange for engagement by said flange of said shell via said sealing member.

4. An electrical connector assembly according to claim 2, wherein said axially movable member includes a shoulder and said second means includes means disposed between and abutting said shoulder and said flange of said second insulator means.

5. An electrical connector assembly according to claim 1, wherein said conductor means includes a first end having means for engaging a contact of a mating connector assembly, a second end having means for receiving a connection to an electrical circuit and an intermediate portion having electrical continuity with

said first and second ends and carrying said capacitor means.

6. An electrical assembly according to claim 5, wherein said capacitor means includes a tubular first electrode about and electrically connected to said conductor means, a tubular dielectric disposed about said first electrode, and a tubular second electrode disposed about said dielectric for contacting said deformable conductive sealing means.

7. An electrical connector assembly according to claim 1, wherein said conductor means comprises a first conductor including a stepped down portion defining a shoulder and a portion extending axially from said shoulder, and a second conductor including a shoulder and a bore for receiving said axially extending portion of said first conductor, and said capacitor means includes a first electrode contacting the shoulders of said first and second conductors.

8. An electrical connector assembly according to claim 7, wherein said capacitor means includes a dielectric carried on said first electrode, said first electrode includes portions adjacent the shoulders of said first and second conductors which wrap about and embrace said dielectric, and a second electrode for contacting said deformable conductive sealing means carried by said dielectric between and spaced from the wrap-around portions of said first electrode to define insulator bands between said electrodes.

9. An electrical connector filter pin contact assembly comprising:

a first conductor including a first shoulder spaced from one end thereof;

a second conductor including a second shoulder and a bore for receiving and engaging said one end of said first conductor in an electrical contact relationship with said first and second shoulders spaced apart; and

a capacitor including a first electrode contacting said first and second shoulders, a dielectric carried by said first electrode, and a second electrode carried by said dielectric.

10. An electrical connector filter pin contact assembly according to claim 9, wherein said first and second conductors are generally cylindrical at said first and second shoulders and said capacitor is of tubular form and disposed between said shoulders to provide the same generally cylindrical shape for said pin assembly in the area between said first and second shoulders.

11. An electrical connector assembly comprising:

a tubular conductive shell including a first end having means for engaging a mating connector, a threaded second end, an inwardly projecting

flange, and an internal circumferential groove adjacent said second end;

a cylindrical first insulator disposed within said shell and including a circumferential flange and at least one axially extending bore therethrough;

a sealing ring disposed about said first insulator between said inwardly projecting flange of said shell and said circumferential flange of said first insulator;

a cylindrical second insulator disposed within said shell and including a circumferential flange and at least one axially extending bore therethrough aligned with the bore of said first insulator;

retaining ring means disposed about said second insulator and including a portion extending into said circumferential groove;

threaded means engaging said threaded second end of said shell for movement axially along said connector, said threaded means contacting said retaining means, said retaining means and said inwardly projecting flange effective to urge said first and second insulators toward each other as said threaded means is advanced along said shell;

at least one contact pin means including a capacitor element, said contact pin means secured to at least one of said insulators and disposed within said aligned bores; and

deformable resilient conductive sealing means disposed between said first and second insulators and contacting said shell and including an aperture receiving said capacitor element of said pin means, said conductive sealing means deformed by the urging of said first and second insulators toward each other to increase its contact area with said capacitor element.

12. An electrical connector assembly according to claim 11, wherein each of said insulators includes a second circumferential flange adjacent said deformable conductive sealing means disposed to permit deformation of said sealing means over an increased contact area with said shell while preventing flow thereof between said insulators and said shell beyond said second flanges.

13. An electrical connector assembly according to claim 12, wherein said contact pin means includes conductor means for extending an electrical circuit through said assembly and said capacitor element includes a first electrode contacting said conductor means and a second electrode contacting said deformable conducting sealing means.

14. An electrical connector assembly according to claim 13, wherein said conductive sealing means comprises a conductive rubber material.

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