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SPECIFICATION

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SHIELDED ELECTRICAL CONNECTOR

Field of the Invention

This invention generally relates to the art of electrical connectors and, particularly, to connectors which are shielded against ingress and egress of electromagnetic and radio frequency interferences.

Background of the Invention

Electrical circuitry often is provided with protection from electromagnetic interference (EMI) and radio frequency interference (RFI) emanating from or entering the system. Although EMI and RFI now are often used interchangeably, EMI has been used to connote energy occurring anywhere in the electromagnetic spectrum and RFI has been limited at times to interference in the radio communication band. EMI energy can be generated outside as well as inside the system. External EMI energy can interfere with the operation of electronic equipment within the system, while internal EMI energy can create "cross talk" and "noise" which can cause erroneous data transmission.

Electrical connectors are particularly prone to disruptions from EMI energy because of the numerous contact areas and openings for electrical terminals and cables. A typical electrical connector includes a dielectric housing mounting a plurality of conductive terminals. The housing may have a forward mating section. In order to protect the connector from disruptions caused by EMI energy, shields are provided about the dielectric housing and, particularly, the mating section thereof. Such shields often are fabricated of stamped and formed conductive sheet metal material. The sheet material is stamped and then formed or folded into an enclosure for the connector housing. One of the problems with such shields is that

they often are made of multiple components which cause EMI "leakage" and the components are not held together by sufficiently strong engaging means. The present invention is directed to solving these problems in a multi-component shield which is simple and inexpensive to manufacture and assemble.

Summary of the Invention

An object, therefore, of the invention is to provide a new and improved shielded electrical connector of the character described.

In the exemplary embodiment of the invention, the shielded connector includes a dielectric housing having a front mating end for interfacing with a complementary mating connector. A plurality of terminals are mounted on the housing and include contact portions for engaging appropriate terminals of the mating connector. First and second shields of sheet metal material substantially surround the housing. The first shield includes a clamping arm projecting therefrom. The second shield includes a hole for receiving the clamping arm of the first shield. The clamping arm of the first shield is inserted through the hole in the second shield and is bent into engagement with the second shield to hold the shields together about the housing.

As disclosed herein, the housing includes a rear end, a top wall and opposite side walls. The first shield is a main shield mounted on the housing about at least the top wall and opposite side walls thereof. A pair of the clamping arms project rearwardly from opposite sides of the main shield. The second shield is a rear shield about the rear end of the housing and includes a pair of the holes for receiving the clamping arms of the first shield.

Other features of the invention include the rear shield having recessed areas into which the clamping arms are bent. The rear shield is formed by a rear wall and

side flanges projecting forwardly from the rear wall overlapping the opposite sides of the main shield. The holes in the rear shield are located at the junctures of the rear wall and the side flanges thereof.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

Brief Description of the Drawings

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

FIGURE 1 is a rear perspective view of one embodiment of a shielded electrical connector incorporating the concepts of the invention;

FIGURE 2 is a view similar to that of Figure 2, with the rear shield removed to facilitate the illustration;

FIGURE 3 is a front perspective view of the connector of Figure 1;

FIGURE 4 is a fragmented perspective view of a housing within which the connector of Figures 1-3 can be mounted;

FIGURE 5 is a view similar to that of Figure 1, but of a second embodiment of the invention;

FIGURE 6 is a view similar to that of Figure 5, but with the rear shield removed;

FIGURE 7 is a front perspective view of the connector of Figure 5;

FIGURE 8 is a view similar to that of Figure 4, but showing the connector of Figure 5; and

FIGURE 9 is an exploded perspective view of a shielded connector according to the prior art.

Detailed Description of the Preferred Embodiments

Referring to the drawings in greater detail, and first to Figures 1-3, a first embodiment of a shielded electrical connector according to the invention is generally designated 10. The connector includes a dielectric housing, generally designated 12 (Fig. 2), substantially surrounded by a shield means which includes a first or main shield, generally designated 14, and a second or rear shield, generally designated 16. A plurality of terminals, generally designated 18 (Fig. 2), are mounted on housing 12 and include contact portions 18a (Fig. 3) for engaging appropriate terminals of a complementary mating connector.

More particularly, housing 12 is a one-piece structure unitarily molded of dielectric material such as plastic or the like. As best seen in Figure 2, the housing includes a top wall 20 and opposite side walls 22. The housing defines a front mating end 24 of the connector as seen in Figure 3, and the housing has a rear end 26 as seen in Figure 2. Finally, the housing includes a pair of generally parallel plug boards or terminal platforms 28 (Fig. 3).

Terminals 18 include tail portions 18b depending from the housing for insertion into appropriate holes in a printed circuit board and for connection, as by soldering, to appropriate circuit traces on the board and/or in the holes. The terminals are bent at right angles as best seen in Figure 2, so that contact portions 18a of the terminals extend forwardly into the housing toward the front mating end 24 thereof.

First or main shield 14 is stamped and formed of sheet metal material and includes a top plate 30 and side plates 32 positioned over top wall 20 and side walls 22,

respectively, of housing 12. Side flanges 30a of the top plate overlap the top edges of side plates 32. A pair of tabs 30b at the rear of the top plate are bent into engagement within recesses at the rear edge of top wall 20 of the housing. A pair of contact tabs 30c of top plate 30 and 32c of side plates 32 are bent inwardly near the front mating end of the connector for engaging an appropriate shield of the complementary mating connector. Each side plate 32 also has a pair of mounting legs 32d for insertion into appropriate mounting holes in the printed circuit board. The mounting legs also can serve as grounding legs for engaging appropriate ground circuits on the board and/or in the mounting holes in the board.

Referring specifically to Figure 3, main shield 14 also has a front plate 34 formed with a pair of openings or receptacles 34a for receiving plug portions of the complementary mating connector. A pair of grounding arms 32e project forwardly from the front edges of side plates 32 and are bent in front of front plate 34 in registry with a pair of cutouts 34b in the front plate. Arms 32e form grounding fingers at the front of connector 10 for engaging the shield of the complementary mating connector or for engaging a housing within which the connector is mounted, as will be seen hereinafter. The arms or grounding fingers can be displaced into cutouts 34b in front plate 34.

As best seen in Figure 2, a pair of clamping arms 36 project rearwardly of front shield 14. Specifically, the clamping arms project rearwardly from the rear edges of side plates 32 of the main shield.

Rear shield 16 includes a rear plate or wall 38 with a pair of side flanges 39 projecting forwardly of the rear plate in overlapping relationship along the rear edges of side plates 32 of the front shield. A pair of holes 40 are formed in rear shield 16 at the junctures between rear plate 38 and side flanges 39. The rear plate includes

recessed portions 42 which form recessed areas for receiving clamping arms 36.

More particularly, after front shield 14 is assembled about housing 12 as described above, rear shield 16 is assembled in the direction of arrow "A" (Fig. 2). During assembly, clamping arms 36 of front shield 14 are inserted through holes 40 in rear shield 16. Once the rear shield is positioned flush with rear end 26 of housing 12, clamping arms 36 are bent inwardly as shown in Figure 1 into recessed areas 42 of rear plate 38 of the rear shield. The clamping arms therefore are flush with the rear plate of the rear shield.

Figure 4 simply shows one application of shielded connector 10 mounted within a housing 44 which may be a computer housing. A mating connector-receiving hole 46 is divided by a transverse strip 48 which is engaged by grounding fingers 32e (Fig. 3) of front shield 14 of the connector. The split hole 46 is aligned with receptacles 34a (Fig. 3) in front shield 14 about housing 12 of connector 10.

Figures 5-7 show a second embodiment of a shielded electrical connector, generally designated 10A, incorporating the concepts of the invention. Connector 10A is very similar to connector 10 except for the configuration of a rear shield 16A of connector 10A. Therefore, like numerals have been applied in Figures 5-7 corresponding to like components described above in relation to connector 10 in Figures 1-3. In fact, housing 12 and the front or main shield 14 are identical and the structure of the housing and the main shield will not be repeated in relation to connector 10A of Figures 5-7.

More particularly, in the second embodiment of connector 10A, rear shield 16A includes a pair of side plates or walls 50 which replace flanges 39 of rear shield 16 in first connector 10. Side plates 50 extend all the way forwardly to the front of the connector and include

tabs 52 which are bent inwardly into receptacles 34a in front plate 34 of main shield 14. In addition, a pair of outwardly flared grounding fingers 54 also project forwardly of side plates 50 of rear shield 16A.

Otherwise, main shield 14 of second connector 10A includes clamping arms 36 which are inserted into holes 40 in rear shield 16A and are bent into recessed areas 42 of the rear shield.

Figure 8 shows second connector 10A mounted within a housing 56 having a single hole 58 instead of the split hole 46 (Fig. 4) for first connector 10. With the single hole 58, grounding fingers 54 of rear shield 16A of the second connector 10A engage the inside of the housing at the outsides of hole 58.

Figure 9 shows a shielded electrical connector, generally designated 60, according to the prior art. The connector includes a dielectric housing, generally designated 62, a front shield, generally designated 64, and a rear shield, generally designated 66. The shields are mounted about the housing by means of a pair of latching recesses 68 in the front shield and a pair of latching tabs 70 on the rear shield.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

CLAIMS

1. A shielded electrical connector (10,10A), comprising:

a dielectric housing (12) having a front mating end (24) for interfacing with a complementary mating connector, a rear end (26), a top wall (20) and opposite side walls (22);

a plurality of terminals (18) mounted on the housing and including contact portions (18a) for engaging appropriate terminals of the mating connector;

a main shield (14) mounted on the housing (12) about at least the top wall (20) and opposite side walls (22) thereof, and including a pair of clamping arms (36) projecting rearwardly from opposite sides (32) of the main shield; and

a rear shield (16,16A) about the rear end (26) of the housing (12) and including a pair of holes (40) for receiving the clamping arms (36) of the main shield (14),

whereby the clamping arms (36) of the main shield (14) can be inserted through the holes (40) in the rear shield (16,16A) and clamped against the rear shield to hold the shields together about the housing.

2. The shielded electrical connector of claim 1 wherein at least the main shield (14) is fabricated of sheet metal material and said clamping arms (36) are bent into engagement with the rear shield (16,16A).

3. The shielded electrical connector of claim 2 wherein the rear shield (16,16A) is fabricated of sheet metal material and includes recessed areas (42) into which the clamping arms (36) are bent.

4. The shielded electrical connector of claim 1 wherein said rear shield (16,16A) includes a rear wall (38) and side flanges (39,50) projecting forwardly from the rear wall overlapping the opposite sides (32) of the main shield (14).

5. The shielded electrical connector of claim 4 wherein said holes (40) are located at the junctures of the rear wall (38) and the side flanges (39,50) of the rear shield (16,16A).

6. The shielded electrical connector of claim 5 wherein at least the main shield (14) is fabricated of sheet metal material and said clamping arms (36) are bent into engagement with the rear wall (38) of the rear shield (16,16A).

7. The shielded electrical connector of claim 6 wherein the rear shield (16,16A) is fabricated of sheet metal material and includes recessed areas (40) in the rear wall (38) into which the clamping arms (36) are bent.

8. The shielded electrical connector of claim 1 wherein said rear shield (16A) includes a rear wall (38) and side walls (50) projecting forwardly from the rear wall overlapping the opposite sides (32) of the main shield (16) and including grounding fingers (54) at the front mating end (24) of the connector housing.

9. A shielded electrical connector (10,10A), comprising:

a dielectric housing (12) having a front mating end (24) for interfacing with a complementary mating connector;

a plurality of terminals (18) mounted on the housing and including contact portions (18a) for engaging appropriate terminals of the mating connector;

first and second shields (14,16,16A) of sheet metal material substantially surrounding the housing,

said first shield (14) including a clamping arm (36) projecting therefrom, and

said second shield (16,16A) including a hole (40) for receiving the clamping arm (36) of the first shield (14),

whereby the clamping arm (36) of the first shield (14) can be inserted through the hole (40) in the second shield (16,16A) and bent into engagement with the second shield to hold the shields together about the housing.

10. The shielded electrical connector of claim 9 wherein said second shield (16,16A) includes a recessed area (42) into which the clamping arm (36) is bent.

11. The shielded electrical connector of claim 9 wherein said second shield (16,16A) includes a flange (39,50) projecting from a wall (38) of the second shield in overlapping relationship at an edge of the first shield (14), said clamping arm (36) projects from said edge of the first shield, and said hole (40) is located at a juncture of the wall (38) and the flange (39,50) of the second shield (16,16A).

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12. The shielded electrical connector of claim 9, including a plurality of said clamping arms (36) of the first shield (14) and a corresponding plurality of holes (40) of the second shield (16,16A) at least at opposite sides of the shields.