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(54) **Coaxial cable connector system.**

(57) A connector system is provided for terminating and grounding a coaxial cable having a conductor core and a conductor shield means outside the core. A first connector assembly includes a dielectric housing defining a receptacle. A signal terminal and a ground terminal are mounted on the housing and exposed in the receptacle. A second connector assembly (22) includes a dielectric plug (46) configured for insertion into the receptacle of the first connector assembly. A signal terminal (48) is mounted on the plug for termination to the conductor core (12) of the coaxial cable and for mating with the signal terminal on the first connector assembly. A shield (60) is disposed about a substantial area of the plug, coupled to the shield means (16) of the coaxial cable. A contact portion (70) on the outside of the plug engages the ground terminal on the first connector assembly.

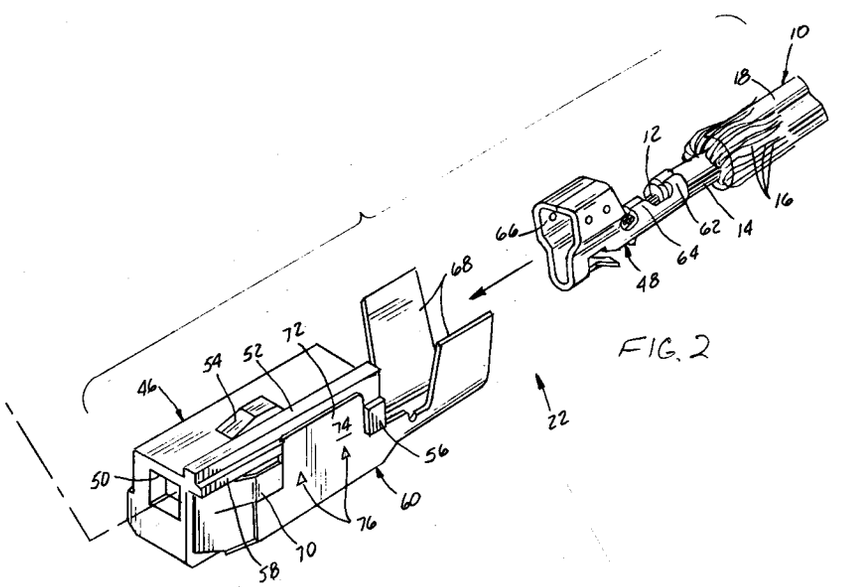

FIG. 2

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Field of the Invention

This invention generally relates to the art of electrical connectors and, particularly, to a connector system for terminating and grounding a coaxial cable.

Background of the Invention

Modern electronic systems often require large numbers of coaxial cables for high speed signal transmission purposes, such as in systems incorporating computer equipment and associated peripheral equipment. Such systems involve not only interconnections of integrated circuits to printed circuit boards but also printed circuit boards to other printed circuit boards. A popular form of connection is called a post and socket connection utilizing a two-piece connector. These connections provide high reliability and standardized design which have contributed to the popularity of such systems.

Coaxial cables are used widely in such systems because they are advantageous in their ability to provide shielding functions to prevent escape of electromagnetic energy and/or undesirable input of electromagnetic energy with respect to signal conductors. They also have impedance characteristics that improve accuracy and efficiency, such as the speed of signal transmission and the transmitted signal quality.

A conventional coaxial cable typically includes a signal conductor or core surrounded by an insulating sheath, with shield or ground means between the insulating sheath and an outer insulating jacket. The shielding means may be a conductive braid or foil, for example.

There is a constant need for simple and cost-effective connector systems of the character described for terminating and grounding coaxial cables without compromising their accuracy and efficiency characteristics. Because of the large numbers of coaxial cables which eight be used in a single electronic apparatus, cost effectiveness is a prime consideration in designing coaxial cable connector systems. Using multiple components or parts to provide both a terminating function and a grounding function on the cables, as well as providing shielding means for the cable terminals significantly increases the costs of the connector systems. This is particularly true in two-part connectors of the post and socket type. This invention is directed to satisfying the continuing need for very simple, cost effective, yet reliable connector systems of the character described.

Summary of the Invention

An object, therefore, of the invention is to provide a new and improved connector system for terminating and grounding a coaxial cable which has a conductor core and a conductor shield means about the core, with appropriate insulation therebetween and thereabout.

In the exemplary embodiment of the invention, the connector system includes a first connector assembly including a dielectric housing defining a receptacle. A signal terminal is mounted on the housing and exposed in the receptacle. A ground terminal is mounted on the housing and is also exposed in the receptacle. A second connector assembly includes a dielectric plug configured for insertion into the receptacle of the first connector assembly. A signal terminal is mounted on the plug for termination to the conductor core of the coaxial cable and for mating with the signal terminal on the first connector assembly. A shield of the second connector assembly is disposed about a substantial area of the plug, coupled to the shield means of the coaxial cable, and includes a contact portion on the outside of the plug for engaging the ground terminal on the first connector assembly.

As disclosed herein, the dielectric housing of the first connector assembly includes an outer wall, with the ground terminal disposed inside the wall. Therefore, the area of engagement between the ground terminal and the contact portion of the shield of the second connector assembly is protected by the outer wall of the housing of the first connector assembly.

Both the dielectric housing of the first connector assembly and the dielectric plug of the second connector assembly are unitarily molded components. Complementary interengaging guide means are molded integrally with the housing and the plug to guide the plug into the receptacle of the housing. Complementary interengaging latch means also are molded integrally with the housing and the plug to secure the connector assemblies in a mating condition.

The shield about the plug of the second connector assembly includes a shielding portion spaced from its contact portion. The plug has a signal-terminal-receiving cavity disposed between the shielding portion and the contact portion, whereby the signal terminal is disposed between those portions and shielded thereby. In the preferred embodiment of the invention, the shield is generally U-shaped in cross-section, with the contact portion and the shielding portion of the shield defining the legs of the U-shape. The dielectric plug is generally rectangularly shaped in cross-section, with the U-shaped shield substantially covering three sides of the plug. The plug is elongated and the signal-terminal-receiving cavity is formed by a longitudinal through hole in the plug, and the

U-shaped shield extends along a substantial length of the plug. Complementary interengaging retaining means between the shield and the plug are provided to properly position the shield longitudinally of the plug.

The invention also contemplates that the components of the first and second connector assemblies be configured so that the contact portion on the shield of the second connector assembly engages the ground terminal on the first connector assembly before the signal terminal on the second connector assembly engages the signal terminal on the first connector assembly. Therefore, the grounding circuit will be closed before the signal circuit, thereby assuring proper shielding of the transmission interconnection.

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 perspective view of the first connector assembly of the connector system of the invention;

FIGURE 2 is an exploded perspective view of the second connector assembly of the system;

FIGURE 3 is a top plan view of the shield of the second connector assembly;

FIGURE 4 is a side elevational view of the shield of Figure 3;

FIGURE 5 is a bottom plan view of the plug of the second connector assembly;

FIGURE 6 is a side elevational view of the plug of Figure 5;

FIGURE 7 is a longitudinal vertical section through the housing of the first connector assembly; and

FIGURE 8 is a somewhat schematic illustration of the second connector assembly in an initial position of mating, illustrating the ground terminal being engaged before the signal terminal.

Detailed Description of the Preferred Embodiment

Referring to the drawings in greater detail and first to Figures 1 and 2, the connector system of the invention is designed for terminating and grounding a coaxial cable, generally designated 10, which includes a central conductor core 12 surrounded by an insulating sheath 14, with shielding means 16 between the sheath and an outer insulating jacket 18. Shielding means 16 may be stranded wires, a braid, a foil or the like, as is known in the art.

Generally, the electrical connector system of the invention includes a first connector assembly, generally designated 20 and shown in Figure 1, and a second connector assembly, generally designated 22 and shown in Figure 2.

First connector assembly 20 includes a dielectric housing, generally designated 24, which includes a top wall 26, a bottom wall 28, a side wall 30 and an end wall 32. The dielectric housing is unitarily molded of plastic material or the like. The housing defines a receptacle, generally designated 34, between the top, bottom and side walls. A groove 36 is formed on the inside of bottom wall 28, and a groove 38 is formed on the inside of top wall 26, for purposes described hereinafter.

First connector assembly 20 also includes a signal terminal 40 mounted on housing 24 through end wall 32 and includes a mating end 40a and a terminal end 40b. A ground terminal 42 also is mounted on housing 24 through end wall 32 and includes a mating end 42a and a terminal end 42b. Mating ends 40a and 42a of signal terminal 40 and ground terminal 42, respectively, are exposed in receptacle 34 of housing 24. Terminal ends 40b and 42b of signal terminal 40 and ground terminal 42, respectively, may terminate the connector system of the invention to a complementary electronic component, such as inserting the terminal ends of the terminals through appropriate holes in a printed circuit board. To that end, the outside of end wall 32 is provided with stand-offs 44 to space connector assembly 20 from the surface of the printed circuit board.

At this point, it should be understood that the use of the terms "top", "bottom", "vertical", "horizontal", and other similar directional terms, is solely to facilitate a clear and concise description of the exemplary embodiment of the invention as depicted in the drawings, it being understood that the connector system and connector assemblies 20 and 22 are omni-directional in use. For instance, as stated above, terminal ends 40b and 42b of terminals 40 and 42, respectively, can be inserted into holes in a printed circuit board which may be vertically oriented, horizontally oriented or canted in any direction.

Second connector assembly 22 shown in Figure 2 includes a dielectric plug, generally designated 46, which is unitarily molded of plastic material or the like. The plug is sized and configured for insertion into receptacle 34 of housing 24 of first connector assembly 20. A signal terminal,

generally designated 48, is mounted in plug 46 in a through hole longitudinally of the plug and which defines a signal terminal receiving cavity for second connector assembly 22. A forward mouth 50 of the cavity is visible in Figure 2.

Dielectric plug 46 includes an integrally molded longitudinal rib 52 on the top of the plug for positioning in slot 38 of housing 24 of the first connector assembly to guide the plug into receptacle 34. A camming latch 54 also is integrally molded with the top of the plug for engaging complementary latch means inside the plug, as described in greater detail hereinafter. A positioning block 56 and a horizontal rib 58 are integrally molded on one side of plug 46 for longitudinally positioning a shield, generally designated 60, also as described in greater detail hereinafter.

Signal terminal 48 has two pairs of crimping sections 62 and 64 at a terminating end of the terminal. Crimping sections 62 are crimped onto insulating sheath 14 of coaxial cable 10 to provide strain relief therefor. Crimping sections 64 are crimped onto conductor core 12 of the cable for conductively terminating the signal terminal to the conductor core. The signal terminal has a female mating end 66 which is the lead end of the terminal inserted into the rear of plug 46, with the female mating end being aligned with mouth 50 at the front end of the plug. Consequently, when second connector assembly 22 is inserted into receptacle 34 of first connector assembly 20, mating end 40a of signal terminal 40 will enter mouth 50 and terminate with signal terminal 48 within female end 66 thereof.

Shield 60 is a stamped and formed unitary metal component and is configured for positioning about a substantial area of dielectric plug 46. As will be seen in relation to Figures 3 and 4, the shield is generally U-shaped in cross-section for covering a substantial area of three sides of plug 46. Continuing to refer to Figure 2, the shield has a pair of crimping arms 68 for crimping onto shield means 16 of coaxial cable 10 to ground the shield means with the shield. A contact portion 70, in the form of an outwardly bent spring finger, is formed out of shield 60, on the outside of plug 46, for engaging ground terminal 42 inside receptacle 34 of first connector assembly 20. Consequently, ground terminal 42 and contact portion 70 will be disposed within side wall 30 of housing 24 and be protected thereby. Figure 2 also shows that an upwardly directed tab portion 72 of a plate-like side wall 74 of shield 60 is sandwiched between positioning block 56 and rib 58 of the plug to facilitate longitudinally positioning the shield on the plug and retaining the shield lengthwise of the plug. Lastly, staking detents 76 are stamped into side wall 74 of shield 60 to provide frictional surface retention on the inside of the side wall against the molded plastic material of plug 46.

Figures 3 and 4 show shield 60 in greater detail and like numerals have been applied to the portions of the shield described in relation to Figure 2. As stated above, the shield is generally U-shaped in cross-section and includes side wall 74 and an opposite side wall 78 defining the legs of the U-shape. A bottom wall 80 defines the bight or base of the U-shape. An elongated aperture 82 is formed in bottom wall 80, for purposes described hereinafter. The transverse inside dimensions of U-shaped shield 60 are very slightly greater than the transverse rectangular configuration of plug 46 so that there is a tight fit between the shield and the plug. Whereas side wall 74 includes contact finger 70, side wall 78 of the shield is substantially planar. Figure 3 shows how staking detents 76 project inwardly from side walls 74 and 78 to frictionally engage and indent the molded plastic material of plug 46.

Figures 5 and 6 show side elevational and bottom plan views, respectively, of plug 46. Positioning block 56 and rib 58 are clearly shown in this view. In addition, it can be seen that a latch projection 84 and a positioning projection 86 are molded integrally to the bottom of the unitary plug. Figure 5 shows that there actually are two positioning projections 86 at the forward end of the plug. Latch projection 84 is located for snapping into aperture 82 (Fig. 2) of the bottom wall 80 of shield 60. Positioning projections 86 are designed for abutting against a front edge 88 of the shield. Figure 5 shows a pair of positioning and retaining blocks 90 molded integrally with the side of plug 46 opposite that shown in Figure 2, at opposite ends of the plug. These positioning blocks are located for abutting against the front and rear ends of side wall 78 of shield 60.

Figure 7 is a longitudinal section through housing 24 of first connector assembly 20 to illustrate that a third groove 92 is formed on the inside of top wall 26, the groove being blocked at the front end thereof, as at 94, by the molded plastic material of the housing. That is why the groove cannot be seen in Figure 1. This groove is of a width for receiving latch projection 84 (Figs. 5 and 6) and defines an abutment shoulder 96 for engaging an abutment shoulder 98 (Figs. 5 and 6) of latch projection 84. When plug 46 is inserted into housing 24, top wall 26 of the housing will yield sufficiently for latch projection 84 to snap into groove 92 and latch and retain the second connector assembly in the receptacle defined by housing 24 of the first connector assembly. To this end, a leading surface 100 (Fig. 6) of latch projection 84 is angled to engage an angled surface 102 (Fig. 7) on housing 24 to provide a camming action for ease of

snapping the latch projection into the groove. Figure 7 shows that groove 92 actually extends into an opening 104 in end wall 32 of housing 24. This opening is provided for molding purposes. Lastly, Figure 7 shows a hole 106 in end wall 32 through which signal terminal 40 (Fig. 1) projects.

Figure 8 shows somewhat schematically a feature of the invention wherein the various components of second connector assembly 22 are relatively assembled so that the grounding circuit through the connector system will be closed before the signal circuit is closed, thereby assuring proper shielding during interconnection between the circuit components. Specifically, contact finger 70 is located for engaging ground terminal pin 42 before signal terminal 44 engages female portion 66 of signal terminal 48. Ground terminal pin 42 and signal terminal pin 44 also are shown schematically as removed from housing 24 of first connector assembly 20 in order to represent that second connector assembly 22 can be used with various electronic components having ground and signal terminal pins.

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 connector assembly for terminating and grounding a coaxial cable having a conductor core and conductor shield means outside the core, comprising:

a first connector assembly including a dielectric housing defining a receptacle, a signal terminal mounted on the housing and exposed in the receptacle, and a ground terminal mounted on the housing and exposed in the receptacle; and

a second connector assembly including a dielectric plug configured for insertion into the receptacle of the first connector assembly, a signal terminal mounted on the plug for termination to the conductor core of the coaxial cable and for mating with the signal terminal on the first connector assembly, and a shield about a substantial area of the plug, coupled to the shield means of the coaxial cable, and including a contact portion on the outside of the plug for engaging the ground terminal on the first connector assembly.

2. The connector assembly of claim 1 wherein the dielectric housing of said first connector assembly includes an outer wall, with said ground terminal disposed inside the outer wall whereby the area of engagement between the ground terminal and the contact portion of the shield is protected by the outer wall of the housing.

3. The connector assembly of claim 1 or claim 2, including complementary interengaging guide means between the dielectric housing of the first connector assembly and the dielectric plug of the second connector assembly to guide the plug into the receptacle.

4. The connector assembly of any preceding claim wherein each of said dielectric housing and said dielectric plug comprises a unitarily molded component, and said complementary interengaging guide means are molded integrally therewith.

5. The connector assembly of any preceding claim, including complementary interengaging latch means between the dielectric housing of the first connector assembly and the dielectric plug of the second connector assembly to secure the connector assemblies in a mating condition.

6. The connector assembly of claim 5 wherein each of said dielectric housing and said dielectric plug comprises a unitary molded component, and said complementary interengaging latch means are molded integrally therewith.

7. The connector assembly of claim 1 or claim 2, wherein said shield includes a shielding portion spaced from said contact portion, and the dielectric plug has a signal-terminal-receiving cavity disposed between the shielding portion and the contact portion whereby the signal terminal is disposed between said portions and shielded thereby.

8. The connector assembly of claim 7 wherein said shield is generally U-shaped in cross-section, with said contact portion and said shielding portion defining the legs of the U-shape.

9. The connector assembly of claim 8 wherein said dielectric plug is generally rectangularly shaped in cross-section, with the U-shaped shield substantially covering three sides of the plug.

10. The connector assembly of claim 9 wherein said dielectric plug is elongated and said

signal-terminal-receiving cavity is formed by a longitudinal through hole in the plug, and the U-shaped shield extends along a substantial length of the plug.

11. The connector assembly of claim 10, including complementary interengaging retaining means between the shield and the plug to properly position the shield longitudinally of the plug.

12. A connector assembly as claimed in claim 1, in which the signal terminal and the ground terminal of the first connector assembly and the signal terminal and the contact portion of the shield of the second connector assembly all being dimensioned and configured such that the contact portion engages the ground terminal before the signal.

13. An electrical connector assembly for terminating a coaxial cable having a conductor core and conductor shield means about the core, comprising:

a dielectric housing;

a signal terminal mounted on the housing for termination to the conductor core of the coaxial cable and for mating with a signal terminal means of a complementary electronic component; and

a shield about a substantial area of the housing, coupled to the shield means of the coaxial cable, and including a contact portion on the outside of the housing for engaging a ground means of the complementary electronic component.

14. The electrical connector assembly of claim 13 wherein said shield includes a shielding portion spaced from said contact portion, and the dielectric housing has a signal-terminal-receiving cavity disposed between the shielding portion and the contact portion whereby the signal terminal is disposed between said portions and shielded thereby.

15. The connector system of claim 14 wherein said shield is generally U-shaped in cross-section, with said contact portion and said shielding portion defining the legs of the U-shape.

16. The connector system of claim 15 wherein said dielectric housing is generally rectangularly shaped in cross-section, with the U-shaped shield substantially covering three sides of the housing.

17. The connector system of claim 16 wherein said dielectric housing is elongated and said signal-terminal-receiving cavity is formed by a longitudinal through hole in the housing, and the U-shaped shield extends along a substantial length of the housing.

18. The connector system of claim 17 including complementary interengaging retaining means between the shield and the housing to properly position the shield longitudinally of the housing.

19. In combination with the electrical connector assembly of claim 11, an electronic component which includes a signal terminal pin for mating with said signal terminal of the assembly, and a ground terminal pin for engaging the contact portion of the shield.

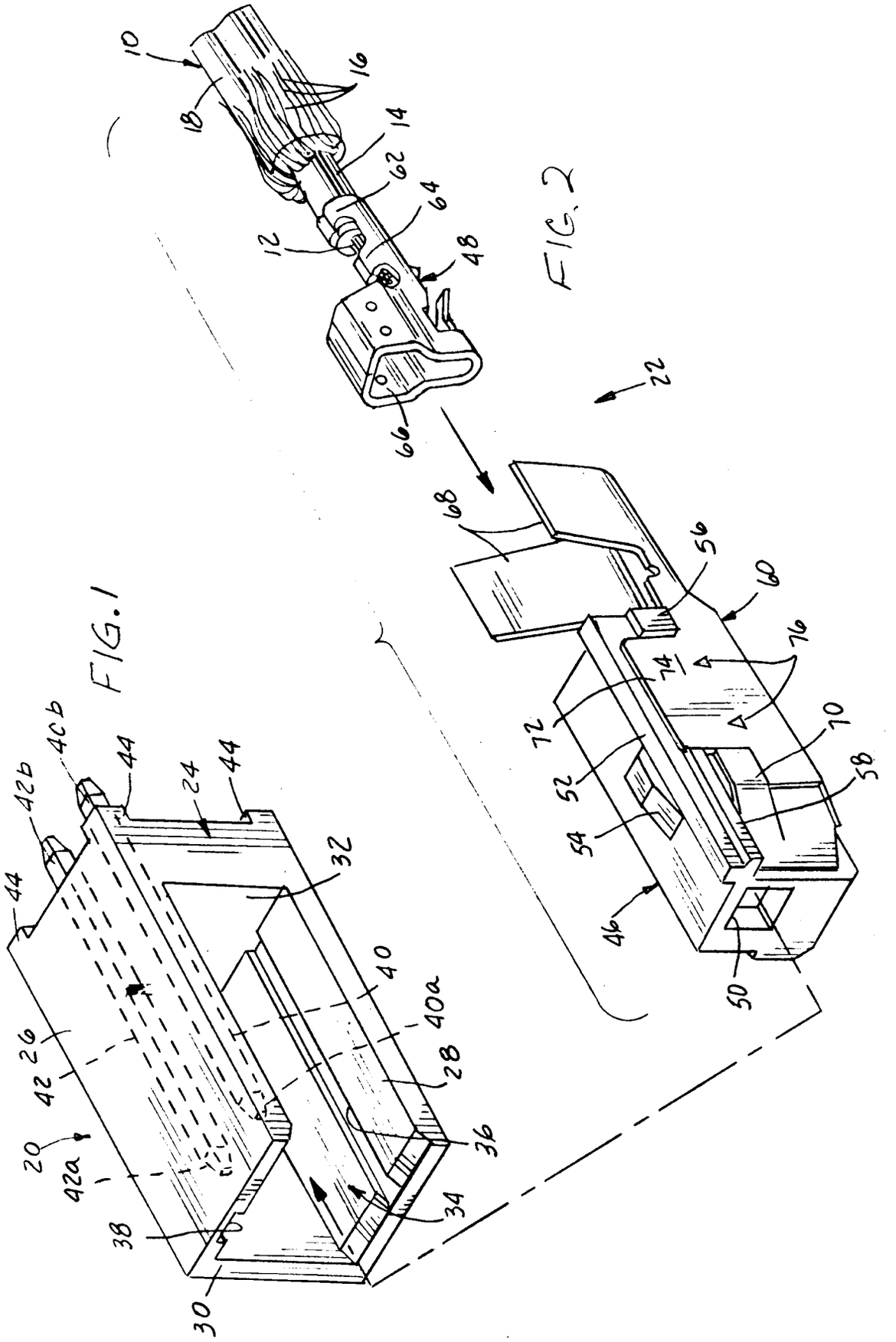
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FIG. 1

FIG. 2

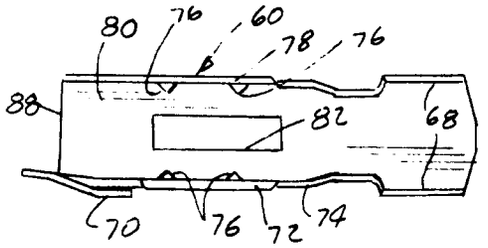

FIG. 3

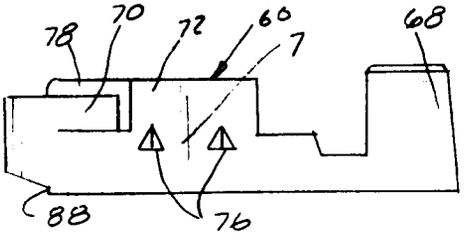

FIG. 4

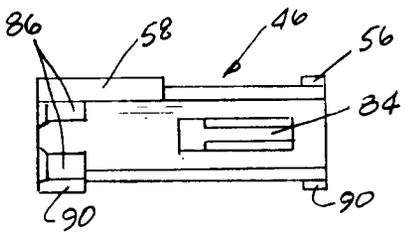

FIG. 5

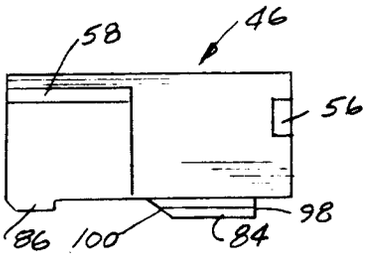

FIG. 6

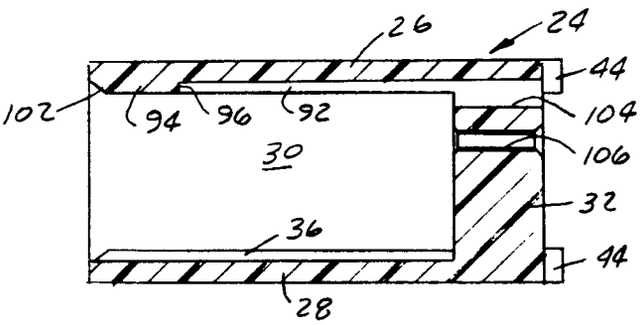

FIG. 7

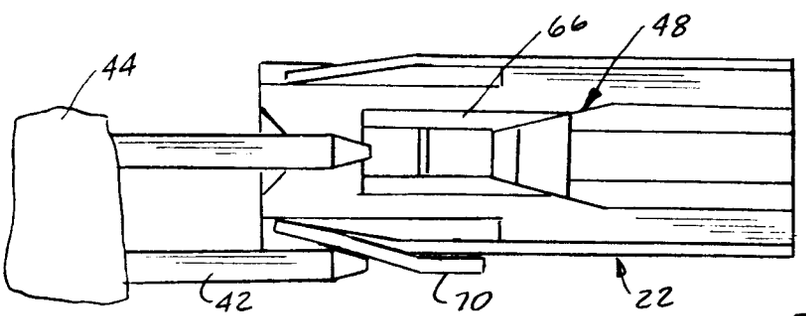

FIG. 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 3559

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-A-2 018 376 (IBM) * page 11, last paragraph - page 12, paragraph 1; figures 1,3,4 *	13	H 01 R 17/12
Y		1	
A		7,9,10, 14,16, 17	
Y	US-A-3 723 942 (J.J. DENNISON) * column 4, lines 1-5,17-27; figure 5 *	1	
X	GB-A-2 104 312 (ITT) * page 2, lines 80-97; figures 1,4-6 *	13	
A		1,7,10	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
H 01 R 17/00
H 01 R 9/00
H 01 R 13/00
H 01 R 23/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	06-12-1991	ALEXATOS G

CATEGORY OF CITED DOCUMENTS

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