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(54) Shielded electrical connector

(57) A shielded electrical connector includes a dielectric housing (10) having a mating end (13) for interfacing with a complementary mating connector. A plurality of terminals are mounted on the housing. A first shield (11) of a highly resilient metal material is mounted on the housing and includes a spring portion (22) for engaging a shield of the mating connector. A second shield (12) of a highly conductive material is mounted on the housing in engagement with the first shield (11) and includes a grounding portion (26,27) projecting therefrom.

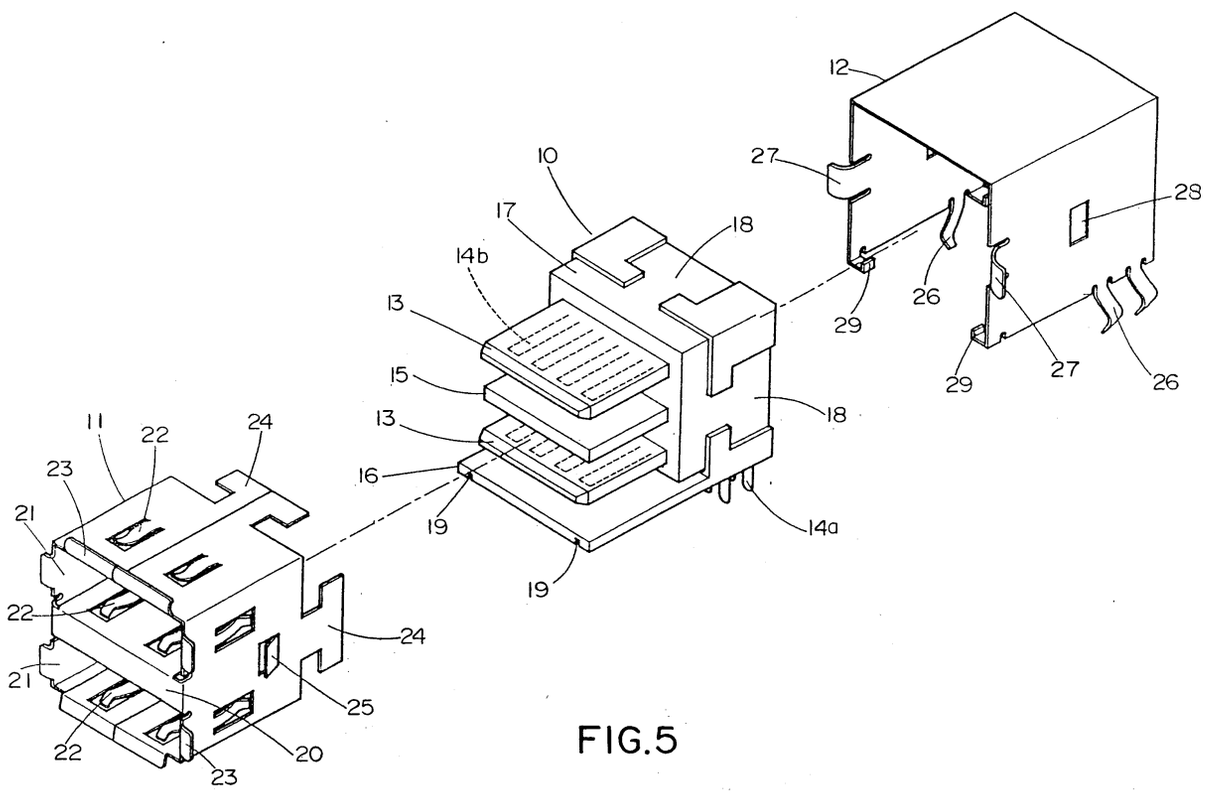

FIG.5

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Description

Field of the Invention

[0001] 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

[0002] 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.

[0003] 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.

[0004] One of the problems in designing such shields for electrical connectors is that the shields have multiple functions in various connector applications, and the functions may not be consistent with the material of the shield. For instance, the shield may have spring portions, such as cantilevered spring fingers, for engaging the shield of a complementary mating connector. It is highly desirable that these spring fingers have high resiliency or resilient power so that they establish a good positive engagement with the shield of the complementary mating connector. A good material for the shield in order to provide high resilient forces is stainless steel, for instance. However, stainless steel is relatively expensive. In order to reduce the cost, a material such as phosphor bronze may be used and then electroplated. However, this material does not provide the positive resilient forces of the stainless steel.

[0005] Continuing further, such shields often are used on connectors which are mounted on a printed circuit board, and the shield may have one or more legs for connection to ground circuits on the board. The connector may be mounted at an aperture in a panel, such as a backplane, and the shield also may have projecting flanges for grounding to the backplane about the aperture. Therefore, the shield should be highly conductive, and stainless steel material is not the best choice for these grounding functions. The electroplated phosphor bronze material would be more appropriate.

[0006] The present invention is directed to solving the above problems by providing a multi-component shield of different materials for different purposes such as described above.

Summary of the Invention

[0007] An object, therefore, of the invention is to provide a new and improved shielded electrical connector of the character described.

[0008] In the exemplary embodiment of the invention, the 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. A first shield of a first material is mounted on the housing about at least a front portion thereof and includes at least one spring portion for engaging a shield of the mating connector. A second shield of a second material is mounted about at least a rear portion of the housing and a rear portion of the front shield.

[0009] As disclosed herein, the first shield includes at least one receptacle at the front mating end of the housing for receiving the mating connector. The spring portion of the first shield is a cantilevered spring finger projecting into the receptacle. The first shield is fabricated of a highly resilient material such as stainless steel or the like so that the spring finger applies a strong engaging force against the shield of the mating connector. The first shield may also include at least one outwardly projecting stop flange for engaging an edge of the second shield.

[0010] The second shield includes at least one outwardly projecting flange for engaging a panel adjacent an aperture at which the connector is mountable. The second shield also includes at least one depending leg for connection to a circuit trace on a printed circuit board. The second shield is fabricated of a highly conductive, readily solderable material, such as an electroplated bronze material, so that the projecting flange and the depending leg establish good ground connections to the panel and the circuit board.

[0011] Other features of the invention include the housing having a platform projecting forwardly into the receptacle, with the contact portions of the terminals juxtaposed on the platform. The housing includes at least one recess in an outer surface thereof for receiving a section of the first shield to retain the first shield on the housing. As disclosed herein, the recess in the housing and the section of the first shield are complementarily

T-shaped.

[0012] 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

[0013] 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 an exploded perspective view of a shielded electrical connector according to the prior art;

FIGURE 2 is a fragmented perspective view of an enclosure within which the prior art connector of Figure 1 typically is mounted;

FIGURE 3 is a front perspective view of the shielded electrical connector according to the invention;

FIGURE 4 is a view similar to that of Figure 3, with the outer shield shown removed from the connector;

FIGURE 5 is an exploded perspective view of the connector of the invention; and

FIGURE 6 is a fragmented perspective view of an enclosure within which the connector of the invention can be mounted.

Detailed Description of the Preferred Embodiment

[0014] Referring to the drawings in greater detail, and first to Figure 1, a shielded electrical connector according to the prior art is shown to include a dielectric housing 1, a front shield 2 and a rear shield 3. The housing typically is molded of plastic material, and the front and rear shields are stamped and formed of sheet metal material.

[0015] Housing 1 has a pair of insertion slots 4 in a front mating face la of the housing. A plurality of terminals are mounted in the housing, and the terminals have tail portions 5 depending from a bottom face 1b of 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 have contact portions (not shown) exposed within insertion slots 4 for engaging appropriate terminals of a complementary mating connector inserted into the slots.

[0016] Front metal shield 2 and rear metal shield 3 of the prior art connector substantially surround housing 1 to provide EMI protection for the connector. The shields are latched together by a pair of latching tongues 8 on opposite sides of rear shield 3 which snap into latching holes 9 in opposite sides of front shield 2.

[0017] Front metal shield 2 of the prior art connector includes a pair of front grounding fingers 6 stamped and formed out of a front plate 2a of the shield, along with a pair of grounding legs 7 depending from side walls 2b of the shield for insertion into appropriate holes in the printed circuit board and for connection, as by soldering, to appropriate ground traces on the board and/or in the holes. Front shield 2 has a pair of receptacles 2c aligned with insertion slots 4 of housing 1 for receiving the complementary mating connector. A plurality of cantilevered fingers 2d project rearwardly from the edges of receptacles 2c for engaging retention recesses 4a within the insertion slots 4 to retain the front shield of the housing 1.

[0018] The prior art connector of Figure 1 may be mounted within an enclosure "A" shown in Figure 2, which may be a computer housing. A mating connector-receiving hole A1 is divided by a transverse strip A2 which is engaged by grounding fingers 6 at the front of metal shield 2 of the prior art connector. The split hole A1 is aligned with receptacles 2c of front shield 2 and insertion slots 4 of housing 1 of the connector.

[0019] The above description of the prior art connector in Figures 1 and 2 exemplify the problems and the dilemma discussed in the "Background", above. Specifically, it would be desirable for fingers 2d of shield 2 to have high resilient forces for engaging the shield of the mating connector. Fabricating shield 2 of a material such as stainless steel would provide these high resilient forces. However, stainless steel is quite expensive. In addition, grounding fingers 6 and grounding legs 7 of shield 2 should be highly conductive to provide for good grounding of the shield to the printed circuit board and/or the housing or chassis "A". Stainless steel is not the most suitably conductive material for these grounding functions. On the other hand, if a suitably conductive material, such as an electroplated bronze, is used for the shield, this material will not provide good resilient forces for fingers 2d which engage the shield of the mating connector. This dilemma or problem is solved by the connector of the invention, as described below.

[0020] More particularly, referring to Figures 3-5, the shielded electrical connector of the present invention includes a dielectric housing 10, a front or inner shield 11 and a rear or outer shield 12. The connector is adapted for mounting on a printed circuit board, such as in a computer for receiving a complementary mating connector from a peripheral apparatus.

[0021] Housing 10 is molded of dielectric material such as plastic or the like and includes a pair of generally parallel plug boards or terminal platforms 13. A plurality of terminals 14 are mounted in the housing and include tail portions 14a depending therefrom for insertion into appropriate holes in the printed circuit board and for connection, as by soldering, to appropriate circuit traces on the board and/or in the holes. The terminals have con-

tact portions 14b (shown in phantom) juxtaposed on the bottom sides of terminal platforms 13 for engaging appropriate terminals on the mating connector. A partition wall 15 is disposed between terminal platforms 13 and spaced generally equidistant therefrom. A forwardly extending bottom platform 16 is spaced below the bottom terminal platform 13. A pair of mounting grooves 19 are formed in the underside of bottom platform 16. Finally, the top and sides of housing 10 are recessed, as at 17, and include T-shaped recesses 18 for facilitating mounting inner shield 11 on the housing.

[0022] Inner shield 11 is stamped and formed of highly resilient sheet metal material, such as stainless steel. The shield has a strip-like front face 20 separating a pair of receptacles 21. A plurality of spring fingers 22 are stamped and formed out of the side walls of the shield and project into receptacles 21 for engaging the shield of the mating connector with high resilient forces provided by the stainless steel material of the shield. A plurality of stop flanges 23 project outwardly from the front of inner shield 11 for abutment by a front edge 12a (Fig. 5) of outer shield 12. The rear of shield 11 is mounted onto recessed area 17 of housing 10, and the inner shield has three T-shaped sections 14 for positioning in the T-shaped recesses 18 of the housing to hold the inner shield on the housing. Finally, inner shield 11 has a latch tab 25 stamped and formed out of each opposite side thereof and projecting outwardly therefrom for holding outer shield 12 on the connector, as described hereinafter.

[0023] Outer shield 12 is box-shaped for mounting over housing 10 and inner shield 11 as seen in Figure 3. The outer shield has a plurality of grounding legs 26 for insertion into appropriate holes in the printed circuit board and for connection, as by soldering, to appropriate ground traces on the board and/or in the holes. A grounding flange 27 projects outwardly from each opposite side of outer shield 12 at front edge 12a thereof for engaging a panel or backplane adjacent an aperture at which the connector is mountable, as described hereinafter. Each side wall of outer shield 12 includes a latch aperture 28 for receiving latch tabs 25 of inner shield 11 to hold the outer shield onto the inner shield and the housing. Finally, the outer shield includes a plurality of inwardly directed hooked flanges 29 for sliding into mounting grooves 19 in the bottom of platform 16 of the housing to prevent the side walls of the outer shield from spreading apart. Because grounding legs 26 and grounding flanges 27 of outer shield 12 preferably should be of high conductivity, the outer shield preferably is fabricated of such materials as an electroplated phosphor bronze material.

[0024] From the forgoing, it readily can be understood that high resilient forces are provided for spring fingers 22, stop flanges 23 and latch tabs 25 of inner shield 11 by fabricating the inner shield of a highly resilient material such as stainless steel. Conversely, grounding legs 26 and grounding flanges 27 of outer shield 12 are made highly conductive by fabricating the outer shield of a different material than the inner shield, such as the aforementioned electroplated bronze material.

[0025] The connector can be mounted at aperture B1 in enclosure B of Figure 6. Grounding flanges 27 engage the panel around the aperture B1 to common the shields 11 and 12 to the enclosure B. Because the grounding flanges 27 project outwardly from each opposite side at front edges 12a of outer shield 12, the aperture B1 does not require a transfer strip like A2 of aperture A1 from the prior art. Accordingly, the apertures in the enclosure for accommodating the connector of the present invention is more simple.

[0026] 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, comprising:

   a dielectric housing (10) having a front mating end (13) for interfacing with a complementary mating connector;
   a plurality of terminals mounted on the housing and including contact portions (14b) for engaging appropriate terminals of the mating connector;
   a first shield (11) of a first material mounted on the housing about at least a front portion thereof and including at least one spring portion (22) for engaging a shield of the mating connector; and
   a second shield (12) of a second material about at least a rear portion of the housing (10) and a rear portion of the first shield (11).

2. The shielded electrical connector of claim 1 wherein said first shield (11) includes a receptacle (21) at the front mating end of the housing for receiving the mating connector.

3. The shielded electrical connector of claim 2 wherein said spring portion of the first shield comprises a spring finger (22) projecting into the receptacle (21).

4. The shielded electrical connector of claim 3 wherein said first shield (11) is fabricated of a highly resilient metal material.

5. The shielded electrical connector of claim 2 wherein said housing (10) includes a platform (13) projecting forwardly into said receptacle (21), with the contact

portions (14b) of the terminals juxtaposed on the platform.

6. The shielded electrical connector of claim 1 wherein said first shield (11) includes at least one outwardly projecting stop flange (23) for engaging an edge (12a) of the second shield (12).

7. The shielded electrical connector of claim 1 wherein said second shield (12) includes at least one outwardly projecting flange (27) for engaging a panel adjacent an aperture at which the connector is mountable.

8. The shielded electrical connector of claim 1 wherein said second shield (12) includes a depending leg (26) for connection to a circuit trace on a printed circuit board.

9. The shielded electrical connector of claim 8 where said second shield (12) is fabricated of a readily solderable material.

10. The shielded electrical connector of claim 1 wherein said housing (10) includes a recess (18) in an outer surface thereof for receiving a section (24) of the first shield (11) to retain the first shield on the housing.

11. The shielded electrical connector of claim 10 wherein said recess (18) and said section (24) are complementarily T-shaped.

12. A shielded electrical connector, comprising:

a dielectric housing (10) having a mating end (13) for interfacing with a complementary mating connector;
a plurality of terminals mounted on the housing and including contact portions (14b) for engaging appropriate terminals of the mating connector;
a first shield (11) fabricated of a highly resilient metal material mounted about at least a portion of the housing (10) and including a spring portion (22) for engaging a shield of the mating connector; and
a second shield (12) fabricated of a second, highly conductive material mounted about at least a portion of the housing (10) and at least a portion of the first shield (11) and including a grounding leg (26) projecting therefrom.

13. The shielded electrical connector of claim 12 wherein said first shield (11) is fabricated of stainless steel.

14. The shielded electrical connector of claim 12 wherein said second shield (12) is fabricated of electroplated bronze.

15. The shielded electrical connector of claim 12 wherein said first shield (11) includes a receptacle (21) at the front mating end of the housing for receiving the mating connector.

16. The shielded electrical connector of claim 15 wherein said spring portion of the first shield comprises a spring finger (22) projecting into the receptacle (21).

17. The shielded electrical connector of claim 15 wherein said housing (10) includes a platform (13) projecting forwardly into said receptacle (21), with the contact portions (14b) of the terminals juxtaposed on the platform.

18. The shielded electrical connector of claim 12 wherein said first shield (11) includes at least one outwardly projecting stop flange (23) for engaging an edge (12a) of the second shield (12).

19. The shielded electrical connector of claim 12 wherein said second shield (12) includes at least one outwardly projecting flange (27) for engaging a panel adjacent an aperture at which the connector is mountable.

20. A shielded electrical connector, comprising:

a dielectric housing (10) having a front mating end (13) for interfacing with a complementary mating connector and a mounting face for mounting on a printed circuit board;
a plurality of terminals mounted on the housing and including contact portions (14b) for engaging appropriate terminals of the mating connector and mounting portions (14a) for connection to appropriate circuit traces on the printed circuit board;
an inner shield (11) of a first material mounted on the housing (10) about at least a front portion thereof and including a receptacle (21) for receiving the mating connector and at least one spring finger (22) projecting into the receptacle for engaging a shield of the mating connector; and
an outer shield (12) of a second material about at least a rear portion of the housing (10) and a rear portion of the first shield (11), the second shield including at least one outwardly projecting flange (27) for engaging a panel adjacent an aperture at which the connector is mountable and at least one depending leg (26) for connection to an appropriate ground trace on the printed circuit board.

21. The shielded electrical connector of claim 20 wherein said first shield (11) is fabricated of a highly resilient metal material.

22. The shielded electrical connector of claim 21 wherein said first shield (11) is fabricated of stainless steel.

23. The shielded electrical connector of claim 21 where said second shield (12) is fabricated of a readily solderable material.

24. The shielded electrical connector of claim 20 wherein said housing (10) includes a platform (13) projecting forwardly into said receptacle (21), with the contact portions (14b) of the terminals juxtaposed on the platform.

25. The shielded electrical connector of claim 20 wherein said first shield (11) includes at least one outwardly projecting stop flange (23) for engaging an edge (12a) of the second shield (12).

26. A shielded electrical connector, comprising:

a dielectric housing (10) having a mating end (13) for interfacing with a complementary mating connector;
a plurality of terminals mounted on the housing and including contact portions (14b) for engaging appropriate terminals of the mating connector;
a first shield (11) of a first material mounted on the housing about at least a portion thereof and including at least one spring portion (22) for engaging a shield of the mating connector; and
a second shield (12) of a second material mounted about at least a portion of the housing (10) and engageable with the first shield (11).

27. The shielded electrical connector of claim 26 wherein said first shield (11) is fabricated of a highly resilient metal material and includes a receptacle (21) for receiving the mating connector, and said spring portion of the first shield comprises a spring finger (22) projecting into the receptacle (21).

28. The shielded electrical connector of claim 27 wherein said second shield (12) is fabricated of a readily solderable material and includes a depending leg (26) for connection to circuit trace on a printed circuit board.

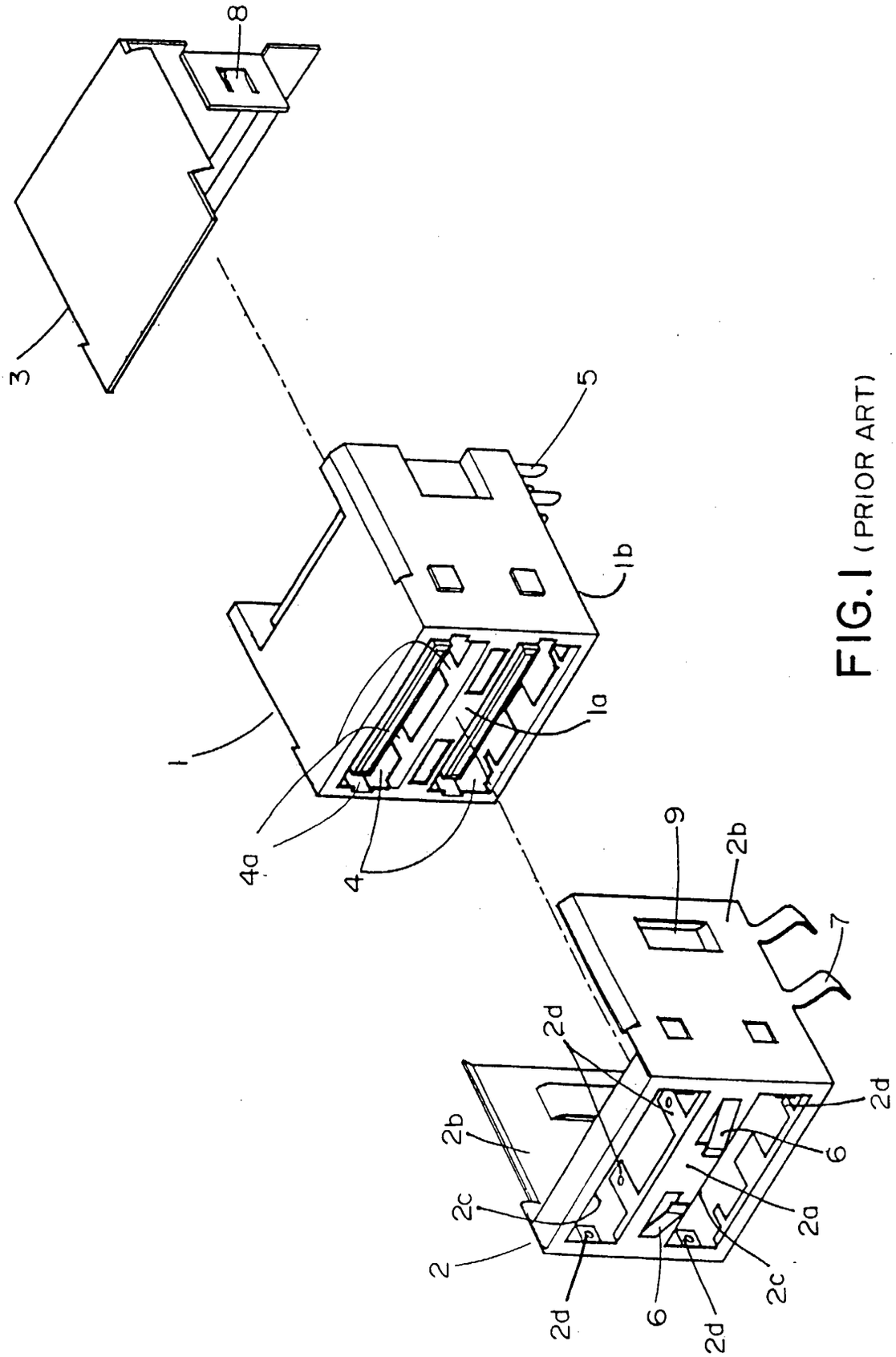

FIG. 1 (PRIOR ART)

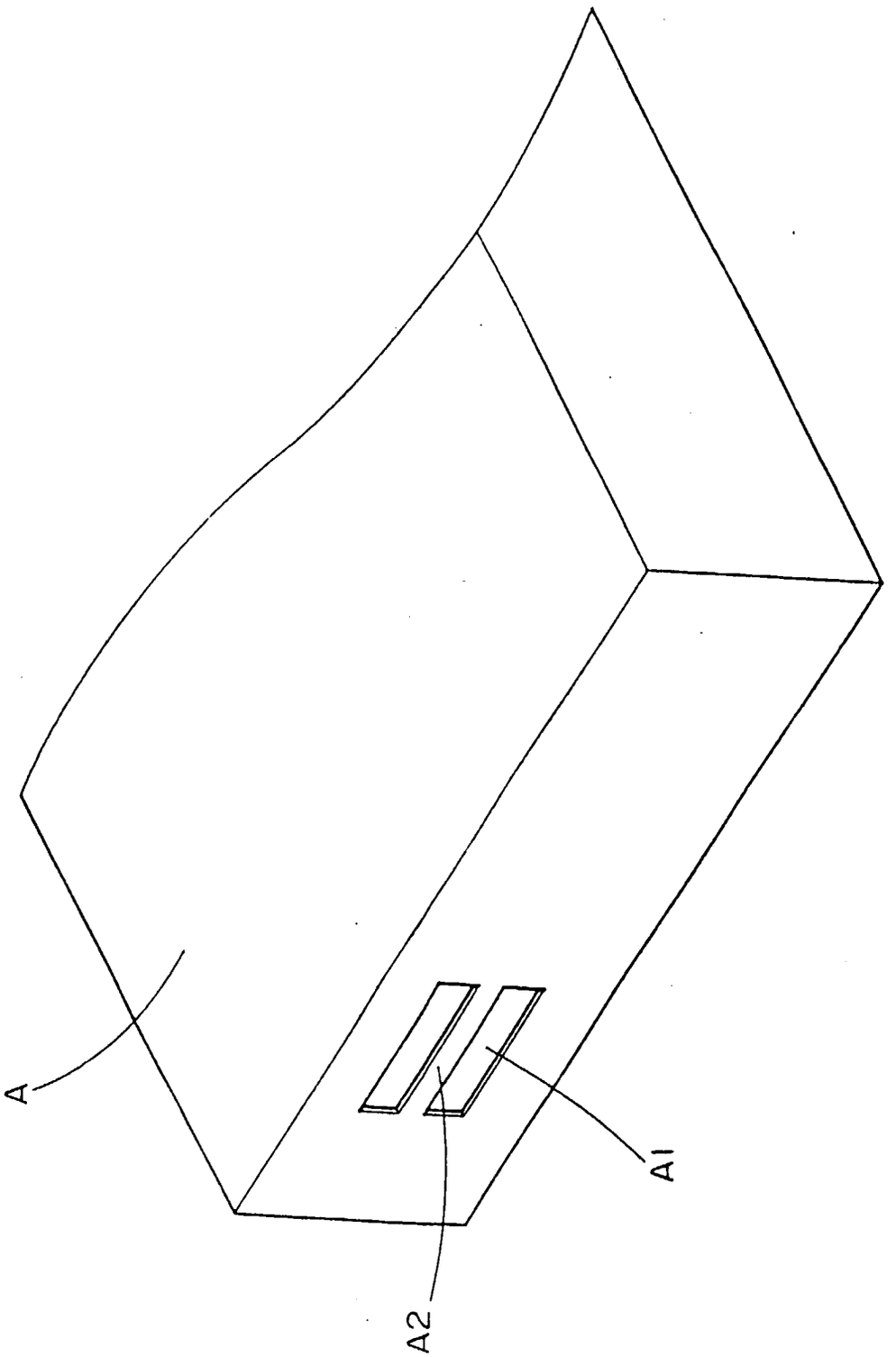

FIG.2 (PRIOR ART)

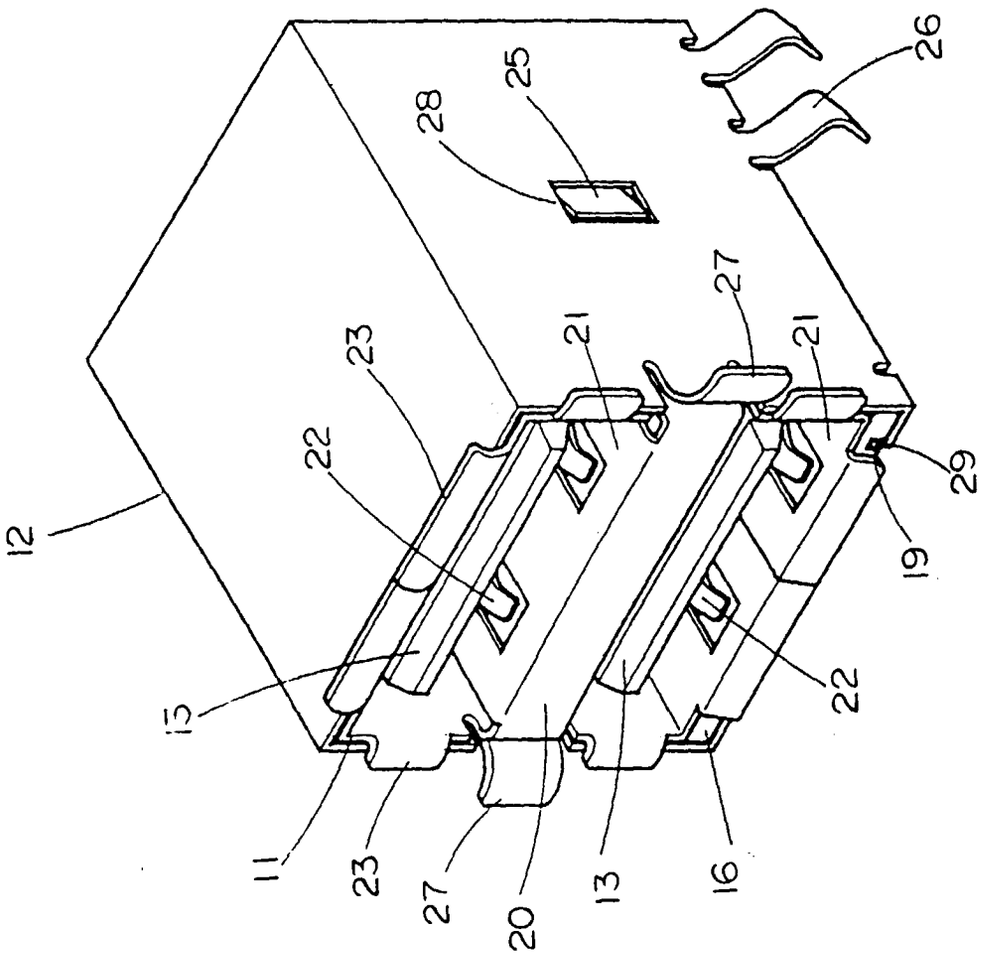

FIG.3

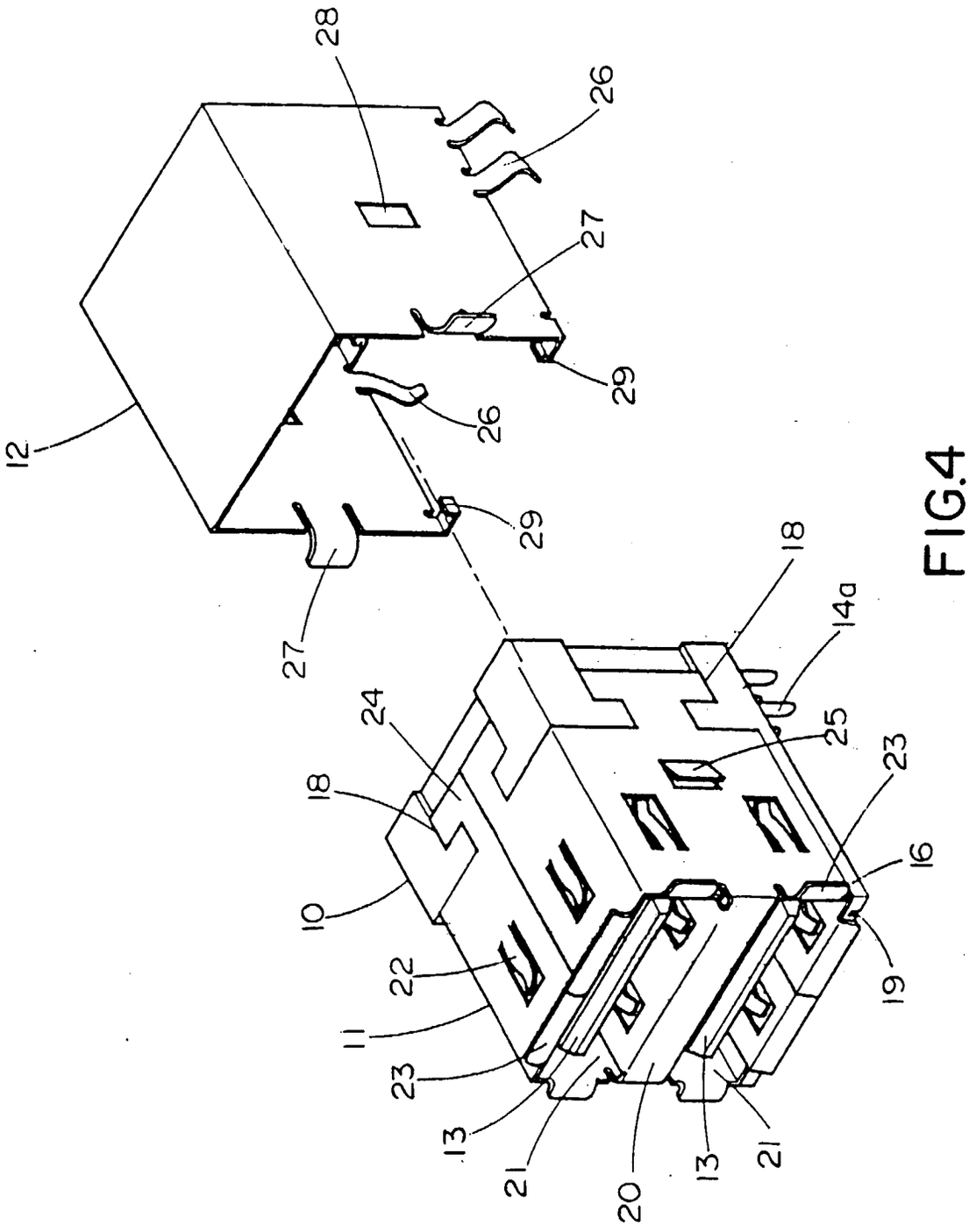
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FIG.4

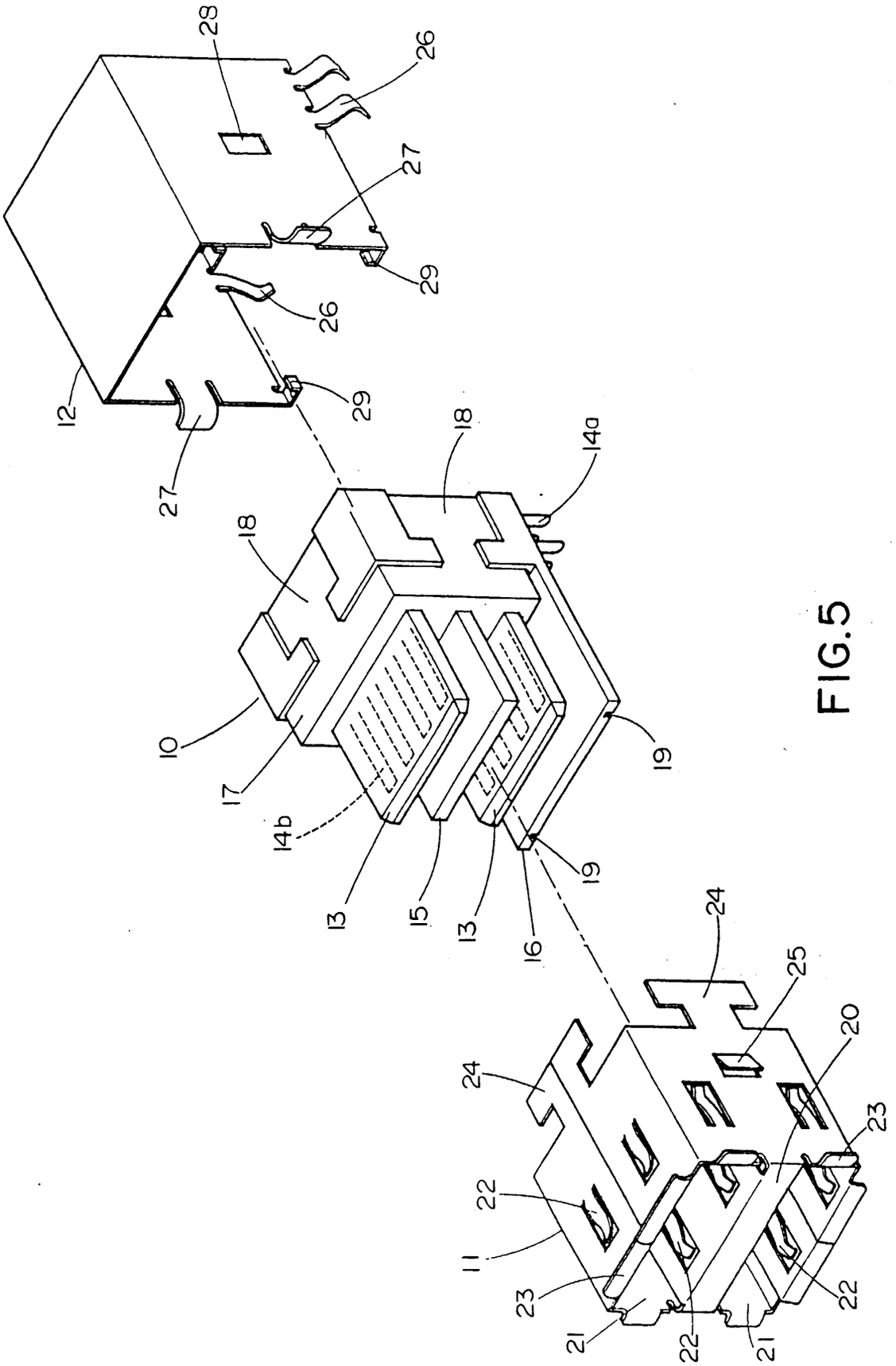
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FIG.5

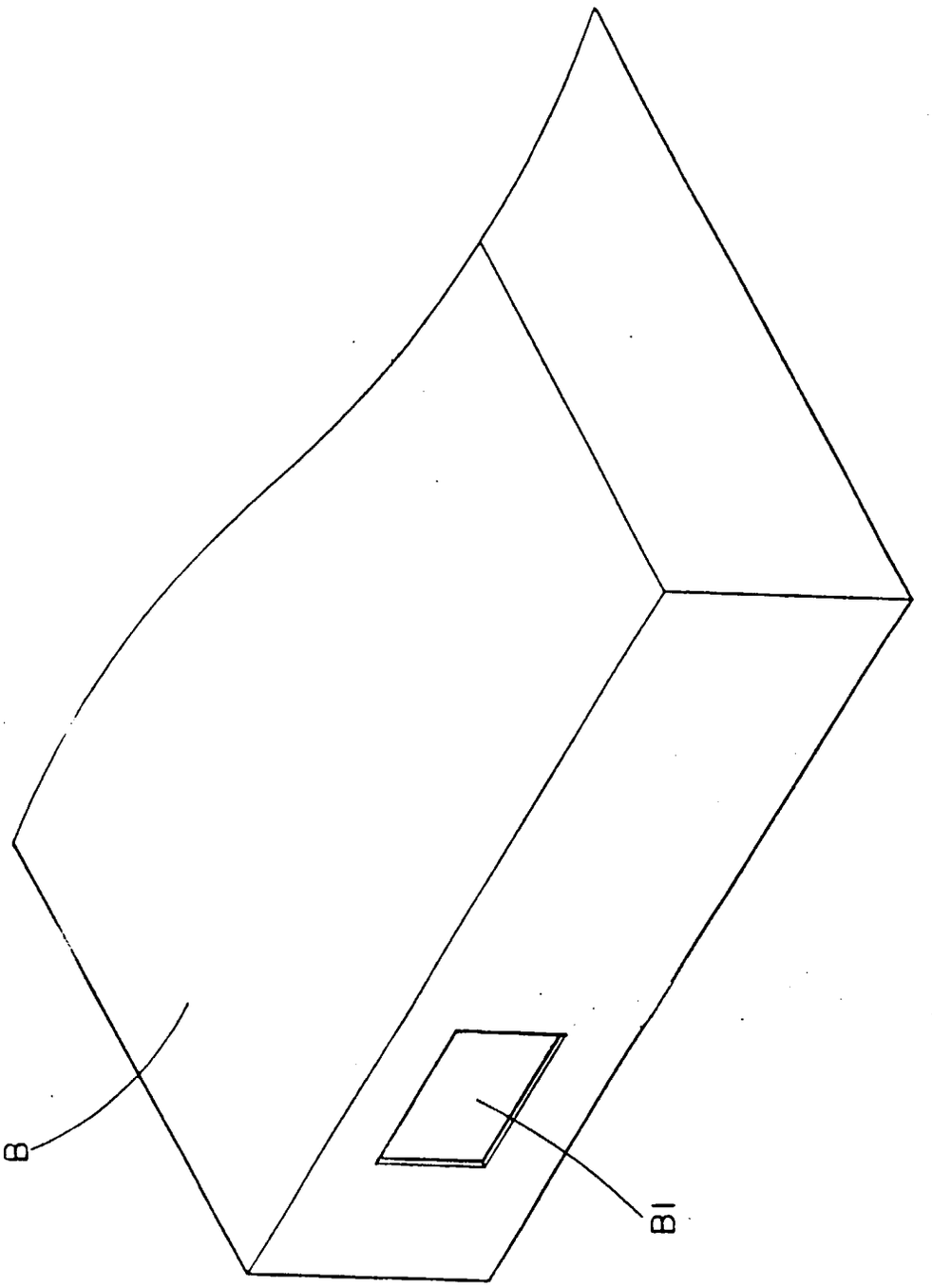

FIG.6

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EUROPEAN SEARCH REPORT

Application Number
EP 99 10 3612

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION
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Y	* column 2, line 3 - column 3, line 6 * * column 4, line 16 - column 5, line 9; figures 18,20 *	13,14,22	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	2 August 1999	Kohler, J

CATEGORY OF CITED DOCUMENTS

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02-08-1999

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