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(54) Connector for printed circuit boards.

(57) Connector modules (32) connect child boards (31) to a daughter board (30). Each module (32) is adapted to lie along and connect to a daughter board (30) contacts at one edge of a child board (31). BoltS (18) secure the module and board assembly. Each module (31) has a body (1) having ends joining two parallel side walls (21, 22) and contains a multiplicity of contact elements (2), the body being open to allow the contact elements to contact both the child (31) and daughter (32) boards. A cover lies against the child board (31) on the side thereof remote from the daughter board.

EP 0 343 864 A2

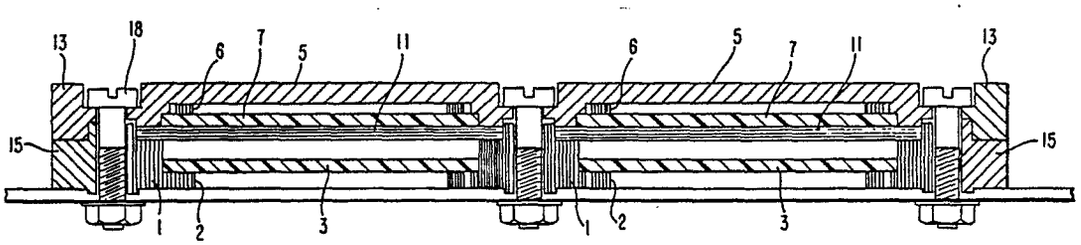

FIG. 3

CONNECTOR FOR PRINTED CIRCUIT BOARDS

The invention relates to connectors for connecting together printed circuit boards.

In recent times, with the ability to increase density of circuitry on printed circuit boards, the value of a printed circuit board of a given size has increased dramatically, thus tending to make uneconomical scrapping of an entire board when a fault occurs in it. In view of this, suggestions have been made to reduce printed circuit board values by division of circuitry into smaller units. For example, it has been proposed that a standard physical size of printed circuit board known as a "standard double Eurocard", could be divided into eight "child" boards mounted on and with appropriate electrical connections to a "daughter" board of standard double Eurocard size; if a fault occurs in one child board, seven out of the eight child boards could be retained for further use.

This daughter and child board arrangement requires convenient and sophisticated physical and electrical connections to be established between the daughter board and child boards mounted on it, as well as a facility for connections between child boards. Electrical connections between both sides of a child board and a daughter board are advantageous, and a high connection density is also important.

An existing proposal provides for direct contact between contacts arranged around the periphery of one side only of a child board and contact receptors arranged on a daughter board, the child board being held in place to make electrical contact by a frame extending around the periphery of the child board and attached to the daughter board. This arrangement suffers from disadvantages that electrical contacts are on one side only of the child board, their physical size allows 132 contacts only per child board, and the use of a frame for securement means that the circuitry is totally enclosed between the daughter board, child board and the frame which gives rise to difficulties in heat dissipation.

According to the invention, there is provided modular connector apparatus for connecting electrically and physically a daughter board and one or more child boards, the apparatus comprising a plurality of connector modules, each module adapted to lie along and connect to a daughter board contacts at one edge of a child board, and securement means for securing each module and thereby the associated child board to the daughter board, each module comprising a body having ends joining two parallel side walls, the side walls lying in use adjacent an edge of but perpendicular to an associated child board, each side wall having a multiplicity of parallel slots adapted to be slidingly engaged by body contact elements extending between the side walls, the body being open to allow each body contact element to make contact with both the daughter and child boards, and a cover adapted to lie against the side of the child board remote from the daughter board, the cover being hollow with a multiplicity of parallel slots in opposing side walls adapted to be slidingly engaged by cover contact elements extending between the side walls for making electrical contact between an upper surface of the child board and one of an adjacent child board and the daughter board.

The apparatus preferably includes retaining means for retaining the contact elements in position while assembly of the module takes place, in use. The retaining means may comprise a bar of insulating material.

The apparatus preferably further comprises means for connecting together adjacent modules. The connecting means preferably comprise mutually engageable profiles on the modules, such that adjacent modules can be connected together mutually perpendicularly. The mutually engageable profiles may comprise male and female dovetail profiles. Adapter means are preferably provided to connect together adjacent modules rectilinearly. End profiles of modules and adapter means are preferably shaped to define a hole through which the securement means, such as a bolt, may pass in use.

The cover, alternatively, may have an engagement profile such that adjacent covers meet end to end and coaxially.

The cover may take one of two preferred forms, a first for locating cover connectors for connecting electrically adjacent child boards, and a second, where one side wall of the cover extends to the daughter board, for locating cover connectors for connecting contacts on the upper side of the child board to the daughter board.

The invention further provides a printed circuit board assembly comprising a daughter board, at least one child board and two connector modules located parallel one to the other either side of the or each child board, whereby air is free to pass between the child board and the daughter board.

For low power child boards, the or each child board may be associated with four modules, heat dissipation in such circumstances not being a problem.

The contact elements are preferably planar.

By way of example, one embodiment of modular connector apparatus according to the invention, together with a modification thereto, will now be

described with reference to the accompanying drawings in which:-

Figure 1 is a plan view of a standard double Eurocard carrying eight child boards;

Figure 2 is a plan view on a larger scale of a daughter board and four child boards;

Figure 3 is a sectional view along the lines A-A in Figure 2; and

Figure 4 is a sectional view along the lines B-B in Figure 2.

Figure 1 is a module layout on a standard double Eurocard 30 on which are mounted eight 50mm^2 child boards 31. The child boards 31 are connected electrically and physically to the Eurocard daughter board by modular connector apparatus in the form of modules 32. In the arrangement in Figure 1, all the modules 32 lying at the periphery of the child boards 31 are the same, there being twenty-two such modules 32 in all in Figure 1. As can be seen in Figure 1, end portions of the modules 32 have mutually engaging dovetail profiles and attachment of the modules to the Eurocard 30 is by way of bolts passing through the Eurocard 30 and through holes 33 defined by end portions of the modules 32. Around the periphery of the child board assembly, infill portions are provided, these being of two types, a centre infill piece 34 or a corner infill piece 35. This arrangement will be described in more detail with reference to the further drawings. With the arrangement of Figure 1, the child boards 31 are fully enclosed by the modules 32 and in this arrangement, heat output from the child boards must be sufficiently low for heat dissipation not to cause a problem.

Figures 2, 3 and 4 show a modified arrangement in more detail, Figures 3 and 4 being sectional views along the lines A-A and B-B respectively in Figure 2.

A daughter board 12 carries in this arrangement four child boards 11, all boards being provided with electrical contact areas, those of the child boards 11 being arranged in the region of the periphery of the child boards.

The child boards are held in place physically and electrical connections between adjacent child boards or between the child boards and the daughter board 12 by means of modules equivalent to the modules 32 of Figure 1. In the arrangement of Figures 2, 3 and 4, two modules only are associated with each child board 11, thereby allowing full air passage on both sides of each child board 11 to allow good heat dissipation (shown clearly in Figure 4).

Each module has a body portion 1 and a cover portion 4 5 or 8; as can be seen in Figures 2 and 4, the shapes of the cover portions 4, 5 and 8 differ to allow therewithin different contact elements, or omission of a contact element.

Each body portion 1 has a pair of parallel, spaced apart side walls 21, 22 joined by end portions which carry dovetail profiles as shown in Figure 2. Inside surfaces of the side walls 21 and 22 are provided with many parallel, closely spaced slots into opposing pairs of which bridging contact elements 2 are slidingly engaged. In this particular embodiment, each side wall has seventy-two slots to allow seventy-two contacts on a 0.5mm pitch to be located in each body portion 1. As can be seen in Figure 4, the contact elements 2 are able to make contact between the undersides of adjacent child boards 11 and the daughter board 12. Illustrated in Figure 4 is a contact retainer 3 for the body portion contact 2. The retainers 3 ensure that while the modules are being assembled, the body portion contacts 2 remain in place. It can be seen in Figure 4 that the slots engaged by the body portion contacts 2 do not extend fully across the side walls 21 and 22 so that a lower stop is provided for the body portion contact elements 2.

Further contact elements 6 and 9 are arranged to contact the child boards 11 on upper surfaces thereof. Three different cover shapes 4, 5 and 8 are employed as is illustrated best in Figure 4.

Edge cover 4 includes no contact element but bridging cover 5 and edge contact cover 8 include bridging contact elements 6 and top edge contact elements 9 respectively. The bridging cover 5 includes parallel slots in its side walls, as with the body portion 1 the slots being at 0.5mm pitch and being in number seventy-two in each side wall therefore providing for location of seventy-two bridging contact elements 6 in each bridging cover 5.

Similarly, the edge contact cover 8 has seventy-two slots at 0.5mm pitch in the side walls to provide for location of seventy-two top edge contact elements 9. As with the body portion 1, contact retainers 7 and 10 are provided in each bridge cover and edge contact cover respectively.

Turning to assembly of the modules, the body portions 1 have end portions with male and female dovetail portions corresponding to the cover portions 5, thereby giving a facility for a mutual engagement at right angles or with body centre pieces 16, in a straight line. At the ends of rows, body corner pieces 15 are provided. With the body centre pieces 16 and body corner pieces 15, a hole is defined with the body portion 1 to which a bolt 18 may pass (see Figure 3).

Securement of the bridging covers 5 and edge covers 4 using cover centre pieces 14 and cover corner pieces 13 is effected similarly to the arrangement for the body portions in that male and female dovetail connections are provided and at each connection, a hole engageable by the bolt 18

is formed.

Slightly different securement arrangements are provided for the edge contact covers 8 in that these pieces engage directly in line as can be seen in Figure 2. Thus where two edge contact covers 8 are joined by mutually engageable dovetail profiles, no filler piece is required. To complete the end of a run of edge contact covers 8, edge contact cover end pieces 17 are provided. In these arrangements holes are defined, each engaged by one of the bolts 18.

This arrangement provides the flexibility available from a modular system and, as with Figure 1 can be used to surround the child board or as in Figure 2 can be used on two edges only of a child board to provide access to cooling air. Contact density using stamped, planar contact elements is greater than has hitherto been achieved; with the Figure 2 arrangement, 288 contacts per child board can be made and with the Figure 1 arrangement, 576 contacts with each child board can be made. Assembly of the child and daughter board assemblies are simple.

It will be appreciated that the foregoing description is by way of example only and that modifications and alterations may be made within the scope of the invention.

Claims

1. Modular connector apparatus for connecting electrically and physically a daughter board and one or more child boards, the apparatus comprising a plurality of connector modules, each module adapted to lie along and connector a daughter board contacts at one edge of a child board, and securement means for securing each module and thereby the associated child board to the daughter board, each module comprising a body having ends joining two parallel side walls, the side walls lying in use adjacent an edge of but perpendicular to an associated child board, each side wall having a multiplicity of parallel slots adapted to be slidingly engaged by body contact elements extending between the side walls, the body being open to allow each body contact element to make contact with both the daughter and child boards, and a cover adapted to lie against the side of the child board remote from the daughter board, the cover being hollow with a multiplicity of parallel slots in opposing side walls adapted to be slidingly engaged by cover contact elements extending between the side walls for making electrical contact between an upper surface of the child board and one of an adjacent child board and the daughter board.

2. Apparatus as claimed in Claim 1 including retaining means for retaining the contact elements in position while assembly of the module takes place, in use.

3. Apparatus as claimed in Claim 2 wherein the retaining means comprise a bar of insulating material.

4. Apparatus as claimed in any one of Claims 1 to 3 comprising means for connecting together adjacent modules.

5. Apparatus as claimed in Claim 4 wherein the connecting means comprise mutually engageable profiles on the modules, such that adjacent modules can be connected together mutually perpendicularly.

6. Apparatus as claimed in Claim 5 wherein the mutually engageable profiles comprise male and female dovetail profiles.

7. Apparatus as claimed in any one of Claims 4 to 6 comprising adapter means for connecting together adjacent modules rectilinearly.

8. Apparatus as claimed in Claim 7 wherein end profiles of modules and adapter means are shaped to define a hole through which the securement means may pass in use.

9. Apparatus as claimed in Claim 4 wherein the cover has an engagement profile such that adjacent covers meet end to end and coaxially.

10. Apparatus as claimed in any one of Claims 1 to 9 wherein one or more covers has a side wall extending to the daughter board for locating cover connectors for connecting contacts on the upper side of the child board to the daughter board.

11. A printed circuit board assembly comprising a daughter board, at least one child board and two connector modules located parallel one to the other either side of the or each child board, whereby air is free to pass between the child board and the daughter board.

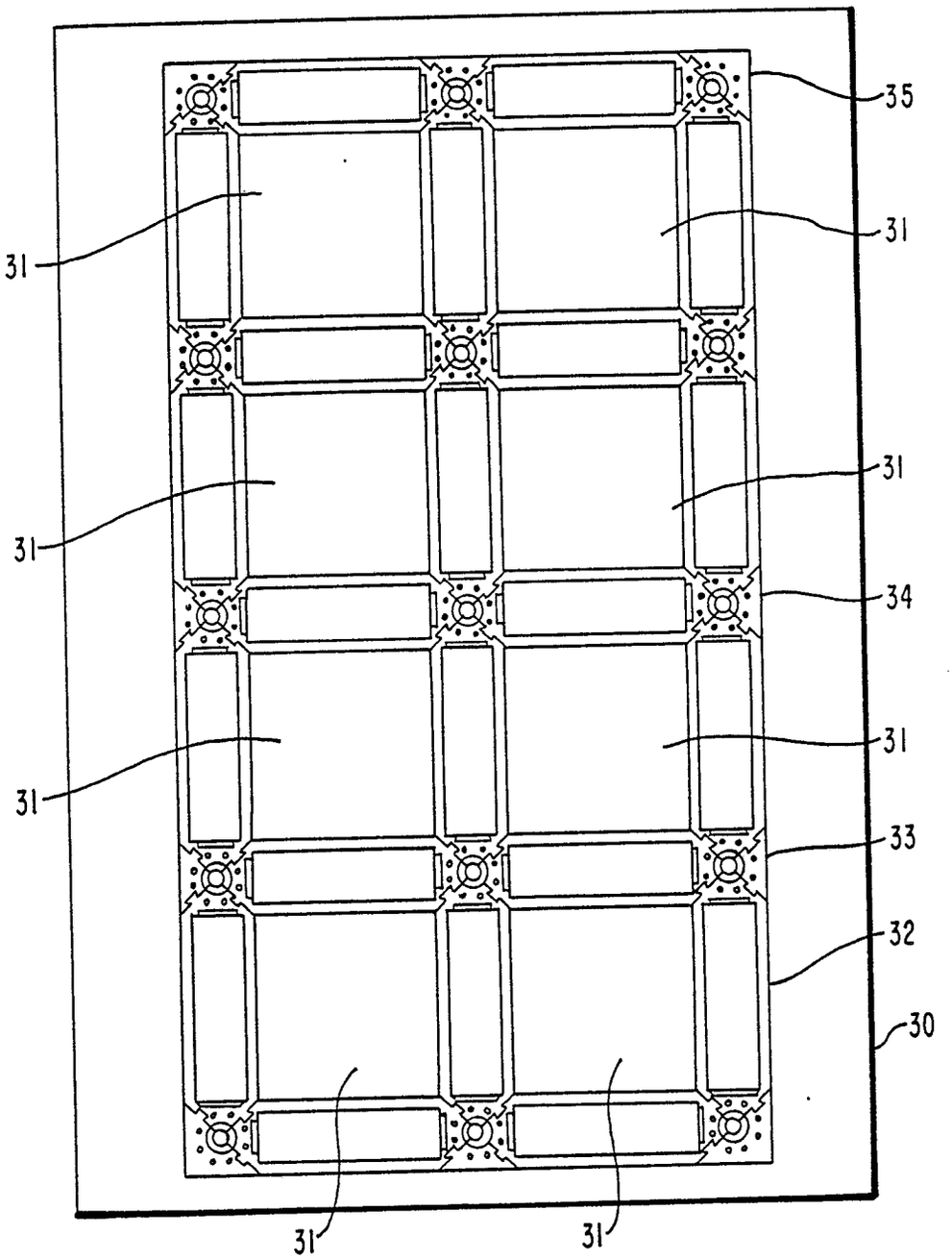

FIG. 1

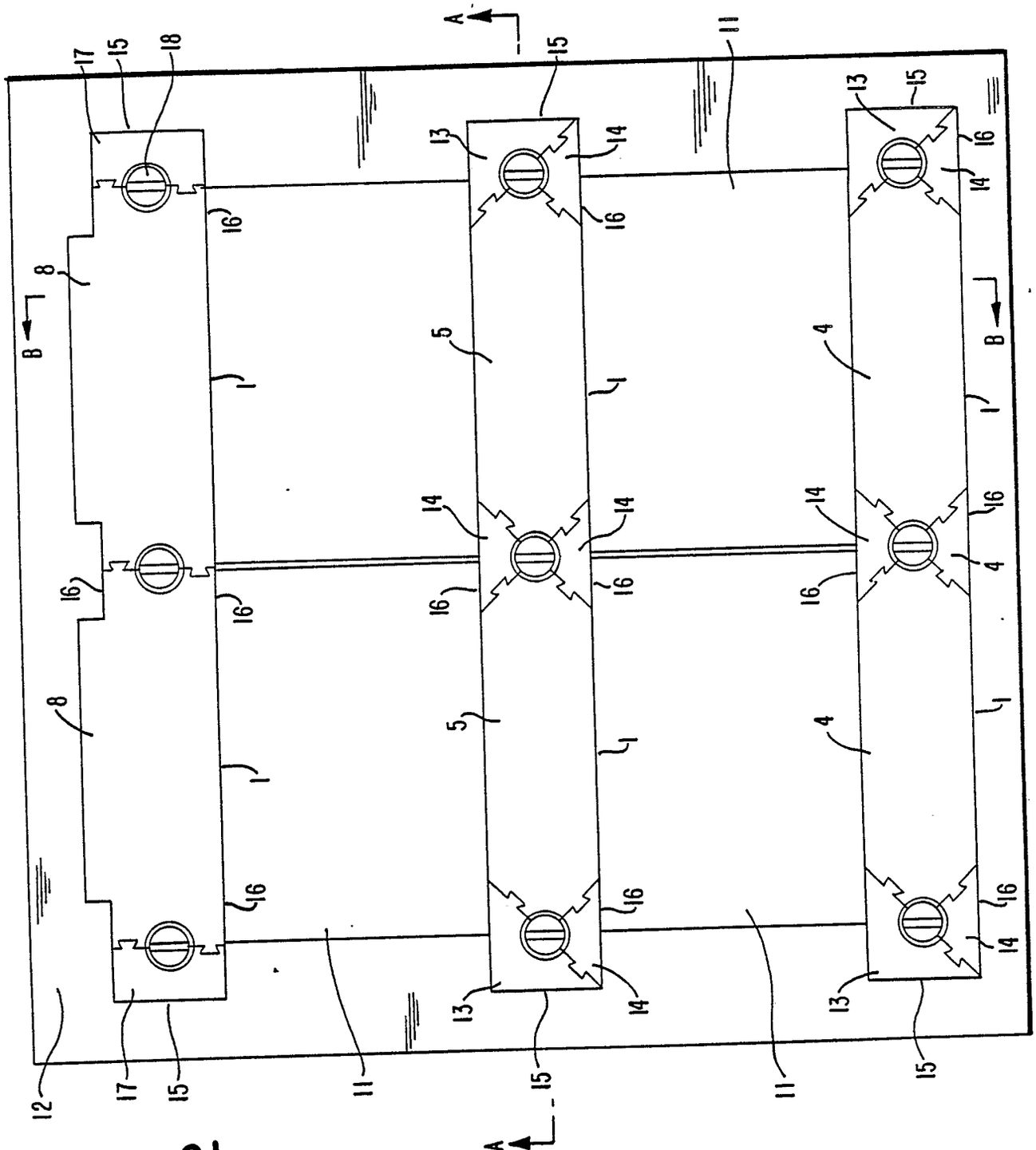

FIG.2

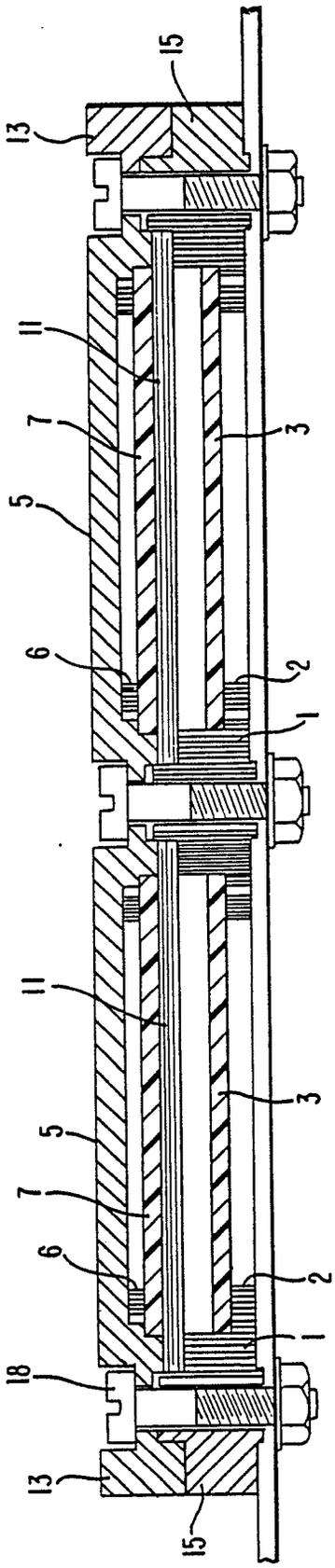

FIG. 3

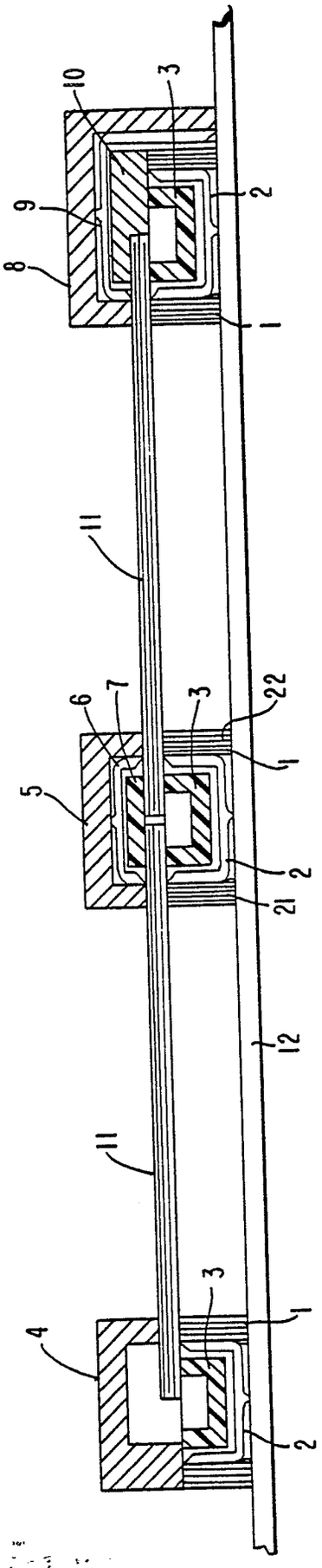

FIG. 4