



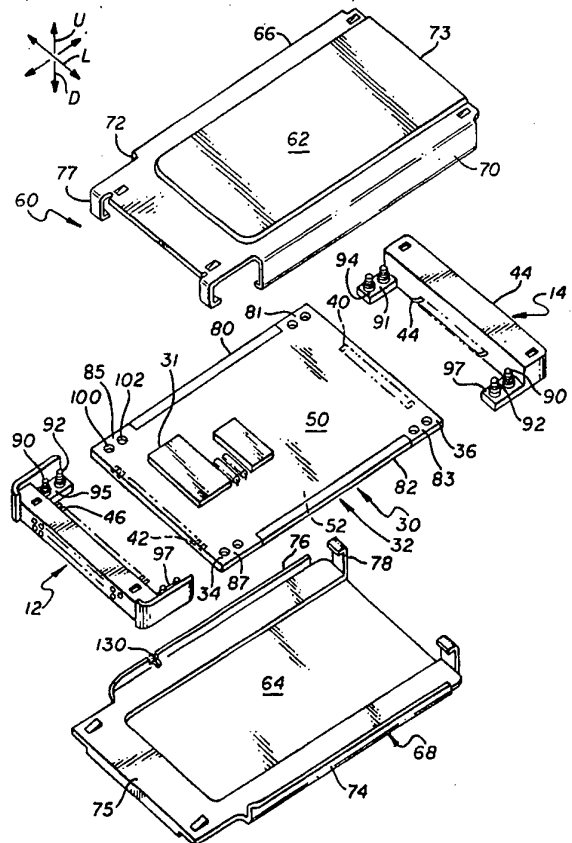
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/US94/12683 (22) International Filing Date: 3 November 1994 (03.11.94) (30) Priority Data: 08/168,101 15 December 1993 (15.12.93) US 08/201,983 25 February 1994 (25.02.94) US (71) Applicant: ITT INDUSTRIES, INC. [US/US]; 1105 North Market Street, Wilmington, DE 19801 (US). (72) Inventor: BETHURUM, Gary, Cain; 10 Viewpoint Lane, Laguna Niguel, CA 92677 (US). (74) Agents: WINTER, Richard, C.; PCT Int'l., Inc., ITT Components, Inc., Legal Dept., P.O. Box 35000, 1851 East Deere Avenue, Santa Ana, CA 92705-6500 (US) et al.</p>		<p>(81) Designated States: CA, CN, FI, JP, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i></p>

(54) Title: IC CARD WITH BOARD POSITIONING MEANS

(57) Abstract

A low cost IC card includes a circuit board (30, Fig. 2) with forward and rearward end portions (34, 36) that are mounted directly on forward and rearward connectors (12, 14), without a separate frame to mechanically hold them together. A cover (60) with upper and lower parts (66, 68), is mechanically mounted to the connectors and is coupled to the circuit board only in an electrical ground. Each connector is mounted to a circuit board end by pegs (90, 92) of support parts (91, 93 and 95, 97) that lie on laterally opposite sides of the row of connector contacts (46), with each peg being received in a hole (100, 102) of the circuit board and with the circuit board resting on a board-supporting surface (150, fig. 4) lying adjacent to the peg.



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IC CARD WITH BOARD POSITIONING MEANS

BACKGROUND OF THE INVENTION:

IC cards, which are often memory cards, are commonly constructed with a molded plastic frame. Front and rear connectors are mounted and/or molded into the frame, and top and bottom covers are mounted on the frame. U.S. Patents 5,207,586 and 5,244,397 show IC cards of this construction. If the number of parts to be constructed and assembled were reduced, the IC cards could be constructed at lower cost.

10 SUMMARY OF THE INVENTION

In accordance with one embodiment of the present invention, a low cost IC card includes a circuit board with its forward and rearward end portions respectively mounted on forward and rearward connectors, without requiring an intermediate frame. The cover is also mounted on the front and rear connectors and is connected to the circuit board substantially only by an electrical ground connection.

At least a first connector has a laterally-extending row of contacts that engage corresponding contact pads on an end portion of the circuit board. At least the first connector also has pegs lying laterally beyond opposite ends of the row of contacts. Each circuit board end portion has holes at its opposite sides which receive corresponding pegs.

The novel features of the invention are set forth with particularity in the appended claims. The invention will be best understood from the following description when read in conjunction with the accompanying drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of an IC card of the present invention, and showing, in phantom lines, a portion of an electronic device that receives the card.

5 FIG. 2 is an exploded isometric view of the IC card of FIG. 1.

FIG. 3 is a partial exploded view of a connector and of a circuit board end portion that can mount thereon.

FIG. 4 is a partial sectional view taken on line 4 - 4 of FIG. 3, showing the parts in an assembled position.

10 FIG. 5 is a partial sectional view of the connector and circuit board of FIG. 4, and also showing two other circuit boards which can be used.

FIG. 6 is a partial sectional view of the IC card of FIG. 1.

FIG. 7 is a partial sectional view of the IC card of FIG. 1.

15 FIG. 8 is a partial isometric view of a peg constructed in accordance with another embodiment of the invention.

FIG. 9 is a partial exploded view of a peg and circuit board constructed in accordance with another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

20 FIG. 1 illustrates an IC card 10 which has connectors 12, 14 at its opposite ends. The connectors 12, 14 can be designated respectively as front and rear connectors, although the opposite could be done. The card is designed to be inserted in a forward direction F into an electronic device 16, until contacts 20 on the front connector engage corresponding contacts 22 of
25 the electronic device. The card is withdrawn in a rearward direction R. IC cards have standard maximum dimensions under JEIDA standards, of 4.83mm in upward and downward directions U, D, of 54mm in lateral directions L, and of 85.6mm in longitudinal directions F, R. The IC card should be constructed

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at low cost while providing maximum utilization of the limited space within the card to hold electronic components.

FIG. 2 shows that the IC card includes a circuit board assembly 30 with electronic components 31 such as integrated circuits, resistors, capacitors, etc., which are mounted on a circuit board 32. The circuit board has laterally opposite side 80, 82 and forward and rearward end portions 34, 36, and has laterally-extending rows of contact pads 40, 42 at its opposite end portions. The front and rear connectors 12, 14 each include a block of molded plastic. At least the front connector 12, and preferably both connectors, have at least one laterally extending row of contacts with contact tails 44, 46 constructed to engage corresponding rows of contact pads 40, 42 on the circuit board. It is noted that the circuit board has upper and lower surfaces 50, 52, and the contact pads are normally located on the lower surface 52.

A cover 60 is designed to surround the circuit board assembly. The cover includes upper and lower cover parts 66, 68 that have sheet-like portions 62, 64 that lie respectively above and below a majority of the surface area of the circuit board. The upper cover part includes a pair of upper side flanges 70, 72, which engage corresponding lower side flanges 74, 76 on the lower cover part. The parts are assembled by first mounting the circuit board opposite end portions on the connector 12, 14. This subassembly is placed in the lower cover part 68. The rear 73 of the upper cover part is placed at the front 75 of the lower one, and the upper cover part is slid in the rearward direction R. U-shaped fingers 77, 78 at the front and rear of corresponding cover parts help to keep the fully assembled cover parts in place on the connectors.

Previous JEIDA IC cards have used a molded plastic frame which held the other parts together. U.S. Patents 5,207,586 and 5,244,397 show IC cards of this type, wherein the molded plastic frame extended between the front

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and rear connectors and held them rigidly in place, supported the circuit board assembly, and supported top and bottom cover parts. Although in previous and present IC cards there is some mechanical connection between the circuit board and the connectors through the soldering connection of the rows of
5 contact tails or contacts 44, 46 with the conductive pads 40, 42 on the circuit board, such solder connections cannot be relied upon for strong mechanical coupling, which was previously achieved by the molded plastic frame.

In accordance with the present invention, applicant provides a
10 frameless IC card wherein the opposite end portions 34, 36 of the circuit board, mount directly on the front and rear connectors 12, 14. The rear end portion 36 of the board has board mount parts 81, 83 at its opposite sides, that mount on the rear connector 14, and the front end portion 34 of the board has board mount parts 85, 87 that mount on the front connector 12. The connectors have
15 corresponding support parts 91, 93, 95 and 97, with all mount parts being similar and all support parts being similar. Each connector, including its support parts, has a longitudinal length (in directions F, R) that is less than one-half the longitudinal length of the card, and preferably that is less than one-fourth as much. As shown in FIG. 3, each circuit board mount part such as 81,
20 extends laterally beyond a corresponding row of contact pads 42 (e.g. laterally beyond an end of the row). Each board mount part such as 81 of the circuit board end portion is directly mounted on a corresponding connector support part such as 91 which extends laterally beyond a corresponding row of contacts 46. Each support part such as 91, includes first and second platforms, or projections, or pegs 90, 92 that extend up from a first board-
25 supporting surface 94. The side 80 of the circuit board which forms the mount part 81, has a pair of holes 100, 102 that are designed to closely receive the corresponding pegs 90, 92. Thus, the front and rear connectors form an

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apparatus for holding the circuit board. Each of the pegs preferably has several steps, which will be discussed below.

With the front and rear portions of the circuit board securely mounted on the front and rear connectors, the cover can be placed around the circuit board and connectors. FIG. 6 shows the manner in which the upper and lower cover parts 66, 68 are mounted on the front and rear connectors 12, 14. The upper cover part 66 has downwardly-inclined tabs 110, 112 which project into corresponding recesses 114 at the tops of the connectors. The lower cover part has tabs 115, 116 that project into corresponding recesses 117 at the bottoms of the connectors. The tabs form connect parts that mount the cover ends to the connectors, to thereby attach the cover parts to the connectors. Cover parts such as 118 lying against the connectors also form connect parts. Adhesive also can be used to hold the cover parts to the connectors. The cover parts also have interfitting side flange parts (FIG. 7).

It is noted that the covers are directly mounted on the front and rear connectors, as is the circuit board 30. No intermediate frame apart from the cover parts and circuit board, extends between the connectors. It is noted that there is a grounding electrical connection between the cover and a ground plane of the circuit board. FIG. 7 shows that the lower cover part 68 has a tab 130 which engages a location on a ground plane 132. However, this does not provide a rigid connection or mechanical support, and there is substantially no other direct connection between the circuit board and cover.

FIGS. 3 and 4 show that each platform or peg 90, 92 has a plurality of peg parts or steps 140, 142, and 144. The first step 140 is of greatest width A, while the second and third steps 142, 144 have progressively smaller widths B and C. The support part 91 forms board-supporting surfaces or surface regions 94, 150, 152 at the bottom of each step. The holes such as 100 in the circuit board 30, are shown in FIG. 4 as having a hole width B so the

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walls of the circuit board holes are closely received in the second steps 42, and the lower surface of the circuit board rests on the second board-supporting surface region 150.

The connectors 12, 14 (FIG. 2) and cover 60 are usually made by
5 a manufacturer who makes large volumes of such connectors and covers. The connector and cover manufacturer commonly sells such parts to a firm that designs and constructs a circuit board with its own circuitry thereon, and assembles the circuit board to the connectors and cover to form a complete IC card. The circuit board manufacturer usually has drills that can form the
10 holes such as 100, 102 so the holes are of a closely controlled width or diameter, and in a pattern wherein the holes are precisely located. The circuit board manufacturer can choose the particular height of the circuit board by choosing the diameter of the circuit board holes that he drills. A particular height of the circuit board above the first surface 94, is chosen so that the
15 desired circuit components can be mounted on the circuit board. If an engineer who designs the circuit board requires components of large vertical thickness, he may drill small holes so that the circuit board rests on the third platform 152 (FIG. 4). This will leave a relatively thick space below the bottom of the circuit board, on which the thick component can be mounted. However,
20 it will leave little room for mounting components on the upper surface of the circuit board. On the other hand, if the engineer wishes to cram a large number of circuit components of moderately small thickness onto the board, he can use large diameter holes so the circuit board rests on the first surface 94. This will leave thick spaces both above and below the circuit board,
25 between the board and the covers 66, 68.

FIG. 5 shows another circuit board 160, that is similar to the circuit board 30, but wherein the circuit board 160 has holes 162, 164 to enable it to be received by the lowermost step or peg part 140. The figure also shows still

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another circuit board 170 with smaller holes 172, 174 that enable it to be closely received by the third pegs or steps 144.

A variety of approaches can be used to securely fasten the circuit board in place after its holes have received the pegs. One method is to use simple press fitting. Another method is to use adhesive which will adhere the lower surface and the walls of its holes to the peg and/or the lowermost surface 94. FIG. 8 shows a modified peg 90A with a slot 150 that permits the peg to be compressed when a circuit board is pressed firmly in place. In FIG. 8, the peg 90A is manufactured separately from the connector 12A, with the peg 10 having a post 152 press fitted into a hole in the connector.

FIG. 9 illustrates part of an assembly 180 of another embodiment of the invention, wherein each peg or platform is of rectangular shape as seen in a plan view taken along vertical line 194. A particular peg or platform 192 has three steps 200, 202, 204 and three corresponding board-supporting surfaces 206, 208, and 210. The circuit board 211 has a hole 212 designed to receive one of the steps, with the particular hole 212 shown in solid lines being designed to receive the uppermost step 204, so the lower surface 214 of the circuit board lies on the board-supporting surface 210. FIG. 9 shows two other hole sizes 216, 218 of different widths to enable the circuit board to lie at progressively lower heights. The holes such as 212 are in the form of slots that extend to the extreme side edge 220 of the circuit board. While such slots are not as easy to form as round holes, they can be formed by saws that cut into the edge of the circuit board. FIG. 9 also shows that the circuit board 211 has a ridge or integral beam portion 222 that increases the longitudinal rigidity of the circuit board.

Although terms such as "vertical", "horizontal", "upper and lower", etc, have been used herein to describe the parts of the IC card as shown in the

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figures, it should be understood that the IC card and its parts can be assembled and used in any orientation with respect to gravity.

In the arrangements illustrated, each end portion of the circuit board is rigidly connected to a corresponding connector at locations laterally
5 beyond the row of connector contacts. It is possible for the circuit board to extend rearwardly and forwardly slightly further and to mount to connector locations that lie above the row of contacts. However, such mounting is more difficult because it requires the portions of the connector that hold the front
10 contact portions to be thinner. In the case of the front connector which typically has two vertically spaced rows of contacts (but with the tails usually lying in one row), there is very little room for such mounting. By mounting the circuit board on laterally opposite sides of each connector, applicant uses connector portions that may not be otherwise utilized and which can be easily made to be thinner than the contact-holding portions. In some cards, no
15 contacts are required at the rear of the card, in which case the rear connector can be formed by a block of molded plastic without contacts, and the rear connector serves primarily to mechanically connect the rear end portion of the circuit board to the cover parts and to close the rear of the space between the cover parts.

20 Thus, the invention provides an IC card which is of simplified construction. The IC card is frameless, in that opposite end portions of the circuit board are directly and rigidly connected to front and rear connectors. The cover can include upper and lower cover parts or a one-piece cover, that are also directly mounted on the connectors. All of this is preferably
25 accomplished without the use of a separate frame that would extend between the front and rear connectors and which would support the circuit board and cover parts. The connection of each circuit board end portion to a connector is preferably accomplished at locations laterally beyond the row or rows of

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contacts of the connector, at least at the front connector, so that attachment occurs in connector regions of moderately small vertical thickness. Such connections can be accomplished by providing upstanding pegs on the connectors, which are received in holes formed in the circuit board. The pegs are preferably of circular shape as seen in a plan view, so that they can be received in round holes that can be simply drilled by circuit board makers. The pegs can have at least two different steps, with a board-supporting surface at the bottom of each step, and with the higher step or steps having smaller widths than the lower one. This enables a circuit board maker to choose which step will be received, by choosing the width or diameter of the hole that he will form in the circuit board.

Although particular embodiments of the invention have been described and illustrated herein, it is recognized that modifications and variations may readily occur to those skilled in the art, and consequently, it is intended that the claims be interpreted to cover such modifications and equivalents.

IN THE CLAIMS:

1. A combination of components which when assembled form a frameless IC card housing for holding a circuit board assembly that includes a circuit board and components on the circuit board, wherein the circuit board
5 has front and rear board end portions, with at least said front board end portion having a row of conductive pads, said combination comprising:

front and rear connectors, with at least said front connector having a row of contacts for engaging said row of conductive pads;

each of said connectors has a support surface thereon, said
10 support surfaces being adapted to directly support said front and rear board end portions, respectively, of said circuit board; and

a cover for substantially enclosing said circuit board, said cover having forward and rearward cover end portions, each of said cover end portions having parts for attaching said cover to a corresponding one of said
15 connectors.

2. The combination described in claim 1 wherein:

said first connector has a width along a lateral direction and said row of contacts extend along said lateral direction;

said front connector has a pair of mount parts that lie beyond
20 laterally opposite ends of said row of contacts, and that form two of said support surfaces.

3. The combination described in claim 1 including a circuit board with front and rear end portions, wherein:

said front and rear connectors each have support parts that have
25 pegs and that form said support surfaces, and said circuit board end portions each have holes that receive corresponding pegs and have mount parts lying adjacent to said pegs and supported on said board-supporting surfaces.

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4. The IC card described in claim 3 wherein:

each of said pegs has a plurality of vertically stacked peg parts and each of said support parts includes a plurality of said board supporting surfaces with each board supporting surface lying at the bottom of a peg part.

5 5. The combination described in claim 1 including a circuit board with front and rear end portions mounted respectively on said front and rear connectors, and wherein:

said cover is rigidly mechanically connected to said circuit board substantially only through said connectors.

10 6. A frameless IC card comprising a circuit board assembly having a circuit board with circuit components thereon, said circuit board having forward and rearward end portions with said forward end portion having a row of contact pads thereon, said IC card including front and rear connectors with at least said front connector having contacts engaged with said contact
15 pads, and a conductive cover having upper and lower portions that lie respectively above and below a majority of said circuit board, characterized by:

said connectors having support surfaces thereon, with said support surfaces of said front connector being spaced from said contacts;

said circuit board end portions are each rigidly mounted directly
20 on a corresponding one of said support surfaces of said connectors.

7. The IC card described in claim 6 wherein:

said front and rear connectors each have support parts that form said support surfaces and that form pegs projecting above said support surfaces, and said circuit board end portions each have holes that receive
25 corresponding pegs and have board surfaces lying adjacent to said pegs and supported on said support surfaces.

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8. The IC card described in claim 6 wherein:

each of said connectors has laterally spaced opposite sides and has at least one vertically extending projection at each of its sides;

said circuit board has a plurality of holes arranged in a pattern
5 corresponding to the locations of said projections, with each of said projection projecting into one of said circuit board holes, and with said circuit board supported directly on said connectors.

9. The IC card described in claim 6 wherein:

said cover is rigidly mounted on said connectors and is rigidly
10 connected to said circuit board substantially only through said connectors, and said IC card is devoid of any intermediate frame spanning the distance between said connectors to connect said circuit board or cover to said connectors.

10. A method for constructing an IC card, which includes forming front and rear connectors with laterally opposite sides and with at least
15 said front connector having a laterally extending row of contacts, forming a circuit board with front and rear board end portions each having laterally-spaced opposite sides and with a laterally extending row of contact pads on at least its front end portion, forming a cover, and assembling said connectors, circuit board, and cover into an IC card, characterized by:

20 and step of forming said connectors includes forming each of said connectors with at least one upstanding peg at each of its laterally opposite sides, with the pegs on said front connector lying on laterally opposite sides of its row of contacts;

said step of forming said circuit board includes forming holes in
25 said front and rear board end portions with said holes in said circuit board front portion lying laterally beyond said rows of contact pads, and including placing said circuit board end portions against said connectors with said pegs received in said holes.

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11. The method described in claim 10 including:
mounting said cover substantially only on said front and rear
connectors.

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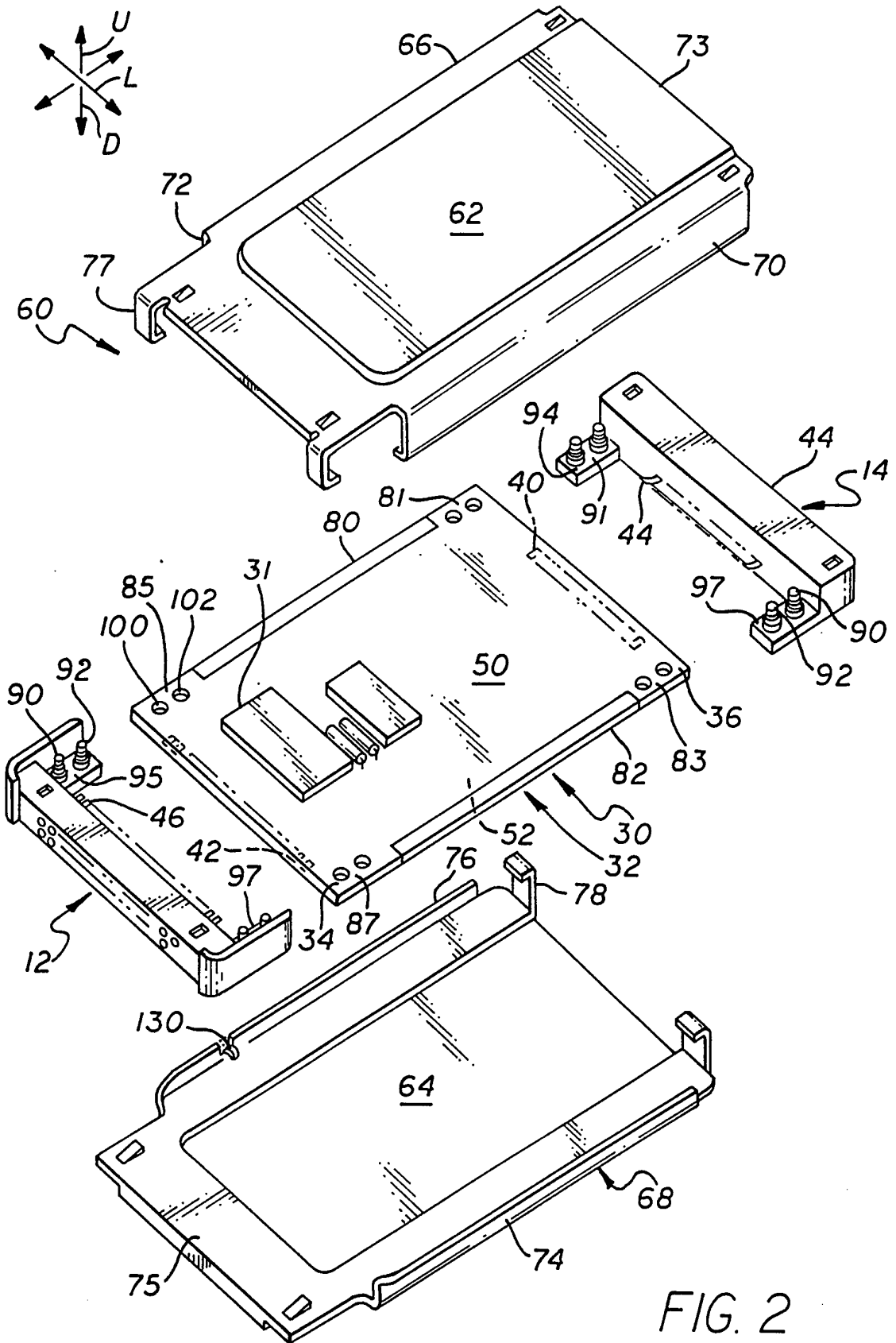


FIG. 2

FIG. 4

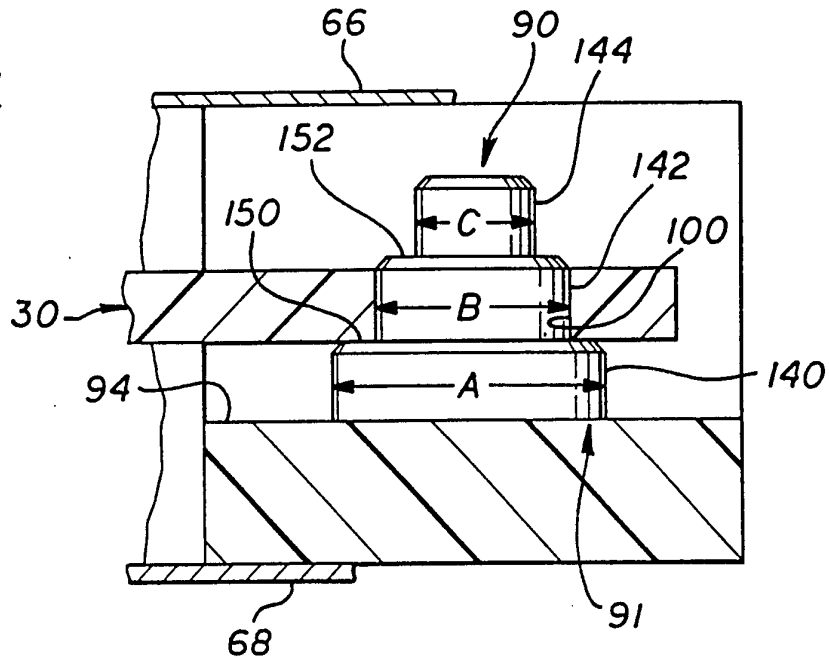


FIG. 5

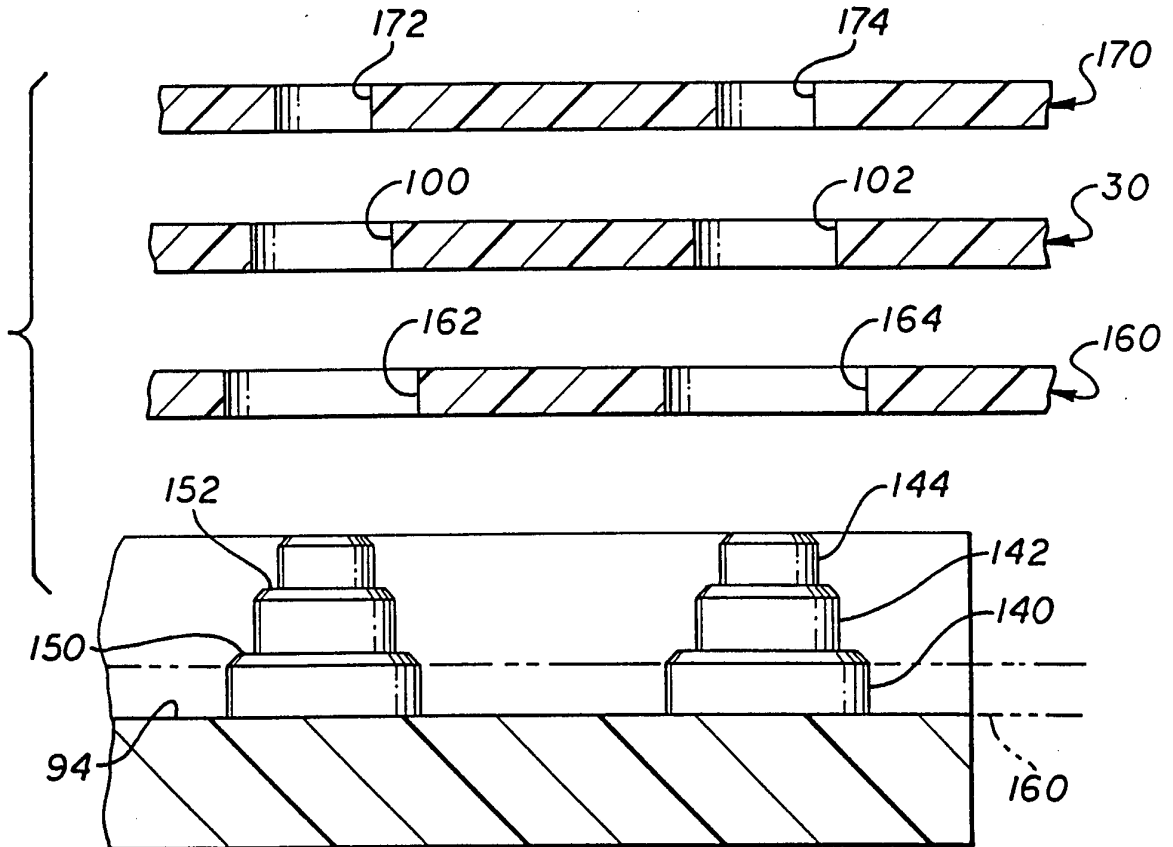


FIG. 6

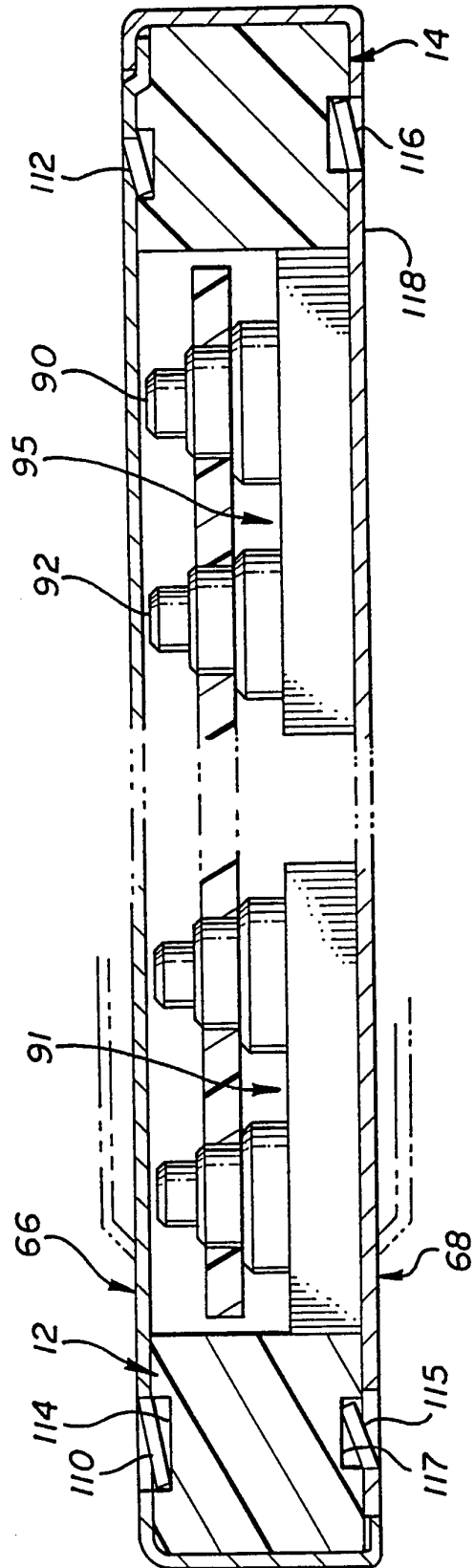


FIG. 7

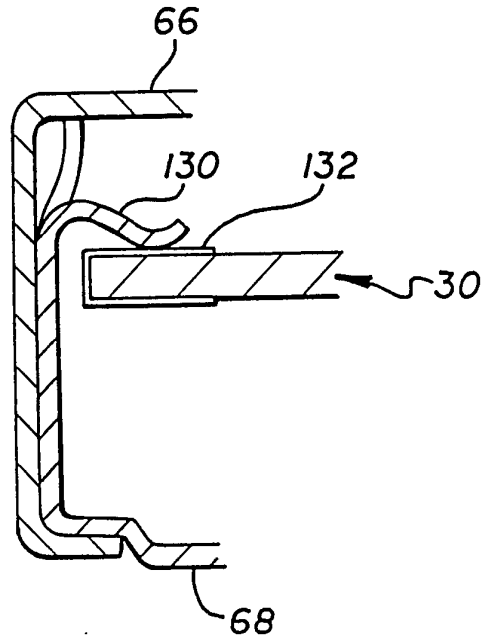


FIG. 8

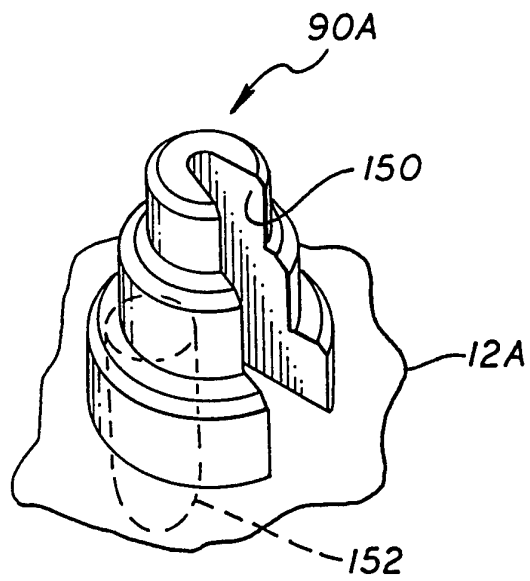
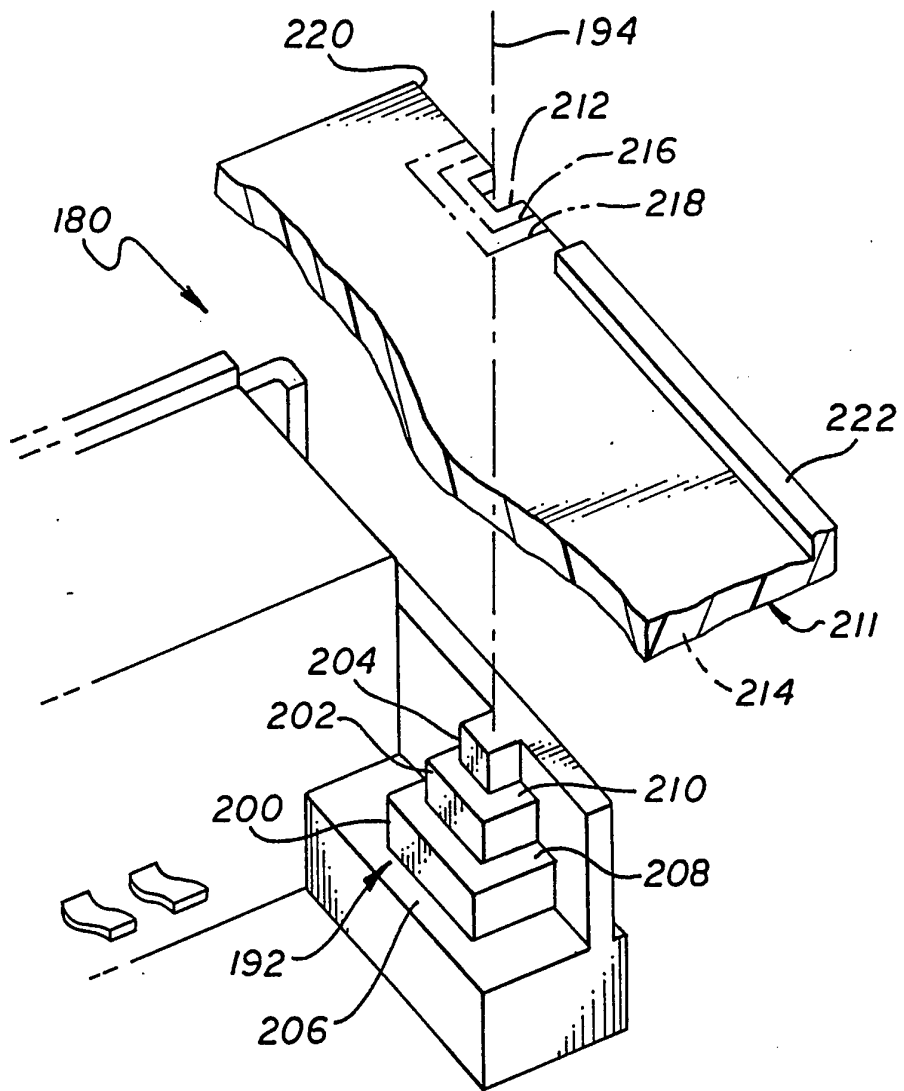


FIG. 9



INTERNATIONAL SEARCH REPORT

Internat. Application No

PCT/US 94/12683

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 6 G06K19/077

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G06K H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,4 924 076 (KITAMURA) 8 May 1990 see the whole document ---	1,2,5,6, 9-11
A	US,A,5 242 310 (LEUNG) 7 September 1993 see the whole document -----	1,2,6,8, 10

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Patent family members are listed in annex.

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Date of the actual completion of the international search

2 February 1995

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-4924076	08-05-90	JP-A- 1018695	23-01-89
US-A-5242310	07-09-93	NONE	