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(71) Applicant: **MOLEX INCORPORATED** [US/US]; 2222
Wellington Court, Lisle, IL 60532 (US).

(72) Inventors: **PELOZA, Kirk, B.**; 1645 Harris Lane,
Naperville, IL 60565 (US). **REGNIER, Kent, E.**; 541
South Grace Street, Lombard, IL 60148 (US).

(74) Agent: **WEISS, Stephen, Z.**; Molex Incorporated, 2222
Wellington Court, Lisle, IL 60532 (US).

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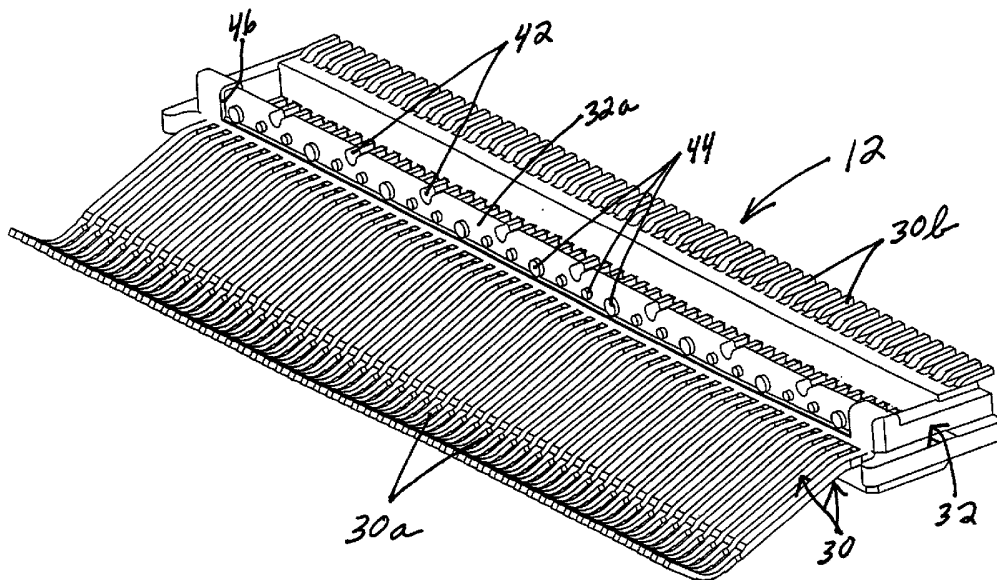
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(54) Title: BOARD MOUNTED ELECTRICAL CONNECTOR



(57) **Abstract:** A board mounted electrical connector includes a dielectric housing for mounting on a printed circuit board. An elongated solder bar of solderable material is secured at a bottom face of the housing for mechanically fixing the housing to appropriate solder pad on the board. The elongated solder bar has opposite ends and air vent openings spaced between the opposite ends to facilitate air flow during a soldering process.

BOARD MOUNTED ELECTRICAL CONNECTOR

Field of the Invention:

This invention generally relates to the art of electrical connectors and, particularly, to an improved means for securing or fixing an electrical connector to a printed circuit board.

5 **Background of the Invention:**

A typical electrical connector includes some form of dielectric housing which mounts a plurality of conductive terminals. The electrical connector may be mounted on a printed circuit board, and the terminals may have tail portions for surface connection, as by soldering, to circuit traces on the board or for insertion into holes in the board for connection, as by
10 soldering, to circuit traces on the board and/or in the holes. Problems continue to be encountered with circuit board mounted electrical connectors caused by damaging forces placed on solder joints between the terminal solder tail and the respective circuit trace on the board.

In order to prevent solder joint damage, various means have been used to
15 mechanically secure or fix the connector housing to the printed circuit board. Such means include fasteners, solderable fitting nails fixed to the dielectric housing, a plated surface on the dielectric housing or a metal housing which, itself, is soldered to a pad on the circuit board. Unfortunately, with the ever-increasing miniaturization of electrical connectors, fasteners are difficult to apply. Fasteners do not work well with smaller connectors, and they
20 require inventory storage and shipment of separate components. Solderable fitting nails typically are inserted into slots in the sides of the connector housing and do not provide support at the middle of the housing between the sides. Plating the connector housing with solderable material can be effective, but such plating processes are quite expensive in comparison to the overall cost of the connector and is not even cost effective for most
25 applications. A metal connector housing may be effectively soldered to pads on the printed circuit board, but metal housings are unduly heavy in comparison to plastic housings and it is difficult to solder beneath the housing which effectively acts as a thermal heat sink. The present invention is directed to solving these problems by providing a board mounted

electrical connector with an improved means for securing or fixing the connector to a printed circuit board.

Summary of the Invention:

5 An object, therefore, of the invention is to provide a new and improved board mounted electrical connector.

 In the exemplary embodiment of the invention, the connector includes a dielectric housing having a bottom face for mounting on a printed circuit board. An elongated solder bar of solderable material is secured to the bottom face of the housing for mechanically fixing
10 the housing to an appropriate solder pad on the board. The elongated solder bar has opposite ends and is provided with air vent openings spaced between the opposite ends to facilitate air flow during a soldering process.

 Preferably, the dielectric housing includes cut-out areas behind the solder bar in registry with the air vent openings. This improves the air flow in the area of the vent
15 openings.

 According to one aspect of the invention, the housing has an elongated rib. The elongated solder bar is U-shaped in cross-section and embraces the rib. The U-shaped solder bar defines a pair of side wall portions joined by a base wall portion. The vent openings are located at least in the base wall portion. In the exemplary embodiment, the vent openings
20 extend into the side wall portions of the U-shaped solder bar. The rib has cut-out areas in registry with the vent openings.

 According to another aspect of the invention, the dielectric housing is molded of plastic material and is overmolded over portions of the solder bar to secure the bar to the housing. Preferably, the solder bar includes a plurality of holes into which the molded
25 material of the housing projects.

 According to a further aspect of the invention, the dielectric housing includes an elongated air vent channel adjacent to and extending along substantially the length of the elongated solder bar. This elongated air vent channel preferably is wider at a central area thereof than at opposite end areas thereof.

30 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:

FIG. 1 is a perspective view looking at the bottom of an electrical connector assembly incorporating the elongated solder bar of the invention;

FIG. 2 is a vertical section taken generally along line 2-2 of FIG. 1;

FIG. 3 is an exploded perspective view of the connector assembly of FIG. 1;

FIG. 4 is an enlarged vertical section through the terminal module which incorporates the elongated solder bar;

FIG. 5 is a perspective of the terminal module, with the elongated solder bar removed to show the details of the fixing rib of the housing;

FIG. 6 is an enlarged perspective view of the elongated solder bar;

FIG. 7 is a plan view showing the configuration of the air vent channel extending along the elongated solder bar; and

FIG. 8 is a vertical section taken generally along line 8-8 of FIG. 7.

Detailed Description of the Preferred Embodiment:

Referring to the drawings in greater detail, and first to FIGS. 1-3, the invention is embodied in a circuit board mountable electrical connector assembly, generally designated 10, which incorporates a pair of terminal modules, generally designated 12 and 12A. The connector assembly is designed for receiving a circuit board 14 having contacts 16 on one side thereof and contacts 18 on an opposite side thereof. As will be seen hereinafter, contacts 16 and 18 on opposite sides of the circuit board engage terminals of terminal modules 12 and 12A.

At this point, it should be understood that the use of such terms as "top", "bottom" and the like herein and in the claims hereof is for providing a more clear and concise description of the invention. The connector assembly can be used in omni-directional applications. In fact, connector assembly 10 is shown in FIGS. 1-3 in what could be considered an upside-down orientation. In other words, the connector assembly is adapted for mounting on a second printed circuit board (not shown) which is positioned onto the top of

the assembly as shown in FIGS. 1-3, whereas in actual practice the connector assembly most likely would be positioned down onto the circuit board.

With those understandings, terminal modules 12 and 12A are mounted on a connector housing, generally designated 20, which includes a pair of mounting posts 22 for insertion
5 into appropriate mounting holes in the second circuit board. The housing has a bottom face 23 from which the mounting posts project. A pair of hold-down members 24 are mounted in cavities within housing 20 and include mounting legs 24a for insertion into appropriate mounting holes in the second printed circuit board. Connector housing 20 may be molded of dielectric plastic material, and hold-down members 24 may be fabricated of metal material.
10 A cover 26 is mounted onto connector housing 20 by means of a pair of latch arms 26a (Fig. 3).

FIGS. 4 and 5 show terminal module 12 in greater detail, particularly in conjunction with FIG. 2. The terminal module includes a plurality of elongated conductive terminals, generally designated 30, which are arranged in a generally parallel side-by-side array as is
15 clearly shown in FIG. 5. The terminals may be stamped and formed of conductive sheet metal material. Each elongated terminal 30 includes a pair of opposite end sections 30a and 30b which form contacts or tail portions of the terminal at opposite ends thereof. End sections or tail portions 30a of the terminals are provided for engaging contacts 16 (Fig. 3) of circuit board 14 as seen in FIG. 2. End sections or tail portions 30b of the terminals are
20 provided for engaging contacts on the second circuit board (not shown) to which connector assembly 10 is mounted. Each terminal also includes a pair of holding sections 30c and 30d (Fig. 4) located immediately adjacent to and inside end section 30a and 30b. A central section 30e is located between holding sections 30c and 30d.

Still referring to FIGS. 4 and 5 particularly in conjunction with FIG. 2, terminal
25 module 12 includes a dielectric, molded plastic housing, generally designated 32, which is overmolded about holding sections 30c and 30d of terminals 30, leaving opposite ends sections or tail portions 30a and 30b exposed as is seen clearly in FIG. 5. In essence, overmolded housing 32 includes a pair of ribs 32a and 32b which are overmolded about holding sections 30c and 30d, respectively, of the terminals.

30 The invention herein is incorporated in an elongated solder bar, generally designated 34 (Fig. 4) which embraces rib 32a of terminal module housing 32. Therefore, rib 32a can be considered an elongated fixing rib.

Referring to FIG. 6, elongated solder bar 34 is shown in greater detail, the elongated solder bar is generally U-shaped in cross-section for embracing fixing rib 32 as seen in FIG. 4. The U-shaped solder bar defines a pair of side wall portions 34a joined by a base wall portion 34b. A plurality of air vent openings 36 are spaced between opposite ends 38 of the solder bar to facilitate air flow during a soldering process. As seen clearly in FIG. 6, air vent openings 36 are formed in base wall portion 34b and extend into side wall portions 34a of the U-shaped solder bar. Side wall portions 34a have a plurality of holes 40 spaced along the length of the bar and into which molded material of plastic housing 32 projects, as described below.

Referring back to FIG. 5, fixing rib 32a of molded plastic housing 32 of terminal module 12 is shown in greater detail. Specifically, the top edge of the fixing rib is molded with a plurality of cut-out areas 42 which are located beneath or behind solder bar 34 in registry with air vent openings 36 in the solder bar. These cut-out areas assist in air flow through vent openings 36 during a soldering process. FIG. 5 also shows a plurality of bosses 44 which project outwardly from opposite sides of fixing rib 32a. These bosses represent the molded plastic material which projects into holes 40 (Fig. 6) in the side wall portions of solder bar 34 to securely hold the solder bar embracing fixing rib 32a as seen in FIG. 4. It should be understood that, in actual practice, fixing rib 32a would not be in the configuration shown in FIG. 5 without the presence of elongated solder bar 34. In other words, housing 32 is overmolded over portions of the solder bar, and the molten plastic material which forms bosses 44 would not be formed until the material actually flows into holes 40 of the solder bar in an appropriate molding die during the overmolding procedure.

FIG. 5 also shows a recessed area 46 running the length of fixing rib 32 and in which solder bar 34 (not shown) is disposed. This will allow the bottom or base wall 34b of the solder bar be at the same level as the tail portion 30b of the terminal.

Terminal module 12A is substantially identical to terminal module 12, except for the shape of end sections or tail portions 30a of the terminals, along with the fact that terminal module 12A does not have an elongated solder bar 34. Tail portions 30a of the terminals of terminal module 12A are configured for engaging contacts 18 (Fig. 3) of circuit board 14. Tail portions 30b of the terminals of terminal module 12A are adapted for engaging appropriate contact pads on the second printed circuit board to which connector 10 is mounted, just as are tail portions 30b of the terminals of terminal module 12.

FIGS. 7 and 8 show another feature of the invention. Specifically, an elongated air vent channel 50 is formed in molded plastic housing 20 of connector 10 adjacent to and extending along substantially the length of elongated solder bar 34 of terminal module 12. This air vent channel facilitates the flow of air around the solder bar to help distribute heat during the soldering process. It can be seen in FIG. 7 air vent channel 50 is wider at the center thereof than at opposite ends thereof. This will more evenly distribute the air across the width of the housing between ends of the solder bar.

FIG. 8 shows the entire connector 10 mounted to the second printed circuit board 52. Base wall portion 34b of solder bar 34 is shown soldered to an elongated soldering pad 54 on the circuit board. Air vent openings 36 in the solder bar, cut-out areas 42 in fixing rib 32a of the terminal module housing, and air vent channel 50 in the connector housing all are shown in this depiction. Arrows "A" show how air is forced into the connector toward the vicinity of the solder bar. Arrow "A" shows how the air is drawn downwardly into and through air vent channel 50. Arrows "C" show that the air is drawn downwardly around the area at which base wall portion 34b of solder bar 34 is soldered to solder pad 54 of the circuit board, including the flow of air through air vent openings 36 in the solder bar and cut-out areas 42 in fixing rib 32a. Finally, FIG. 8 shows tail sections 30b of terminals 30 of terminal module 12 soldered to circuit traces 54 on circuit board 52, as well as tail sections 30b of terminals 30 of terminal module 10A soldered to appropriate circuit traces 56 on the circuit board.

It should be understood that the inventive concepts embodied in the elongated solder bar 34 herein can be used in a wide variety of connector assemblies or configurations. Connector assembly 10 is but one assembly with which the solder bar can be used. In connector assembly 10, the solder bar actually is used in one of the terminal modules, particularly terminal module 12. However, it is contemplated that such an elongated solder bar can be used directly on the connector housing itself as well as on the housings of a wide variety of connector configurations. With the solder bar being elongated and extending substantially between opposite sides of the connector housing, the solder bar supports the middle of the housing and prevents it from bowing during the soldering process. The elongated soldering bar is a vast improvement over individual fasteners or solderable fitting nails of the prior art.

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:

What is claimed is:

1. A board mounted electrical connector, comprising:
a dielectric housing for mounting on a printed circuit board; and
an elongated solder bar of solderable material secured at a bottom face of the housing for mechanically fixing the housing to appropriate solder pad on the board, the elongated solder
5 bar having opposite ends and air vent openings spaced between the opposite ends to facilitate air flow during a soldering process.
2. The board mounted electrical connector of claim 1 wherein said housing includes cut-out areas behind the solder bar in registry with the air vent openings in the solder bar to assist said air flow at the vent openings.
3. The board mounted electrical connector of claim 1 wherein said housing has an elongated rib, and said elongated solder bar is generally U-shaped in cross-section and embraces the rib.
4. The board mounted electrical connector of claim 3 wherein said U-shaped solder bar defines a pair of side wall portions joined by a base wall portion, with said air vent openings being located at least in the base wall portion.
5. The board mounted electrical connector of claim 4 wherein said air vent openings extend into the side wall portions of the U-shaped solder bar.
6. The board mounted electrical connector of claim 5 wherein said rib has cut-out areas in registry with said vent openings to assist in air flow therethrough.
7. The board mounted electrical connector of claim 1 wherein said dielectric housing is molded of plastic material and is overmolded over portions of the solder bar to secure the bar to the housing.

8. The board mounted electrical connector of claim 7 wherein said solder bar includes a plurality of holes into which the molded material of the housing projects.

9. The board mounted electrical connector of claim 1 wherein the connector is part of a connector assembly which includes an assembly housing, and including an elongated air vent channel adjacent to and extending along substantially the length of the elongated solder bar between the solder bar and the assembly housing.

10. The board mounted electrical connector of claim 9 wherein said elongated air vent channel is wider at a central area thereof than at opposite end areas thereof.

11. The board mounted electrical connector of claim 1 wherein said dielectric housing has opposite sides and is elongated therebetween, and said elongated solder bar extends substantially between the opposite sides of the housing.

12. A board mounted electrical connector, comprising:

a dielectric housing molded of plastic material for mounting on a printed circuit board, the housing having an elongated fixing rib; and

5 an elongated solder bar of solderable material overmolded by portions of the housing to secure the solder bar at a bottom face of the housing for mechanically fixing the housing to appropriate solder pad on the board, the elongated solder bar having opposite ends and being generally U-shaped in cross-section for embracing the fixing rib of the housing, the solder bar having air vent openings spaced between the opposite ends thereof to facilitate air flow during a soldering process.

13. The board mounted electrical connector of claim 12 wherein said U-shaped solder bar defines a pair of side wall portions joined by a base wall portion, with said air vent openings being located at least in the base wall portion.

14. The board mounted electrical connector of claim 13 wherein said air vent openings extend into the side wall portions of the U-shaped solder bar.

15. The board mounted electrical connector of claim 14 wherein said rib has cut-out areas in registry with said vent openings to assist in air flow therethrough.

16. The board mounted electrical connector of claim 12 wherein said solder bar includes a plurality of holes into which the molded material of the housing projects.

17. The board mounted electrical connector of claim 12 wherein the connector is part of a connector assembly which includes an assembly housing, and including an elongated air vent channel adjacent to and extending along substantially the length of the elongated solder bar between the solder bar and the assembly housing.

18. The board mounted electrical connector of claim 17 wherein said elongated air vent channel is wider at a central area thereof than at opposite end areas thereof.

19. The board mounted electrical connector of claim 12 wherein said dielectric housing has opposite sides and is elongated therebetween, and said elongated solder bar extends substantially between the opposite sides of the housing.

20. A terminal module for use in an electrical connector, comprising:
a plurality of conductive terminals arranged in a generally parallel side-by-side array, the terminals having tail sections for soldering to appropriate circuit traces on a printed circuit board;

5 a dielectric plastic housing overmolded about portions of the terminals leaving at least said tail portions exposed; and

an elongated solder bar of solderable material secured to the housing for mechanically fixing the housing to appropriate solder pad on the circuit board, the elongated solder bar having opposite ends and air vent openings spaced between the opposite ends to facilitate air
10 flow during a soldering process.

21. The board mounted electrical connector of claim 20 wherein said housing includes cut-out areas behind the solder bar in registry with the air vent openings in the solder bar to assist said air flow at the vent openings.

22. The board mounted electrical connector of claim 20 wherein said housing has an elongated rib, and said elongated solder bar is generally U-shaped in cross-section and embraces the rib.

23. The board mounted electrical connector of claim 22 wherein said U-shaped solder bar defines a pair of side wall portions joined by a base wall portion, with said air vent openings being located at least in the base wall portion.

24. The board mounted electrical connector of claim 23 wherein said air vent openings extend into the side wall portions of the U-shaped solder bar.

25. The board mounted electrical connector of claim 24 wherein said rib has cut-out areas in registry with said vent openings to assist in air flow therethrough.

26. The board mounted electrical connector of claim 20 wherein said solder bar includes a plurality of holes into which the molded material of the housing projects.

27. The board mounted electrical connector of claim 20 wherein said dielectric housing has opposite sides and is elongated therebetween, and said elongated solder bar extends substantially between the opposite sides of the housing.

28. The board mounted electrical connector of claim 20 wherein said electrical connector includes a connector housing, and including an elongated air vent channel adjacent to and extending along substantially the length of the elongated solder bar between the solder bar and the connector housing.

29. The board mounted electrical connector of claim 28 wherein said elongated air vent channel is wider at a central area thereof than at opposite end areas thereof.

AMENDED CLAIMS

[received by the International Bureau on 26 February 2004 (26.02.04) ;
Original claims 1-29 replaced by new claims 1-29 (4 pages).]

1. A board mounted electrical connector (12), comprising:
a dielectric housing (32) for mounting on a printed circuit board (52); and
an elongated solder bar (34) of solderable material secured at a bottom face of the housing for mechanically fixing the housing to appropriate solder pad (54) on the board, the elongated solder bar having opposite ends (38) and air vent openings (36) spaced between the opposite ends to facilitate air flow during a soldering process.

2. The board mounted electrical connector of claim 1 wherein said housing (32) includes cut-out areas (42) behind the solder bar (34) in registry with the air vent openings (36) in the solder bar to assist said air flow at the vent openings.

3. The board mounted electrical connector of claim 1 wherein said housing (32) has an elongated rib (32a), and said elongated solder bar (34) is generally U-shaped in cross-section and embraces the rib.

4. The board mounted electrical connector of claim 3 wherein said U-shaped solder bar (34) defines a pair of side wall portions (34a) joined by a base wall portion (34b), with said air vent openings (36) being located at least in the base wall portion.

5. The board mounted electrical connector of claim 4 wherein said air vent openings (36) extend into the side wall portions (34a) of the U-shaped solder bar (34).

6. The board mounted electrical connector of claim 5 wherein said rib (32a) has cut-out areas (42) in registry with said vent openings (36) to assist in air flow therethrough.

7. The board mounted electrical connector of claim 1 wherein said dielectric housing (32) is molded of plastic material and is overmolded over portions (34a) of the solder bar to secure the bar to the housing.

8. The board mounted electrical connector of claim 7 wherein said solder bar (34) includes a plurality of holes (40) into which the molded material of the housing projects.

9. The board mounted electrical connector of claim 1 wherein the connector is part of a connector assembly (10) which includes an assembly housing (20), and including an elongated air vent channel (50) adjacent to and extending along substantially the length of the elongated solder bar between the solder bar and the assembly housing.

10. The board mounted electrical connector of claim 9 wherein said elongated air vent channel (50) is wider at a central area thereof than at opposite end areas thereof.

11. The board mounted electrical connector of claim 1 wherein said dielectric housing (32) has opposite sides and is elongated therebetween, and said elongated solder bar (34) extends substantially between the opposite sides of the housing.

12. A board mounted electrical connector (12), comprising:
a dielectric housing (32) molded of plastic material for mounting on a printed circuit board (52), the housing having an elongated fixing rib (32a); and
an elongated solder bar (34) of solderable material overmolded by portions of the housing to secure the solder bar at a bottom face of the housing for mechanically fixing the housing to appropriate solder pad (54) on the board, the elongated solder bar having opposite ends (38) and being generally U-shaped in cross-section for embracing the fixing rib (32a) of the housing, the solder bar having air vent openings (36) spaced between the opposite ends thereof to facilitate air flow during a soldering process.

13. The board mounted electrical connector of claim 12 wherein said U-shaped solder bar (34) defines a pair of side wall portions (34a) joined by a base wall portion (34b), with said air vent openings (36) being located at least in the base wall portion.

14. The board mounted electrical connector of claim 13 wherein said air vent openings (36) extend into the side wall portions (34a) of the U-shaped solder bar (34).

15. The board mounted electrical connector of claim 14 wherein said rib (32a) has cut-out areas (42) in registry with said vent openings (36) to assist in air flow therethrough.

16. The board mounted electrical connector of claim 12 wherein said solder bar (34) includes a plurality of holes (40) into which the molded material of the housing projects.

17. The board mounted electrical connector of claim 12 wherein the connector is part of a connector assembly (10) which includes an assembly housing (20), and including an elongated air vent channel (50) adjacent to and extending along substantially the length of the elongated solder bar between the solder bar and the assembly housing.

18. The board mounted electrical connector of claim 17 wherein said elongated air vent channel (50) is wider at a central area thereof than at opposite end areas thereof.

19. The board mounted electrical connector of claim 12 wherein said dielectric housing (32) has opposite sides and is elongated therebetween, and said elongated solder bar (34) extends substantially between the opposite sides of the housing.

20. A terminal module (12) for use in an electrical connector (10), comprising:
a plurality of conductive terminals (30) arranged in a generally parallel side-by-side array, the terminals having tail sections (30b) for soldering to appropriate circuit traces on a printed circuit board (52);

a dielectric plastic housing (32) overmolded about portions of the terminals leaving (30) at least said tail portions exposed; and

an elongated solder bar (34) of solderable material secured to the housing for mechanically fixing the housing to appropriate solder pad (54) on the circuit board (52), the elongated solder bar having opposite ends (38) and air vent openings (36) spaced between the opposite ends to facilitate air flow during a soldering process.

21. The board mounted electrical connector of claim 20 wherein said housing (32) includes cut-out areas (42) behind the solder bar (34) in registry with the air vent openings (36) in the solder bar to assist said air flow at the vent openings.

22. The board mounted electrical connector of claim 20 wherein said housing (32) has an elongated rib (32a), and said elongated solder bar (34) is generally U-shaped in cross-section and embraces the rib.

23. The board mounted electrical connector of claim 22 wherein said U-shaped solder bar (34) defines a pair of side wall portions (34a) joined by a base wall portion (34b), with said air vent openings (36) being located at least in the base wall portion.

24. The board mounted electrical connector of claim 23 wherein said air vent openings (36) extend into the side wall portions (34a) of the U-shaped solder bar (34).

25. The board mounted electrical connector of claim 24 wherein said rib (32a) has cut-out areas (42) in registry with said vent openings (36) to assist in air flow therethrough.

26. The board mounted electrical connector of claim 20 wherein said solder bar (34) includes a plurality of holes (40) into which the molded material of the housing projects.

27. The board mounted electrical connector of claim 20 wherein said dielectric housing (32) has opposite sides and is elongated therebetween, and said elongated solder bar (34) extends substantially between the opposite sides of the housing.

28. The board mounted electrical connector of claim 20 wherein said electrical connector (10) includes a connector housing (20), and including an elongated air vent channel (50) adjacent to and extending along substantially the length of the elongated solder bar between the solder bar and the connector housing.

29. The board mounted electrical connector of claim 28 wherein said elongated air vent channel (50) is wider at a central area thereof than at opposite end areas thereof.

FIG. 2

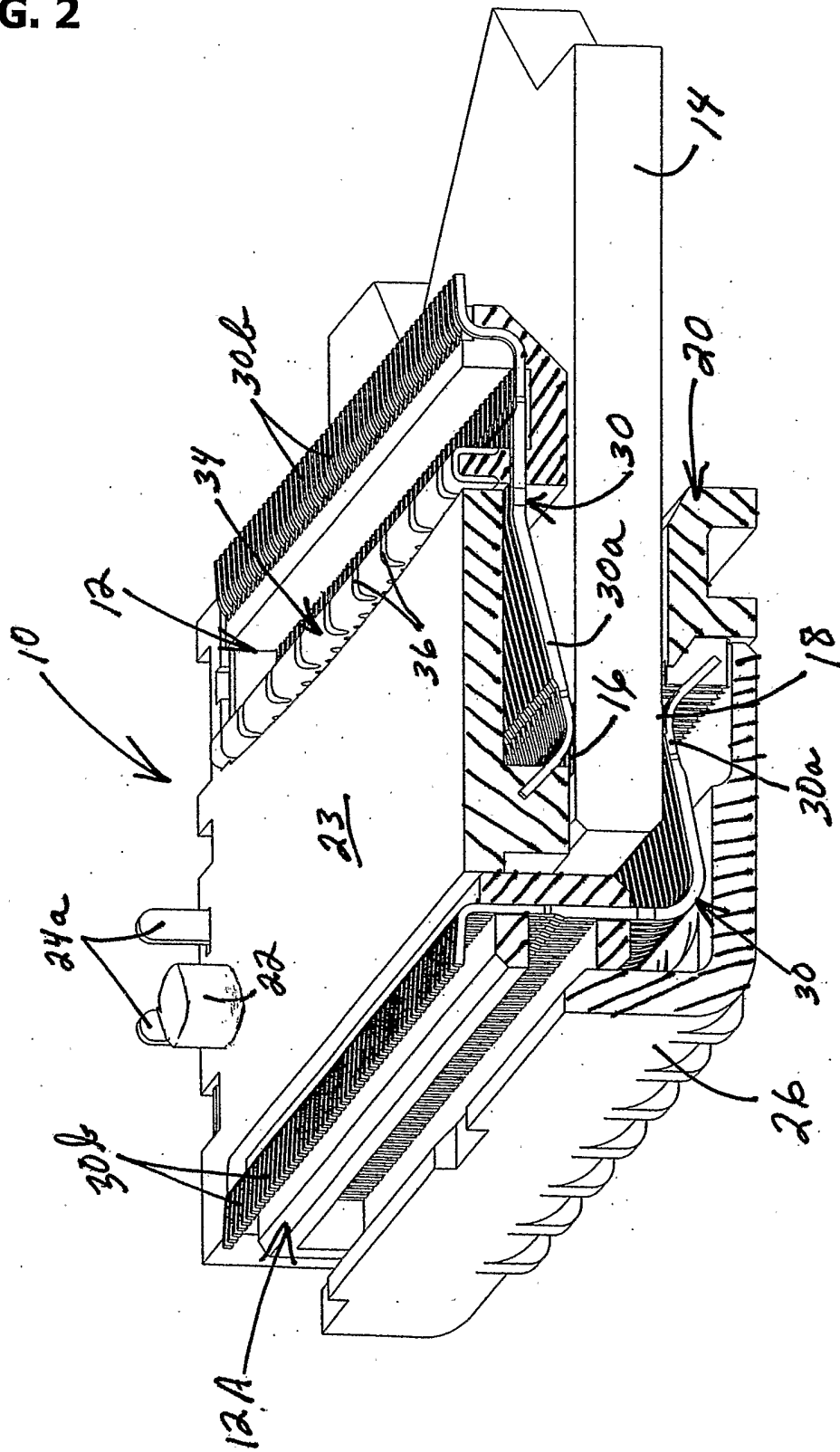


FIG. 3

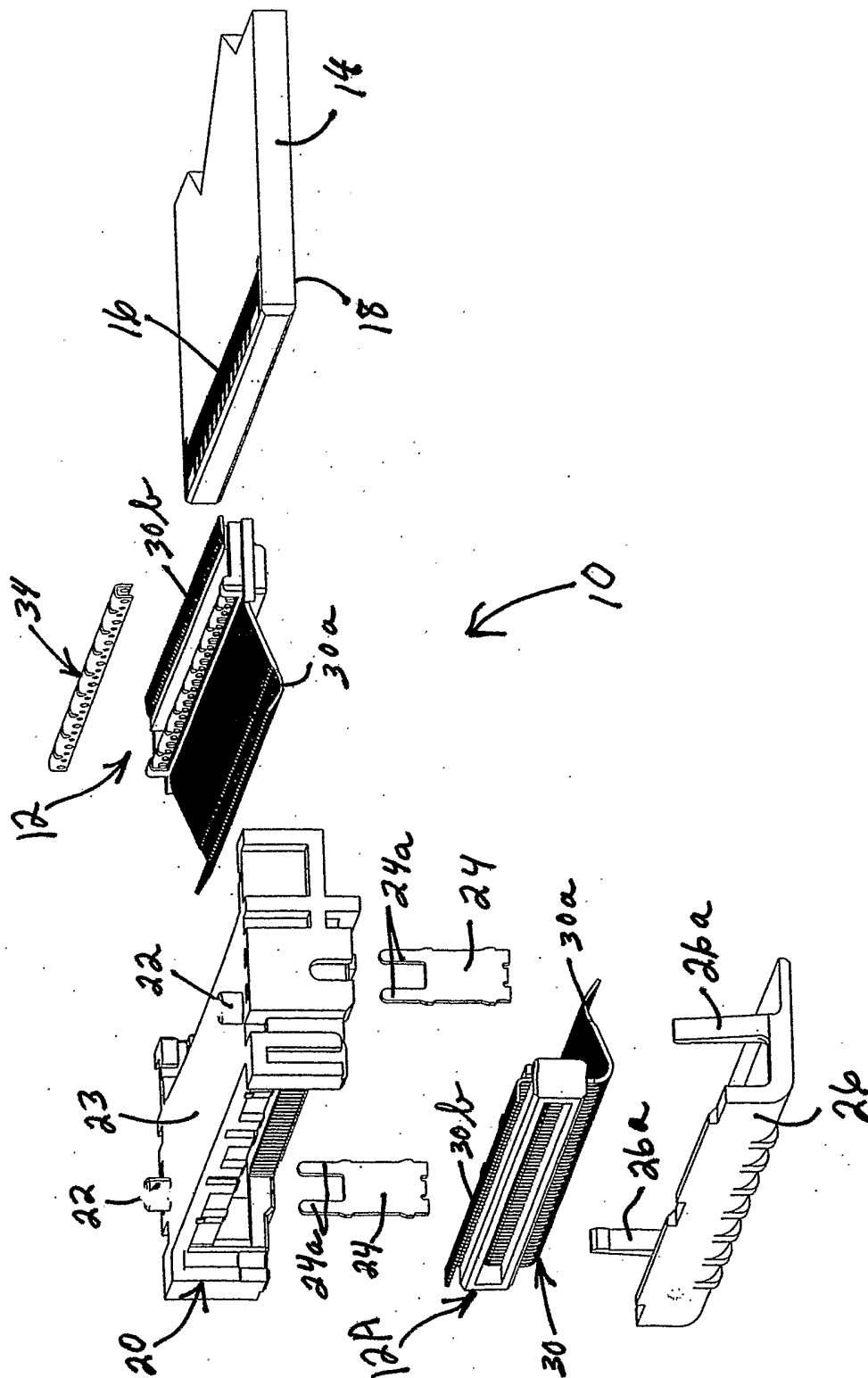


FIG. 4

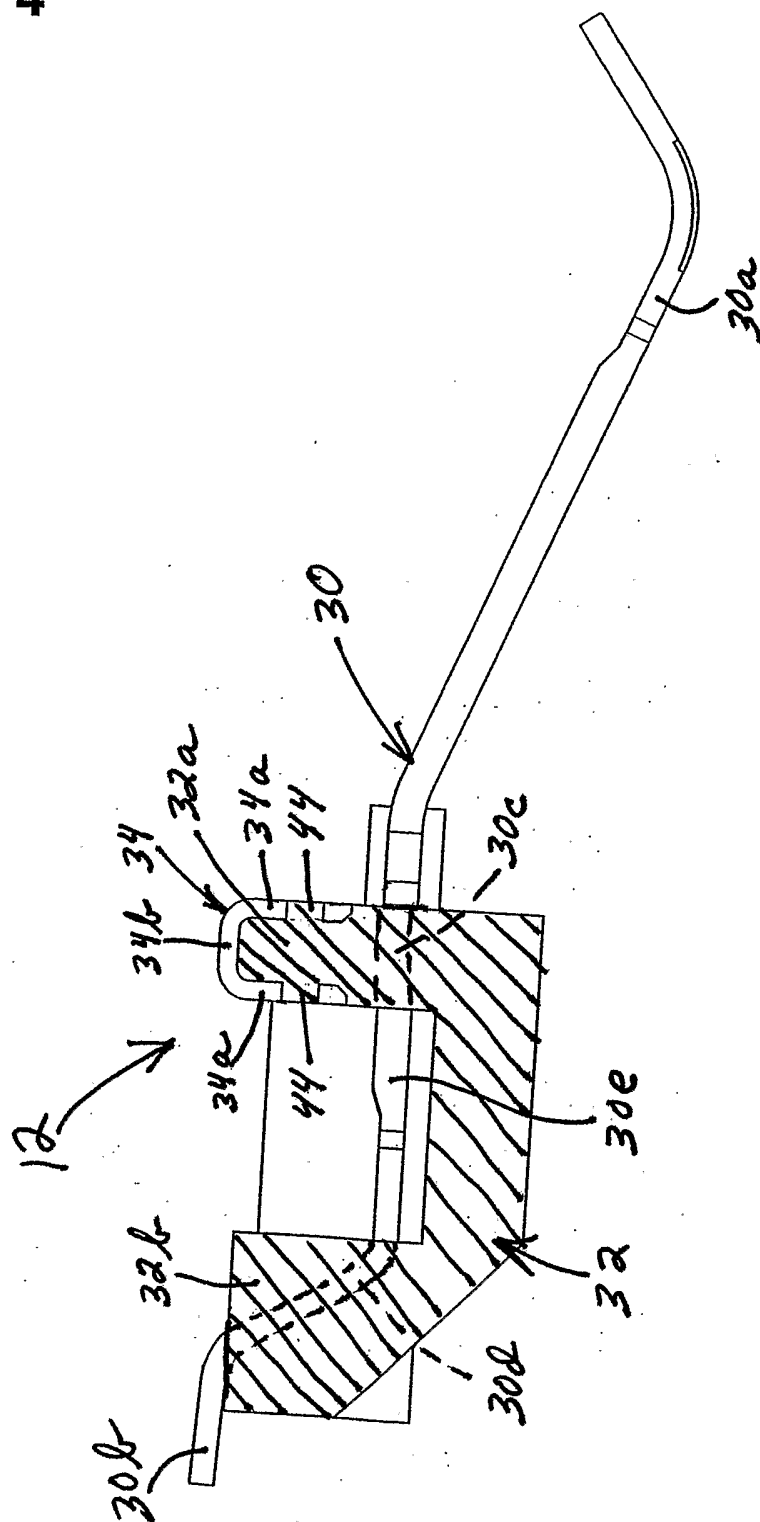


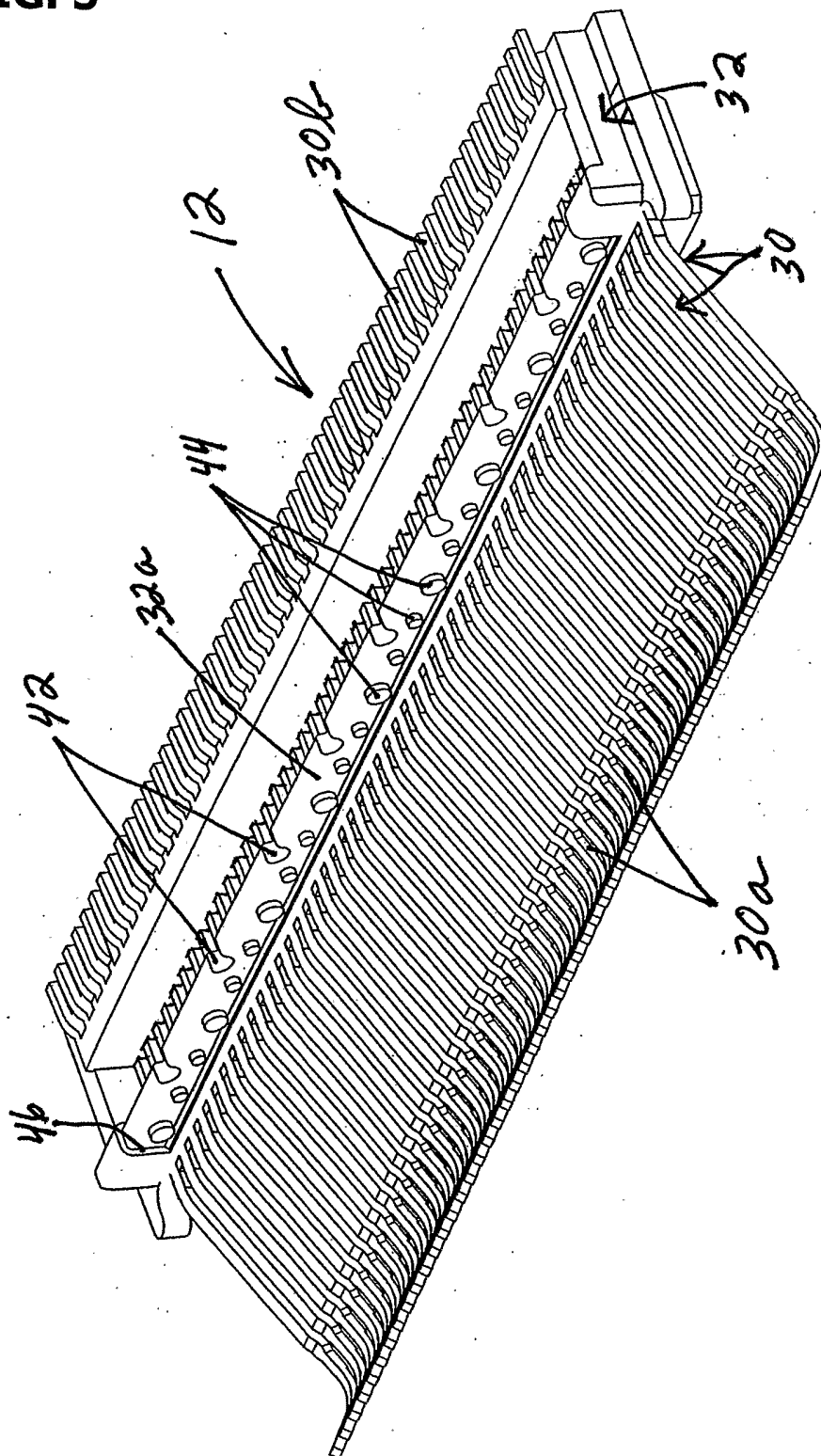
FIG. 5

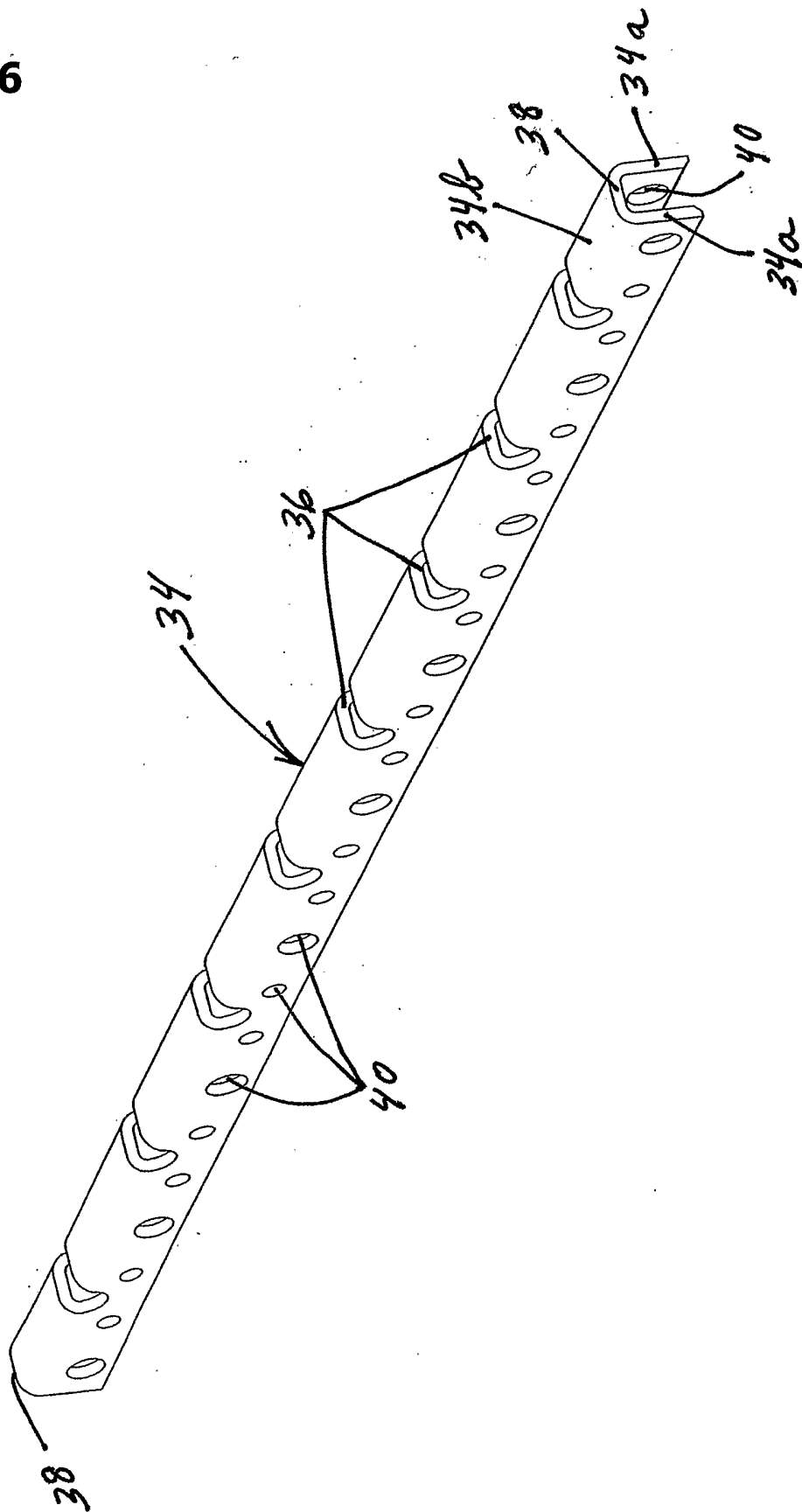
FIG. 6

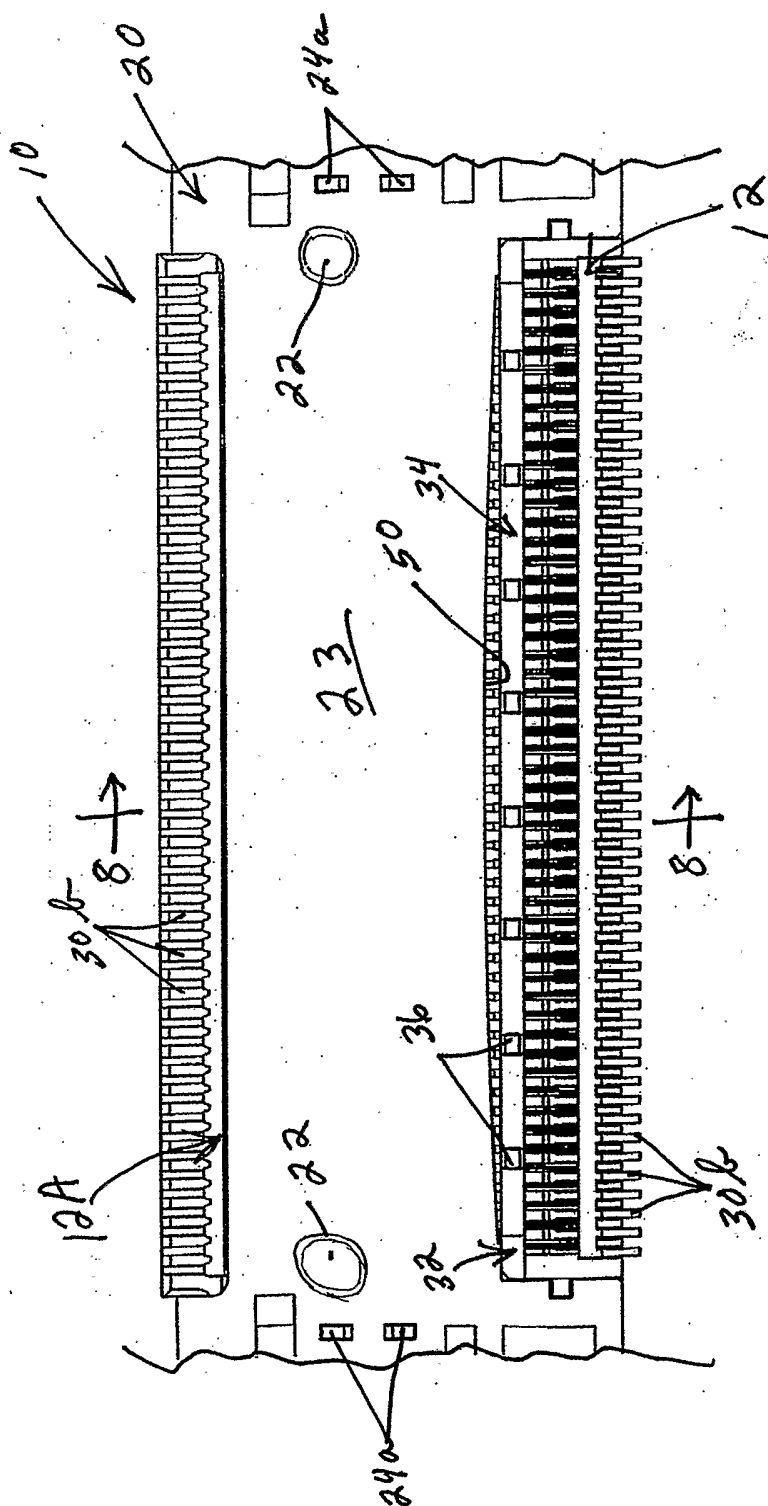
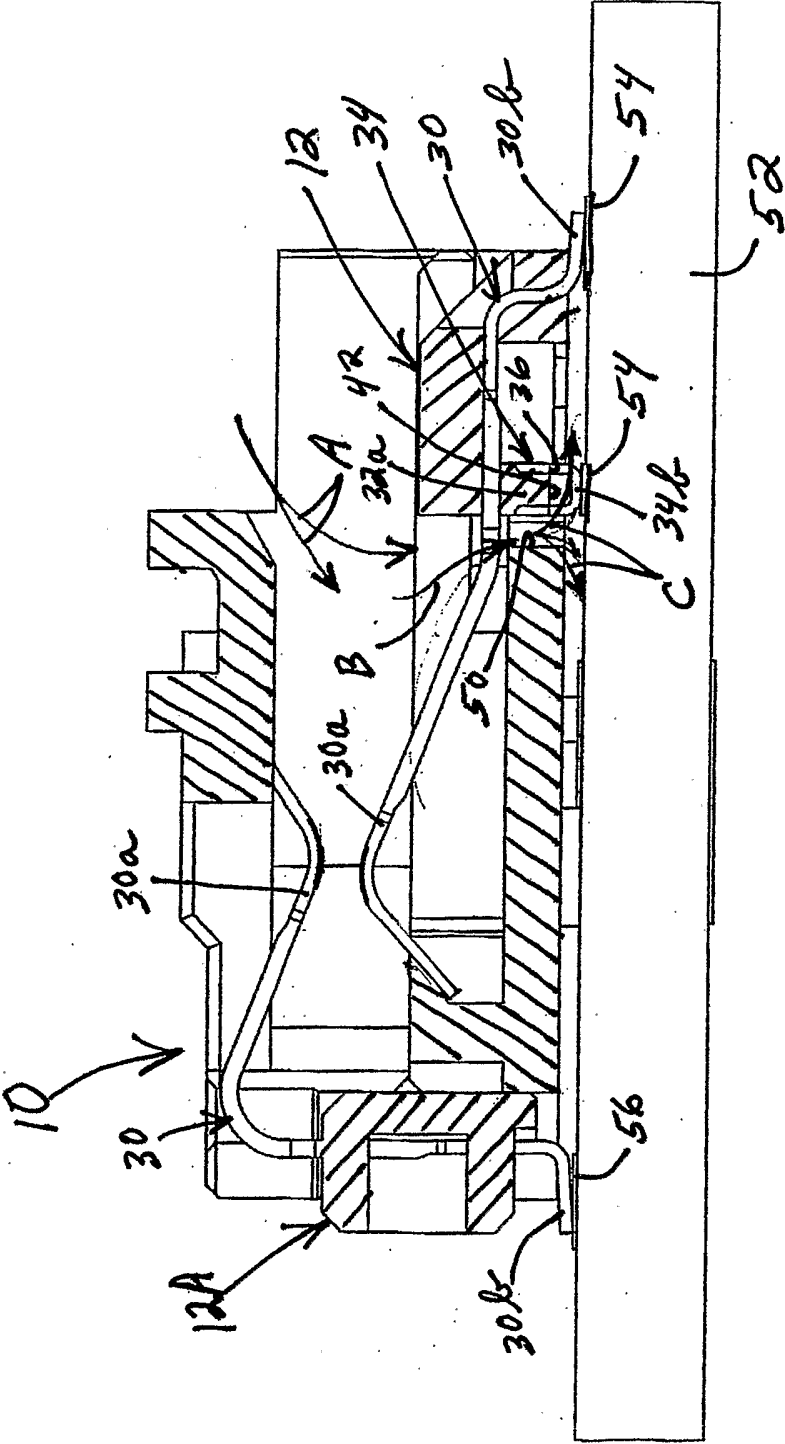
FIG. 7

FIG. 8



INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 03/31879

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01R12/20

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 7 H01R

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)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 079 467 A (TYCO ELECTRONICS LOGISTICS AG) 28 February 2001 (2001-02-28) column 4, paragraph 19 -column 5, paragraph 31; figure 1 ---	1-29
A	US 6 435 906 B1 (LONGUEVILLE JACQUES) 20 August 2002 (2002-08-20) column 3, line 65 -column 6, line 16; figure 1 ---	1-29
A	WO 00 28627 A (HOUTTEMAN BERNARD ;ACKE EDGARD (BE); EMBO GEORGES (BE); LEEMAN REG) 18 May 2000 (2000-05-18) page 4, line 10 -page 6, line 5; figure 1 -----	1-29



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents:

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
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Authorized officer

Stirn, J-P

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Information on patent family members

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