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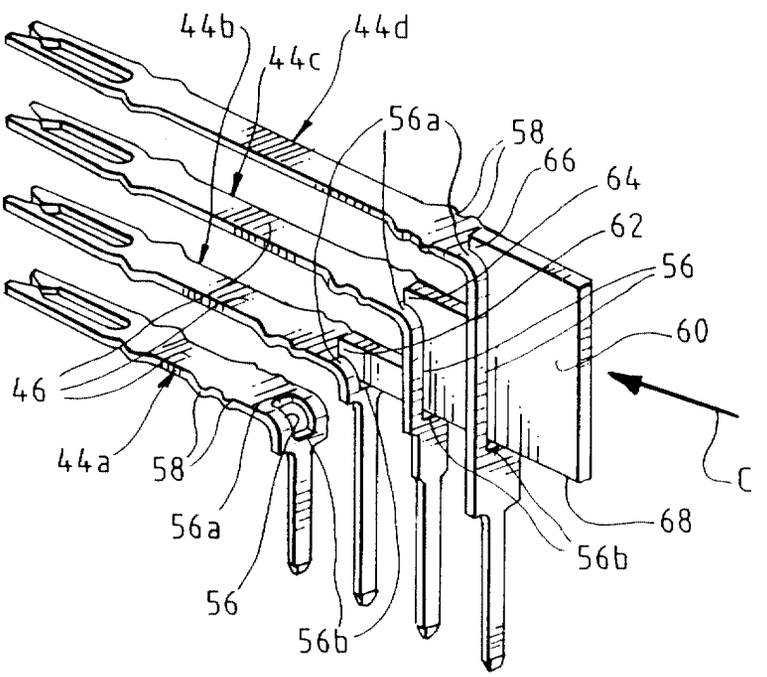
(54) Electrical connector with improved terminal configuration

(57) A right-angled electrical connector is adapted for mounting on a printed circuit board and includes a dielectric housing having a plurality of rows of terminal-receiving passages extending between a front mating face and a rear terminating face of the housing. A plurality of right-angled terminals are inserted into the passages. Each terminal includes an elongated body portion inserted into a respective passage from the terminating face of the housing. A tail portion extends from a bend at a rear end of the body portion generally at a right-angle thereto. A slot extends into the bend and defines an abutment surface in the body portion for engagement by an appropriate insertion tool to insert the terminal into its respective passage.

FIG. 6



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Description

Field of the Invention

[0001] This invention generally relates to the art of terminals used in electrical connectors and electrical connectors using those terminals, and particularly, to an electrical terminal and an electrical connector having an improved terminal structure.

Background of the Invention

[0002] A typical electrical connector includes some form of housing mounting one or more terminals. The housing may be fabricated of dielectric material such as molded plastic or the like, and the terminals may be fabricated of conductive material such as stamped and formed sheet metal material. The housing includes a plurality of terminal-receiving passages within which the terminals are mounted. The terminals may be inserted individually into their respective passages, or a plurality of terminals may be "gang" inserted simultaneously into a plurality of passages. The housing and terminals may be adapted for mating with a complementary mating connector or other connecting device and the terminals may be terminated to various conductors such as electrical wires, circuit traces on a printed circuit board or the like.

[0003] Various problems continue to arise in fabricating electrical connectors of the character described above. Some problems are particularly critical in high density connectors, i.e., when the terminals are very closely spaced. For instance, the terminals may be inserted into closely spaced rows of terminal-receiving passages in the connector housing, and the passages in the rows may be aligned in closely spaced columns. In such high density connectors, the closely spaced terminals cause problems in preventing heat dissipation from the connector. The high density terminals also are difficult to "gang" insert into the housing, and individual insertion of terminals must be performed which is time consuming and expensive. Still further, particularly when the terminals are inserted into rows of terminal-receiving passages in the housing, it is difficult to ascertain when the terminals are fully inserted. One row of terminals may block visual or mechanical access to an underlying row. This is particularly true in right-angled connectors having a mating face generally perpendicular to a printed circuit board, along with appropriate right-angled terminals. Other problems include appropriately locking the terminals in their respective passages in the housing. The present invention is directed to solving these various problems by providing terminals with unique configurations and with features which perform multiple functions.

Summary of the Invention

[0004] An object, therefore, of the invention is to provide an electrical connector of the character described, with new and improved terminal structures.

[0005] In the exemplary embodiment of the invention, the terminals are employed in a right-angled electrical connector for mounting on a printed circuit board. However, it should be understood that some features of the invention are equally applicable for other types of electrical connectors. The right-angled connector herein includes a dielectric housing having a bottom board-mounting surface, a front mating face, a rear terminating face and a plurality of rows of terminal-receiving passages extending between the faces. At least some of the passages in the rows are aligned in columns generally perpendicular to the rows and the printed circuit board.

[0006] A plurality of right-angled terminals are inserted into the terminal-receiving passages. Each terminal includes an elongated body portion inserted into a respective passage from the terminating face of the housing. A tail portion extends from a bend at a rear end of the body portion generally at a right angle thereto for connection to an appropriate circuit trace on the printed circuit board. A slot extends into the bend and defines an abutment surface in the body portion for engagement by an appropriate insertion tool to insert the terminal into its respective terminal-receiving passage.

[0007] As disclosed herein, the abutment surface in the body portion of the terminal is defined by one end of the slot. The slot, in turn, extends into the tail portion of the terminal and defines an alignment surface at an opposite end of the slot. The alignment surfaces at the opposite ends of the slots in the terminals in any given column thereof are in alignment in a direction generally parallel to the insertion direction of the terminals into the terminal-receiving passages. The slots perform a dual function of allowing for heat-dissipating air to pass through the terminals between the rows thereof.

[0008] Still further, the slots extend into the tail portions of the terminals in any given column thereof a sufficient distance such that a single insertion tool can be used to insert more than one terminal in each column. Therefore, at least a portion of the insertion tool can extend through the slot in one terminal and into engagement with the abutment surface of at least one other terminal in the column of terminals.

[0009] Another feature of the invention includes providing at least one locking barb on the body portion of the terminal near the bend thereof (or near the tool-engaging surface) for lockingly interfacing with the housing within the respective passage in the housing. This location of the locking barb prevents the terminal from buckling during insertion. In addition, locating the locking barb at the bend of the terminal, which places the locking barb approximately directly above the narrowed tail portion of the terminal, prevents uplifting of the tail portion

of the terminal upon mounting of the connector onto a printed circuit board or other mounting substrate.

[0010] 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

[0011] The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

FIGURE 1 is a front perspective view of the mating face of an electrical connector embodying the concepts of the invention;
FIGURE 2 is a rear perspective view of the terminating face of the connector;
FIGURE 3 is a view similar to that of Figure 2, cutaway to show a vertical column of terminal-receiving passages, with one passage in each of the four rows thereof;
FIGURE 4 is a perspective view of four terminals in a column of terminals, with one terminal for each of the four rows thereof;
FIGURE 5 is a perspective view of an individual terminal in the top or outer row thereof; and
FIGURE 6 is a view similar to that of Figure 4, with an insertion tool shown in position for simultaneously inserting three terminals in three different rows thereof.

Detailed Description of the Preferred Embodiment

[0012] Referring to the drawings in greater detail, and first to Figures 1-3, the invention is embodied in an electrical connector, generally designated 10, which includes a dielectric housing, generally designated 12. The connector is a right-angled connector for mounting on a printed circuit board. The housing is a one-piece structure unitarily molded of plastic material or the like. Housing 12 includes a bottom board-mounting face 14, a front mating face 16 and a rear terminating face 18. A pair of blind-mating posts 20 project forwardly for facilitating mating connector 10 with a complementary mating connector (not shown) in the direction of arrow "A" (Fig. 1).

[0013] Housing 12 of connector 10 includes a pair of side wing portions 22 having a slot 24 for mounting a pair of board-lock members 26. The board-lock members are fabricated of metal material and are press-fit into slots 24 for mounting the connector on the printed circuit board.

[0014] Connector 10 includes a pair of power terminals, generally designated 28 (Fig. 2) mounted in a pair of terminal-receiving passages 30 in housing 12. Each power terminal includes a contact portion 32 (Fig. 1) for engaging the contact portion of an appropriate power terminal of the complementary mating connector. The power terminals have tail portions 34 (Fig. 2) for insertion into appropriate holes in the printed circuit board and for electrical connection to appropriate power circuit traces on the board and/or in the holes.

[0015] As best in seen in Figures 1 and 3, dielectric housing 12 includes a plurality of terminal-receiving passages 36 for receiving a plurality of right-angled signal terminals, generally designated 38 (Figs. 2 and 3). Terminal-receiving passages 36 are arranged in four rows within the housing. Referring to Figure 1, the four rows include a bottom or first row 40a, a second row 40b, a third row 40c and a top or fourth row 40d. The passages are horizontally spaced so that they are vertically aligned in the rows to define columns of passages, generally designated 42. Figure 3 shows one column 42 of four passages, with a passage from each row 40a-40d in the column.

[0016] Referring to Figure 4 in conjunction with Figures 2 and 3, four terminals, generally designated 44a-44d, are shown for insertion into one column 42 of terminal-receiving passages 36 in housing 12, as best seen in Figure 3. The terminals are stamped and formed of conductive sheet metal material. Terminal 44a can be considered the bottom or inside terminal and is inserted into one of the passages in the bottom or first row 40a of passages. Terminal 44b is inserted into one of the passages in second row 40b. Terminal 44c is inserted into one of the passages in third 40c. Terminal 44d can be considered the top or outside terminal in column 42 and is inserted into a passage in the top or fourth row 40d.

[0017] All of right-angled terminals 44a-44d (Fig. 4) are identical in configuration except for the size (length, etc.) of certain of their components. Therefore, reference is made to Figure 5 wherein one of the top or outside terminals 44d for the passages 36 in the top or fourth row 40d of passages is shown. Like numerals will be applied to the components of terminals 44a-44c corresponding to the specific components described below in relation to terminal 44d in Figure 5.

[0018] Specifically, each right-angled terminal includes an elongated body portion 46 for insertion into a respective one of the terminal-receiving passages 36 in housing 12 in the direction of arrow "B" (Fig. 5). The body portion terminates in a forward bifurcated contact end 48 for engaging an appropriate contact of the complementary mating connector. A pair of guide bosses 50 are formed on the outside of the body portion immediately behind contact end 48 for guiding the body portion into its terminal-receiving passage. A tail portion 52 extends from a bend 54 at a rear end of body portion 46 and terminates in a narrowed tail 52a for insertion into

an appropriate hole in the printed circuit board and for electrical connection to a circuit trace on the board and/or in the hole. With the terminal being a signal terminal, the circuit trace on the board will be a signal circuit. A slot 56 is formed in the terminal and extends from bend 54 into tail portion 52. The slot has one end 56a which defines an abutment surface in body portion 46 and an opposite end 56b which defines an alignment surface in tail portion 52. Finally, an enlarged area 46a of body portion 46 has a plurality of locking barbs 58 projecting outwardly therefrom for locking the terminal in its respective terminal-receiving passage 36 in connector housing 12. The locking barbs skive into the plastic material of the housing within the passage.

[0019] Referring back to Figure 4 in conjunction with the above description of terminal 44d in Figure 5, it can be seen that contact ends 48, guide bosses 50 and locking barbs 58 are substantially the same size and configuration for all terminals 44a-44b. The ends of tails 52a also are in a common plane for insertion into the respective holes in the planar printed circuit board. However, as best understood from the cut-away view of Figure 3, it can be seen that the four rows of terminals are insertable into four rows of holes in the printed circuit board. Therefore, the elongated body portions 46 of terminals 44a-44d are of differing lengths and progressively increase from the bottom or inside terminal 44a toward the top or outside terminal 44d in each column 42 of terminals. This locates tails 52a in four different rows. In addition, with terminal-receiving passages 36 (Fig. 3) increasing in distance away from the printed circuit board in an upward direction in each column 42, tail portions 52 of the terminals likewise increase in length from bottom terminal 44a to top terminal 44b. Finally, Figure 4 also clearly shows that with terminals 44a-44d arranged in vertical columns 42, slots 56 are in general registry to allow for the flow of air in and out of the entire cluster of terminals to promote the dissipation of heat from inside the electrical connector to the outside thereof and, especially, from the underside of the connector near the printed circuit board to the outside thereof.

[0020] Figure 6 shows an assembly or insertion tool 60 for simultaneously inserting three terminals 44b-44d into their respective terminal-receiving passages 36, after terminal 44a in the respective column of terminals has been inserted. It can be seen that abutment surfaces 56a at the upper ends of slots 56 in terminals 44b-44d are in vertical alignment. With slots 56 being in registry, insertion tool 60 can extend through all three slots in all three terminals 44b-44d. Therefore, the insertion tool can have an insertion shoulder portion 62 for engaging abutment surface 56a of terminal 44b, an insertion shoulder portion 64 for engaging abutment surface 56a of terminal 44c and an insertion shoulder portion 66 for engaging abutment surface 56a of terminal 44d. The single insertion tool, thereby, can insert all three terminals simultaneously into their respective passages in the connector housing. By making slots 56 in terminals 44b-44d of increasing lengths, alignment surfaces 56b at the opposite ends of slots 56 can be made in alignment for engaging a single aligning edge 68 at the bottom of insertion tool 60. Insertion tool 60 also allows for preloading of terminals 44b-d onto the insertion tool prior to insertion of those terminals into their respective terminal-receiving passages 36 while at the same time allowing the insertion depth of terminals 44b and 44c into their respective terminal-receiving passages 36 to be accurately controlled relative to the insertion depth of terminal 44d into terminal-receiving passage 36.

[0021] Finally, still referring to Figure 6, with insertion tool 60 being movable in the direction of arrow "C", locking barbs 58 which skive into the plastic material of the connector housing within the terminal-receiving passages, are located near the bend 54 immediately in front of insertion shoulder portions 62-66 of the insertion tool. Therefore, body portions 46 of the terminals can more freely move into the passages without buckling under the insertion forces. In addition, the locking barb 58 may be located at the bend 54 of the terminals 44a-d to prevent uplifting of the narrowed tail portions 52a of the terminals upon mounting of the connector 10 onto a mounting substrate (not shown), such as a printed circuit board.

[0022] 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 right-angled electrical connector for mounting on a printed circuit board, comprising:

a dielectric housing having a bottom board-mounting surface, a front mating face, a rear terminating face and a plurality of rows of terminal-receiving passages extending between said faces, at least some of the passages in said rows being aligned in columns generally perpendicular to the rows and the printed circuit board; and

a plurality of right-angled terminals inserted into said terminal-receiving passages, each terminal including an elongated body portion inserted into a respective passage from the terminating face of the housing, a tail portion extending from a bend at a rear end of the body portion generally at a right-angle thereto for connection to an appropriate circuit trace on the printed circuit board, and a slot extending into the bend and defining an abutment surface in the body portion.

2. The electrical connector of claim 1 wherein said abutment surface in the body portion is defined by one end of the slot.

3. The electrical connector of claim 2 wherein said slot extends into the tail portion of the terminal and defines an alignment surface at an opposite end of the slot.

4. The electrical connector of claim 3 wherein said alignment surfaces at the opposite ends of the slots in at least some of the terminals in any given column thereof are in alignment in a direction generally parallel to the insertion direction of the terminals into the terminal-receiving passages.

5. The electrical connector of claim 1 wherein said abutment surface in said body portion is defined for engagement by an appropriate insertion tool to insert the terminal into its respective terminal-receiving passage in the housing.

6. The electrical connector of claim 5 wherein said slots extend into the tail portions of the terminals in any given column thereof a sufficient distance such that a single insertion tool can be used to insert more than one terminal in each column, whereby at least a portion of the insertion tool can extend through the slot in one terminal and into engagement with the abutment surface of at least one other terminal in the column.

7. The electrical connector of claim 1 wherein said body portion includes at least one locking barb near the bend in the terminal for lockingly interfacing with the housing within the respective passage of the housing.

8. An electrical connector, comprising:

a dielectric housing having a mating face, a terminating face and plurality of terminal-receiving passages extending between the faces, at least some of the passages being in rows; and
a plurality of terminals inserted into said terminal-receiving passages, each terminal including a body portion inserted into a respective passage from the terminating face of the housing, a terminating portion projecting from the terminating face, and a slot in the terminating portion for allowing heat-dissipating air to pass through the terminals between the rows thereof, the slot defining an abutment surface aligned with the body portion.

9. The electrical connector of claim 8 wherein said abutment surface in said body portion is defined for engagement by an appropriate insertion tool to insert the terminal into its respective terminal-receiving passage in the housing.

10. The electrical connector of claim 9 wherein at least some of the terminal-receiving passages in said rows are aligned in columns, and the slots are of sufficient lengths such that a single insertion tool can be used to insert more than one terminal in each column whereby at least a portion of the insertion tool can extend through the slot in one terminal and into engagement with the abutment surface of at least one other terminal in the column.

11. The electrical connector of claim 8 wherein said body portion includes at least one locking barb near said abutment surface for lockingly interfacing with the housing within the respective passage in the housing.

12. A right-angled electrical connector for mounting on a printed circuit board, comprising:

a dielectric housing having a bottom board-mounting surface, a front mating face, a rear terminating face and a plurality of rows of terminal-receiving passages extending between said faces; and
a plurality of right-angled terminals inserted into said terminal-receiving passages, each terminal including an elongated body portion inserted into a respective passage from the terminating face of the housing, a terminating portion extending from a bend at a rear end of the body portion generally at a right-angle thereto, and at least one locking barb near and immediately forward of the bend for lockingly interfacing with the housing within the respective passage of the housing.

13. The electrical connector of claim 12, including an abutment surface generally at said bend immediately rearwardly of the locking barb for engagement by an appropriate insertion tool to insert the terminal into its respective terminal-receiving passage in the housing.

14. A right-angled electrical terminal comprising:

an elongated body portion;
a tail portion extending from a bend at a rear end of the body portion generally at a right-angle thereto; and
a slot extending into the bend and defining an abutment surface in the body portion.

15. The right-angled electrical terminal of claim 14 wherein said abutment surface in the body portion is defined by one end of the slot.

16. The right-angled electrical terminal of claim 15 wherein said slot extends into the tail portion of the terminal and defines an alignment surface at an opposite end of the slot.

17. The right-angled electrical terminal of claim 14 wherein said body portion includes at least one locking barb near the bend in the terminal.

18. A right-angled electrical terminal comprising:

an elongated body portion;
a tail portion extending from a bend at a rear end of the body portion generally at a right-angle thereto; and
a slot extending into the bend.

19. The right-angled electrical terminal of claim 18 wherein said slot extends into the tail portion of the terminal.

20. The right-angled electrical terminal of claim 19 wherein said body portion includes at least one locking barb near the bend in the terminal.

FIG. 1

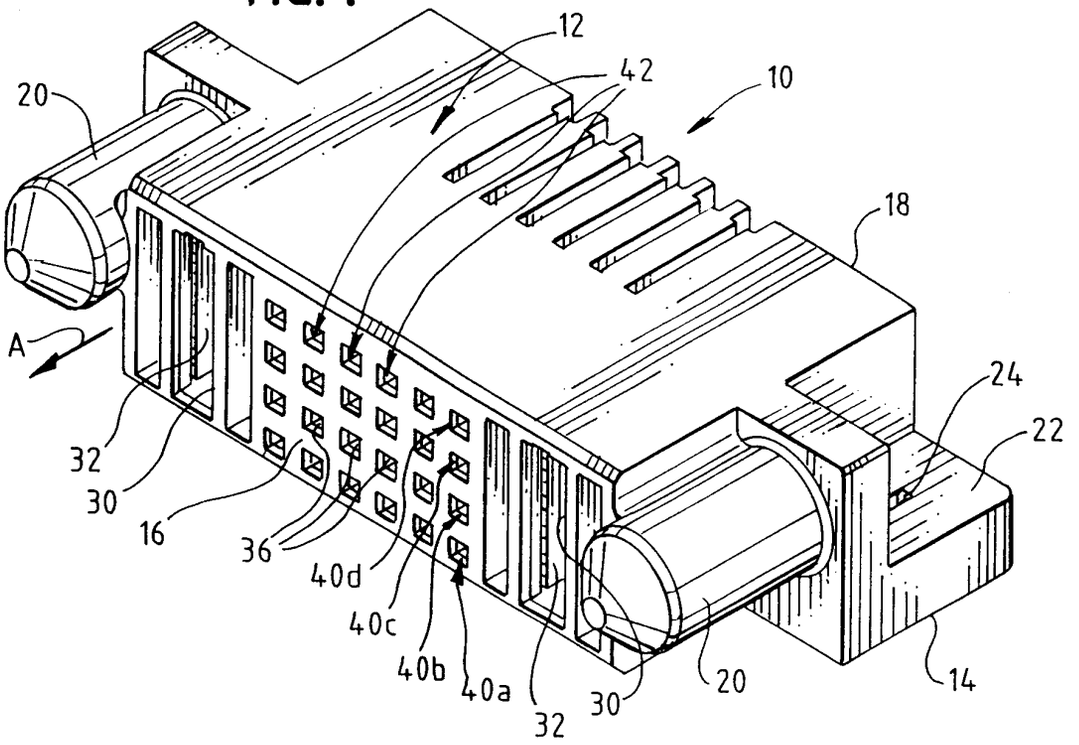
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FIG. 2

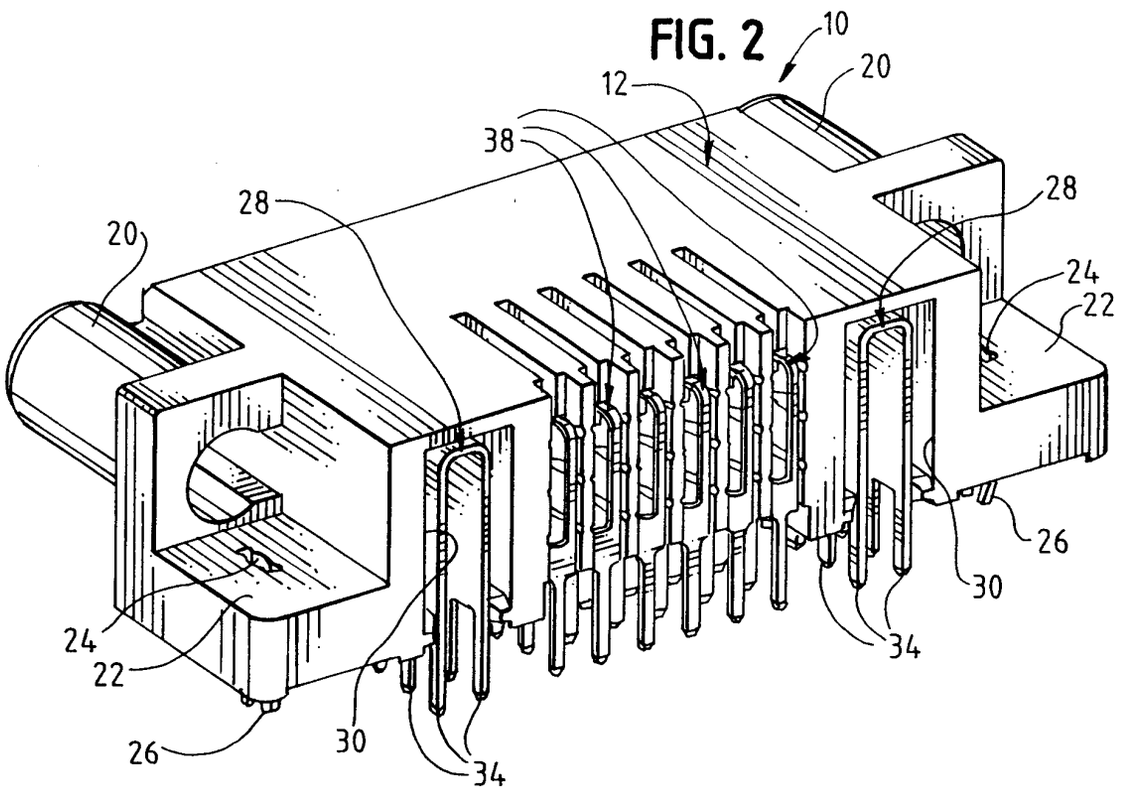
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FIG. 3

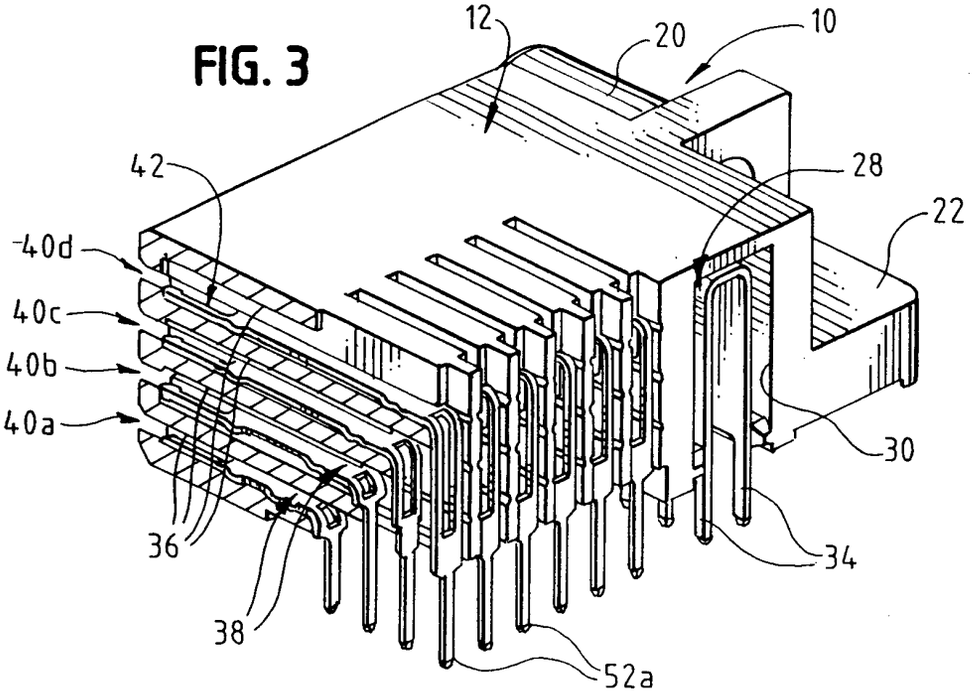


FIG. 4

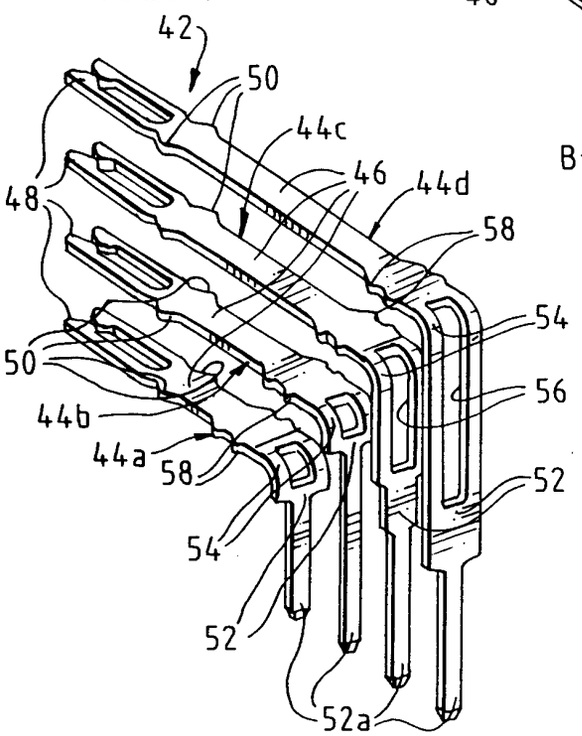


FIG. 5

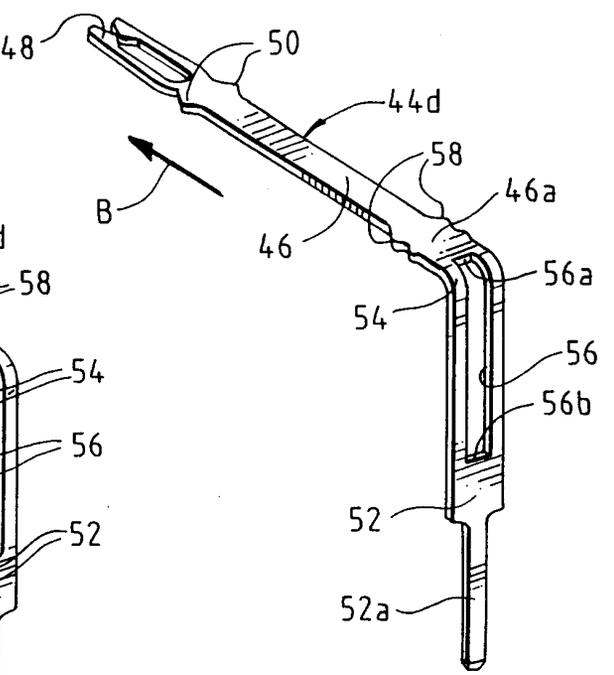
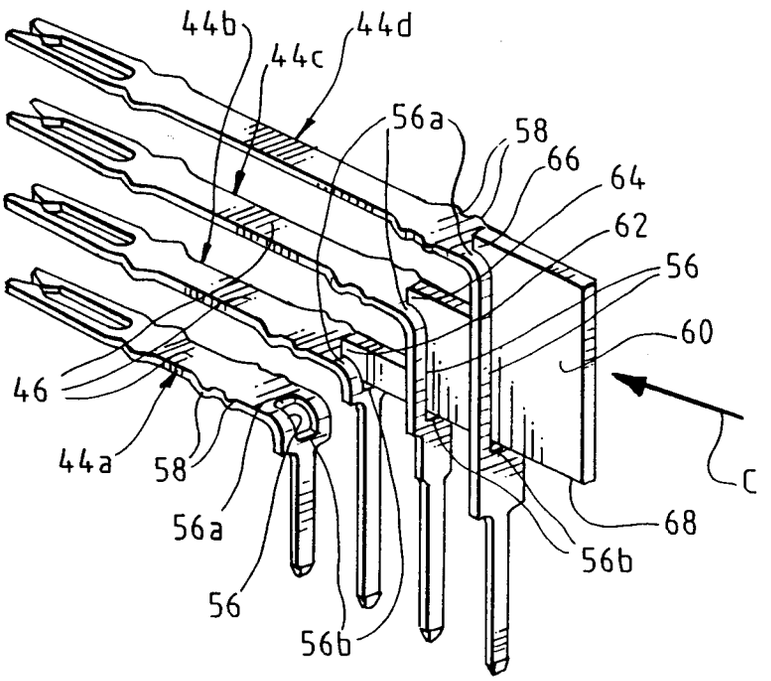


FIG. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 00 12 3788

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	GB 2 024 539 A (BUNKER RAMO) 9 January 1980 (1980-01-09) * page 3, line 103 - line 123 *	12	H01R43/22 H01R13/41 H01R12/20
A	* page 4, line 60 - page 5, line 29; figures 1,8-10 *	7,17,20	
A	DE 39 25 958 C (HARTING) 7 February 1991 (1991-02-07) * column 5, line 13 - line 34; figures 1,3 *	1,3,5,6, 8-10,14, 16,18,19	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	15 March 2001	Alexatos, G

CATEGORY OF CITED DOCUMENTS

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15-03-2001

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