(19) Europäisches Patentamt
European Patent Office
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(11) EP 0 821 450 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
28.01.1998 Bulletin 1998/05

(51) Int Cl.[6]: **H01R 31/08**

(21) Application number: **97202980.5**

(22) Date of filing: **01.09.1993**

(84) Designated Contracting States:
DE FR GB IT NL

(30) Priority: **28.09.1992 US 951498**
22.10.1992 US 965125

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
93306892.6 / 0 590 797

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Remarks:
This application was filed on 29 - 09 - 1997 as a divisional application to the application mentioned under INID code 62.

(54) Board mounted electrical connector

(57) An electrical connector (1) includes an insulative housing (2), and a shroud (3) which receives therein a shorting bar (25) at a selected one of multiple positions (29) for interconnecting electrically at least two electrical contacts (5) selected from multiple contacts (5). Each of the positions (29) of the shorting bar (25) is aligned with at least one of multiple openings (21) which provide an entryway for an extraction tool (30) to extract the shorting bar (25).

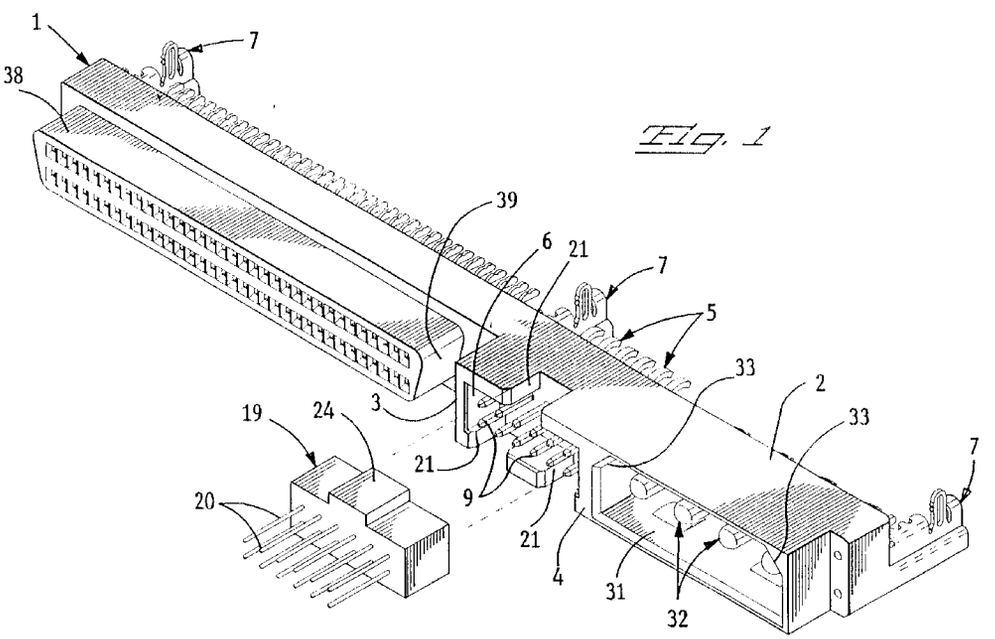

Fig. 1

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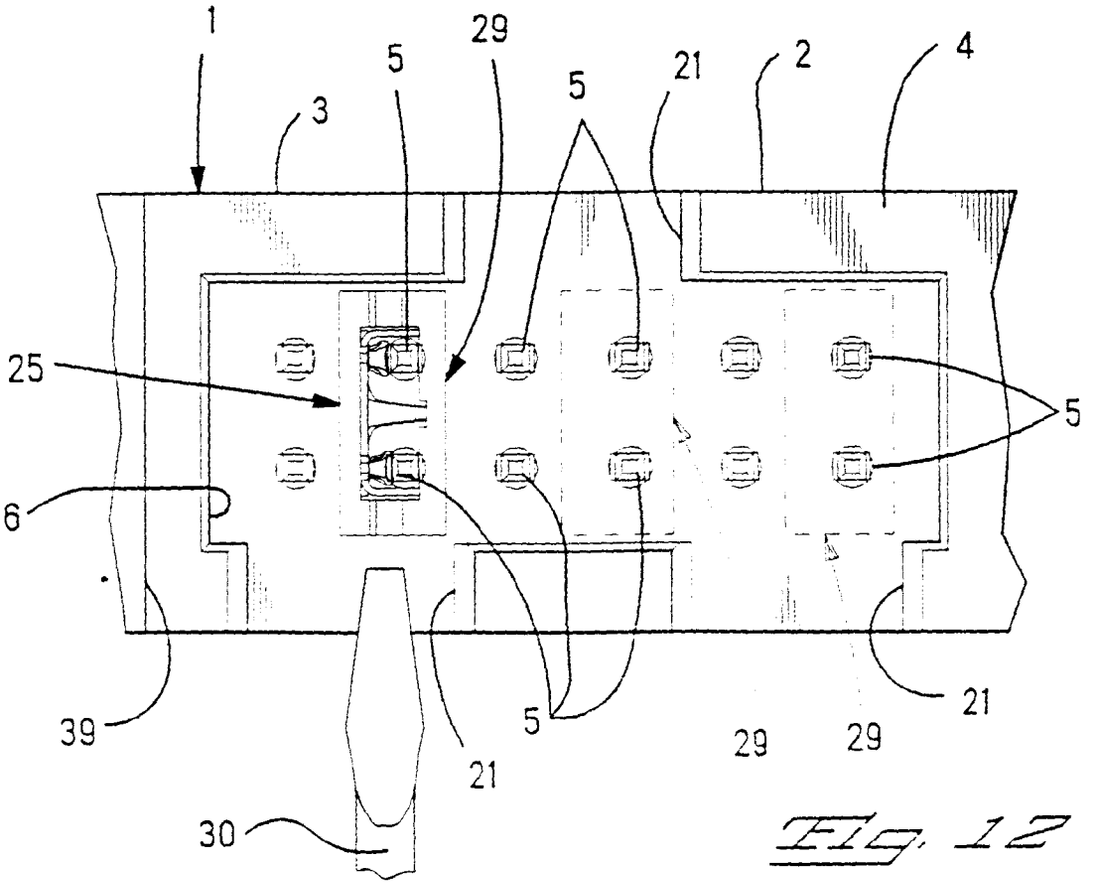


Fig. 12

Description

The invention relates to an electrical connector having a shroud at a mating end of the connector and a board mount system. More particularly, the invention relates to an electrical connector having an insulating housing including a plurality of contacts in a shroud, the housing further includes a board mount system for mounting the housing to a printed circuit board.

A known electrical connector disclosed in U.S. 5,129,831 ('831), comprises; an insulative housing, a shroud at a mating end of the housing, and multiple electrical contacts within the shroud and projecting toward the mating end. The shroud protects the contacts and assists in aligning the known connector during connection with a complementary connector. Keying elements on both the known connector and the complementary connector allow connection of the connectors when the connectors are oriented with the keying elements aligned with one another. The connector of the '831 reference has the advantage of being capable of using a keying protrusion to assure that the appropriate right angle connector is mounted to a corresponding location on a circuit board. The '831 reference has a disadvantage in that it does not provide for a plurality of different types of contacts in the housing or a short circuit bar.

Furthermore, a known board mount disclosed in U. S. 4, 907,987, is fabricated from a metal stamping and comprises; a metal board lock formed with a slotted post defined by two barbed spring members extending along opposite sides of a slot having closed ends that join the spring members. A known electrical connector disclosed in U.S. 4,907,987, comprises; an insulative housing, multiple electrical contacts within the housing projecting toward a mating end of the connector, and a board mount comprising, a metal board lock assembled in an aperture of the housing, the board lock being comprised of a slotted post for insertion in an aperture of a circuit board.

The present invention consists in an electrical connector having an insulating housing including a plurality of contacts in a shroud, and a board mount system for mounting the housing to a printed circuit board, characterised by at least one shorting bar positioned at a selected one of multiple positions in the shroud and electrically interconnecting at least two of the contacts, multiple openings through the shroud about the periphery thereof, each of the multiple positions of the shorting bar being aligned with at least one of the openings, whereby to permit the entry of an extraction tool to remove the shorting bar.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings, in which:-

FIGURE 1 is an isometric view of shrouded electrical connectors combined with an enshrouded electrical connector and a mating plug;

FIGURE 2 is a section view taken along the line 2-2 of Figure 6;

FIGURE 3 is a section view taken along the line 3-3 of Figure 6;

FIGURE 4 is a section view taken along the line 4-4 of Figure 6;

FIGURE 5 is a top plan view of the connector shown in Figure 1;

FIGURE 6 is a front elevation view of the connector shown in Figure 1;

FIGURE 7 is a fragmentary bottom plan view of a circuit board;

FIGURE 8 is a perspective vie of a pair of electrical contacts within a shroud of the connector shown in Figure 1;

FIGURE 9 is a perspective view of an electrical contact within another shroud of the connector shown in Figure 1;

FIGURE 10 is a perspective view of a pair of contacts within the unshrouded connector shown in Figure 1;

FIGURE 11 is an isometric view of a shorting bar, with parts separated from one another;

FIGURE 12 is a fragmentary elevation view of a shorting bar in the connector shown in Figure 1, and further illustrating, a number of alternative positions of the shorting bar;

FIGURE 13 is an isometric view of a board lock for the connector shown in Figure 1;

FIGURE 14 is a section view of the electrical connector with board mount being joined to a circuit board;

FIGURE 15 is an end view of the board lock shown in Figure 13 with parts of the housing removed to illustrate details of the board lock;

FIGURE 16 is a view similar to Figure 14 illustrating an alternative board lock; and

FIGURE 17 is a view similar to Figure 14, illustrating an alternative board lock.

With reference to Figure 1, an electrical connector **1** comprises, an insulative housing **2** of unitary molded plastic construction, a shroud **3** at a mating end **4** of the housing 2, and multiple electrical contacts **5** (Figures 2 and 8) within the shroud 3 projecting toward the mating end 4. The contacts 5 are within a cavity **6** defined by the shroud 3. A board mount **7** on the housing 2 connects the housing 2 with a circuit board **8** (Figure 7).

With reference to Figure 8, each of the contacts 5 is conductive and will now be described. Each contact 5 is of unitary construction obtained by being stamped and formed from a strip (not shown) of conductive metal. Each contact 5 comprises, a front pin **9** of 0.5 mm square cross section, a wider stepped portion **10** and a rear solder terminal **11** with a contact surface **12** for connection to one of multiple conductive pads **13** (Figure 7) of the circuit board 8. The contact surface 12 is convex curved for establishing a surface mount connection with a con-

ductive pad 13. Alternatively, the contact surface 12 can be on a solder terminal 11 shaped as a post (not shown) for establishing a connection in a plated through hole of a circuit board (not shown)

In the cavity 6 of the shroud 3, the pins 9 of the multiple contacts 5 are arranged in two rows, a top row 14 and a bottom row 15 (Figure 6). The pins 9 are on 2.0 mm. pitch spacing, meaning that the centerlines of the pins 9 are spaced apart 2.0 mm. Consequently, the centerlines of the two rows 14, 15 are spaced apart 2.0 mm. Each pin 9 of the top row 14 is directly aligned with a pin 9 in the bottom row 15.

The solder terminal 11 of each contact 5 projects from a rear of the housing 2. The solder terminals 11 of the contacts 5 in the bottom row 15 bend upward to engage a first row **16** of the pads 13 near an edge **17** of the circuit board 8. The solder terminals 11 of the contacts 5 in the bottom row 15, being longer than those of the contacts 5 in the top row 14, bend upward to engage a second row **18** of the pads 13 farther from the edge 17 of the circuit board 8.

The solder terminal 11 of each contact 5 in the top row 14 is offset laterally from the centerline of the pin 9 of the same contact 5. Thereby, a solder terminal 11 of each contact 5 in the bottom row 15 can bend upward without engaging a solder terminal 11 of a contact 5 in the top row 14. The solder terminals 11 of the contacts 5 in one of the rows 14, 15 are offset laterally with respect to the solder terminals 11 of the contacts 5 in the other of the rows 14, 15.

With reference to Figure 1, an electrical plug **19** is a complementary connector adapted for mating connection with the connector 1. The periphery of the shroud 3 is shaped to interfit with the complementary shaped periphery of the plug 19. The shroud 3 assists in aligning the connector 1 during connection with the electrical plug 19. The plug 19 contains electrical contacts (not shown) for mating with the pins 9, such contacts being connected to respective electrical wires **20** terminated with the plug 19. Multiple openings **21** extend through respective sides **22, 23** of the shroud 3 beside one of the rows 14, 15 of the pins 9. The openings 21 are distributed about a periphery of the shroud 3. All of the openings 21 extend through the mating end 4 of the connector 1 and extend rearward from the mating end 4. One of the openings 21 is a keyway located along one side 22 of the shroud 3, and is shaped to interfit with a complementary shaped, projecting key **24** on the plug 19. The plug 19 will connect with the connector 1 only when the key 24 is aligned with the keyway, because no other side 23 of the shroud 3 has an opening 21 in a location which will be aligned with the key 24 when the plug 19 is attempted to be inserted into the shroud 3.

With reference to Figures 11 and 12, a shorting bar **25** comprises, a conductive metal strip **26** with end spring fingers **27** within an insulative sheath **28**, fabricated by insert molding. The shorting bar 25 is adapted to be inserted into the cavity 6 of the shroud 3. The metal strip 26 bridges between a pair of the pins 9 with the fingers 27 frictionally engaging the pair of pins 9 to connect them electrically. The shorting bar 25 is adapted for being positioned at a selected one of multiple positions **29**, some of which are indicated by dotted lines, interconnecting electrically at least two of the pins 9 in the two rows 14, 15. Since the centerlines of the fingers 27 are 2 mm. apart, they can connect with any pair of the pins 9 on 2 mm. pitch spacings. The multiple openings 21 through the shroud allow for entry of an extraction tool **30** to remove the shorting bar 25. Each of the multiple positions 29 of the shorting bar 25 is aligned with at least one of the openings 21, such that the extraction tool 30 can enter the opening 21 and pry the shorting bar 21 away from the pair of pins 9.

The shroud 3 is one of multiple shrouds 3, **31** at the mating end 4 of the housing 2. The multiple shrouds 3, 31 are of different peripheral shapes and contain electrical contacts 5, **32** of different shapes. For example, the shroud 3 is rectangular and is contiguous at the mating end 4 of the connector 1 with the shroud 31 with a periphery that is rectangular with two diagonal chamfered corners **33**. The contacts 32 within the shroud 31 are arranged four in a row. Each of the contacts 32 (Figure 9) is of unitary construction, stamped and formed from metal strip, having a bulbous front end **34** and a solder terminal **35** projecting from a rear of the housing 2. The solder terminal 35 is curved with a contact surface **36** for engaging one of the four solder pads **37** on the circuit board 8. For example, the contacts 32 comprise, 0.84 mm. diameter pins on 0.200 mm. pitch spacing.

The connector 1 further may be unitary with an unshrouded connector **38** with a generally D shaped periphery at the mating end 4 of the connector 1. The unshrouded connector 38 is separated by a clearance space **39** from the shroud 3. Electrical contacts **40** within the connector 38 are arranged in two rows, a top row **41**, and a bottom row **42**. Each of the contacts 40 is of unitary construction, stamped and formed from metal strip. Each of the contacts 40 comprises, an electrical receptacle **43** defined by a pair of opposed spring fingers **44**, a middle portion **45** with barbs **46** along opposite edges **47**, and solder terminals **48** projecting from a rear of the housing 2 for connection to a pad 13' in a row 16' or 18'. For example, the connector 38 can be a 68 position receptacle connector with the contacts 40 on 0.50 mm pitch spacing.

The solder terminal 48 of each contact 40 in the bottom row 42 is offset laterally from the centerline of the receptacle 43 of the same contact 40. Thereby, a solder terminal 48 of each contact 40 in the bottom row 42 can bend upward without engaging a solder terminal 48 of a contact 40 in the top row 41. The solder terminals 48 of the contacts 40 in one row are offset laterally with respect to the solder terminals 48 of the contacts 40 in the other row.

With reference to Figure 13, further details of an em-

bodiment of the board mount 7' will be described. The board mount 7' is fabricated from a one piece metal stamping. A metal board lock of the board mount 7' comprises, a slotted post **19'** defined by two barbed spring members **20'** extending along opposite sides of a slot **21'** having closed ends that join the spring members 20'. The post 19' is adapted for insertion into the aperture 10' of the circuit board 8'. The post 19' is dimensioned with a width having an interference fit within the aperture 10' of the circuit board 8'. Further details of the post 10' and interaction with the aperture 10' are described in U. S. 4,907,987.

The board mount 7' further comprises, a web **22'** having a first edge **23'** and a second edge **24'**. The first edge 23' defines a periphery of both, the post 19', and a first flange **25'** extending transverse to a longitudinal axis of the post 19'. The post 19' projects in a plane defined by the thickness of the web 22'. The first flange 25' is turned outwardly of the plane of the web 22', and is transverse to the plane of the web 22' for engaging the circuit board 8', and, more particularly, to engage one of the pads 9'. Molten solder (not shown) is used to join the first flange 25' to the pad 9'. The first edge 23' along the first flange 25' has a wavy shape for amassing the molten solder, and for distributing the molten solder along the surface of the first flange 25'. The second edge 24' defines a second flange **26'** turned outwardly of the plane of the web 22' to extend transverse to the longitudinal axis of the post 19'. The second flange 26' extends over the axis of the post 19', and provides a force receiving, pressure plate against which an insertion force is pressed to insert the post 19' with an interference fit in one of the apertures 10' of the circuit board 8'.

The web 22' is contiguous with a coplanar anchor fluke **27'** that extends outwardly beside the first flange 25' and the second flange 26'. An opening **28'** extends through the fluke 27'. The housing 2' is of unitary construction, for example, by molding a polymer known as an LCP, liquid crystalline polymer. With reference to Figures 14 through 17, an assembly of the housing 2' and the board mount 7' can be fabricated by insert molding, such that the housing 2' is molded unitarily with the board mount 7', and such that the housing 2' extends through the opening 28' in the fluke 27'. In an embodiment shown in Figure 17, the opening 28' communicates with an edge of the fluke 27'. Core pin opehings **29'** extend through the housing 2' to intersect the fluke 27'. Thereby, the fluke 27' anchors the board mount 7' to the housing 2'. The web 22' and the first flange 25' and the second flange 26' and the post 19' project from a rear of the housing 2'. A notch **30'** at an intersection of the second flange 26' and the fluke 27' permits turning of the flange 26' outwardly.

A finger **33'** on the housing 2' projects from the housing 2', and overlies the second flange 26' and a portion of the web 22' adjacent the second flange 26'. The finger 33' is wider than the second flange 26', and provides a cushion against which an insertion force is applied. The cushion is particularly useful for reducing discomfort when an operator applies the insertion force by manual labor without the use of a tool to apply the insertion force. For example, the finger 33' can be fabricatedunitarily with the housing 2'. The finger 33' partially envelops the second flange 26', adding strength to a connection of the finger 33' and the second flange 26'.

With reference to Figures 14 and 16, a hook **34'** on the fluke 27' projects from the housing 2'. A circuit board receiving space between the hook 34' and the first flange 25' is adapted to receive the edge 17' of the circuit board 8' between the hook 34' and the first flange 25'. The hook 34' and the first flange 25', across the width of the space, spans a thickness of the circuit board 8'. A third edge **43'** along the fluke 27' extends beside the hook 34' and extends from the hook 34' to an intersection of the third edge 43' with the first edge 23'. A notch **44'** at the intersection separates an inner end of the first flange 25' from the third edge 43' and from the fluke 27'. The third edge 43' is adapted to stop against the edge 17' of the circuit board 8', and provides a pivot. The third edge 43' registers in a rounded notch 17" in the edge 17' of the circuit board 17', and quickly locates the aperture 10' and the post 19' in mutual alignment for insertion of the post 19' into the aperture 10' when the third edge 43' is against the notch 17" in the edge 17' of the circuit board 8'. When the board mount 7' is pivoted relative to the circuit board 8', and an insertion force is applied to the second flange 26', the aligned post 19' and aperture 10' are assembled with an interference fit, as shown in phantom outline in Figures 14, 16 and 17.

With reference to Figures 14 and 16, a circuit board 8' must be positioned at an angle of elevation to pass over the post 19' and under the hook 34'. In the embodiment of Figure 16, the post 19" is taller than the post 19' in the embodiment of Figure 15. While the taller post 19" is capable of interfitting with a circuit board 8' of relatively larger thickness than is the shorter post 19', the circuit board 8' of Figure 16 is positioned at a relatively larger angle of elevation, particularly when the circuit board 8' of Figure 16 is thicker than the circuit board 8' of Figure 15.

A tip of the hook 34' in the embodiment of Figure 16 has an undercut clearance **45'** to allow for insertion of the circuit board 8', positioned at an angle of elevation, into the clearance space. A curved end **46'** on the hook 19', next to the undercut clearance 45', engages the circuit board 8', particularly when the post 19' is interfit within the aperture 10', as shown in phantom outline. In the embodiment shown in Figure 17, a hook 34'is absent. The third edge 43' provides a stop for the edge 17' of the circuit board 8'. The third edge 43' can provide a pivot, although the post 19" can be interfit with the aperture 10', either by pivoting, as described with reference to Figures 15 and 16, or by sliding the third edge 43' along the edge of the circuit board 8'.

Claims

1. An electrical connector (1) having an insulating housing (2) including a plurality of contacts (9) in a shroud (3), and a board mount system (7,7') for mounting the housing to a printed circuit board (8,8'), characterised by at least one shorting bar (25) positioned at a selected one of multiple positions (29) in the shroud (3) and electrically interconnecting at least two of the contacts (9), multiple openings (21) through the shroud about the periphery thereof, each of the multiple positions (29) of the shorting bar (25) being aligned with at least one of the openings (21), whereby to permit the entry of an extraction tool to remove the shorting bar.

2. The electrical connector of claim 1, wherein at least one of the openings (21) extends through the mating end (4) of the housing (2) and is shaped to interfit with a complementary shaped key (24) of an electrical plug (19) matable with the connector.

3. The electrical connector of claim 1 or 2, wherein the shorting bar (25) includes a conductive metal strip (26) disposed within an insulating sheath (28) and is removable from the connector through the mating end (4) upon engagement of the extraction tool inserted through one of the openings (21).

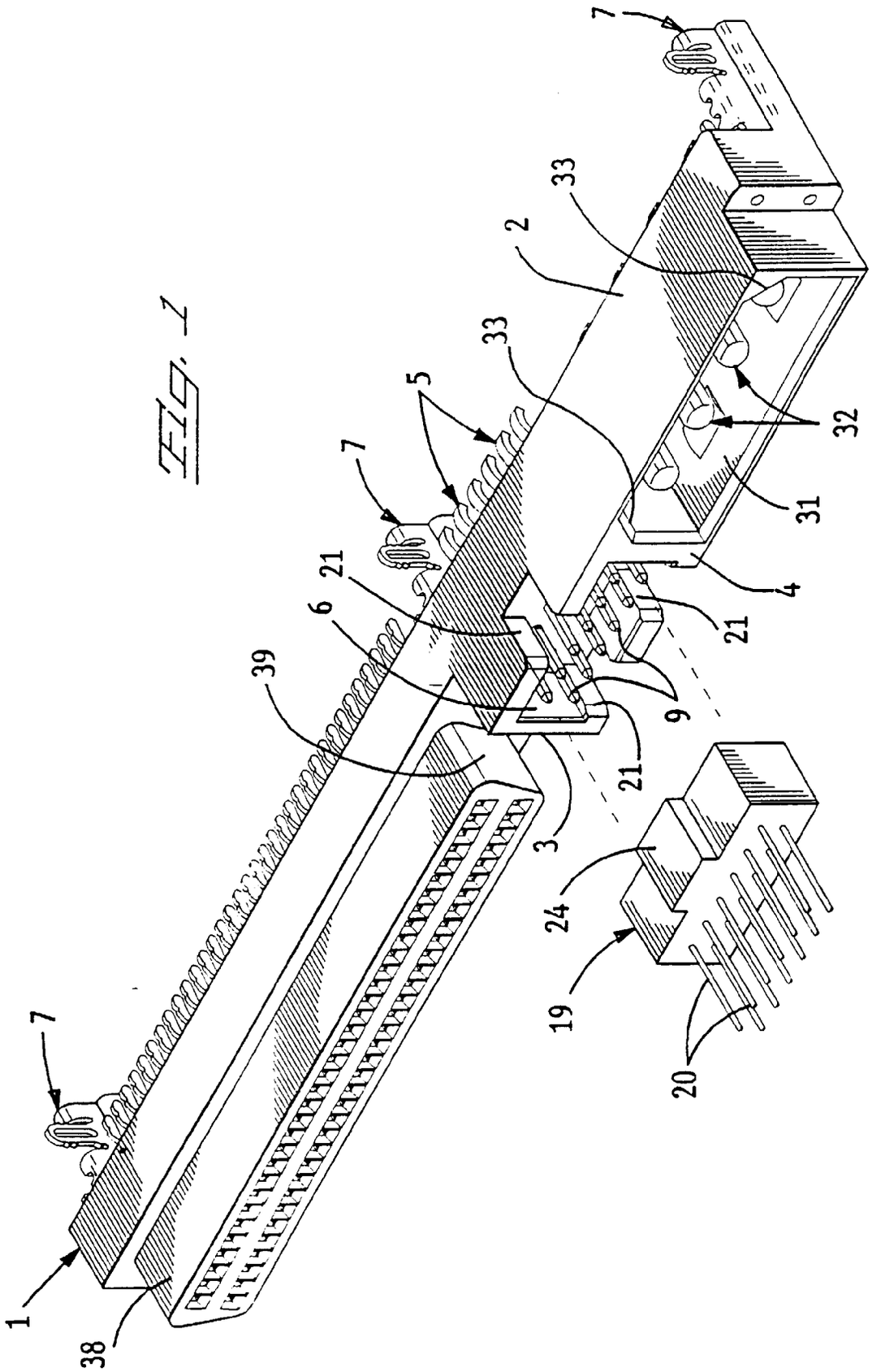


Fig. 1

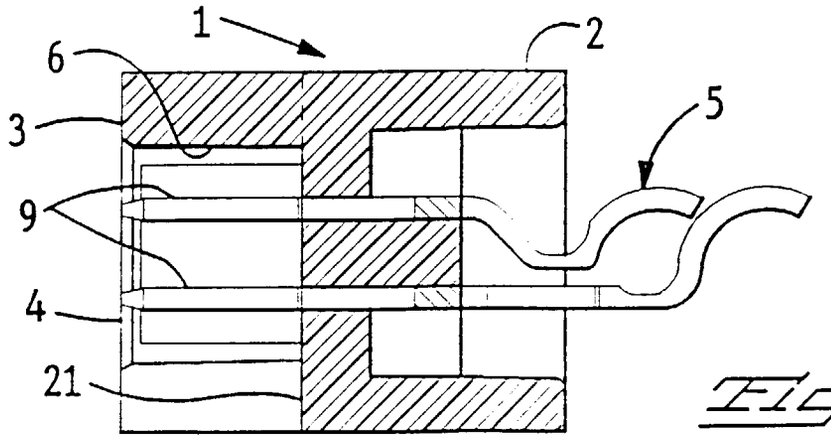


Fig. 2

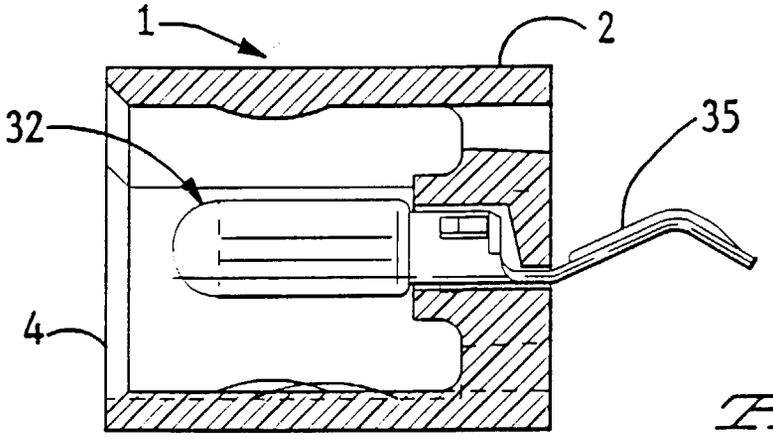


Fig. 3

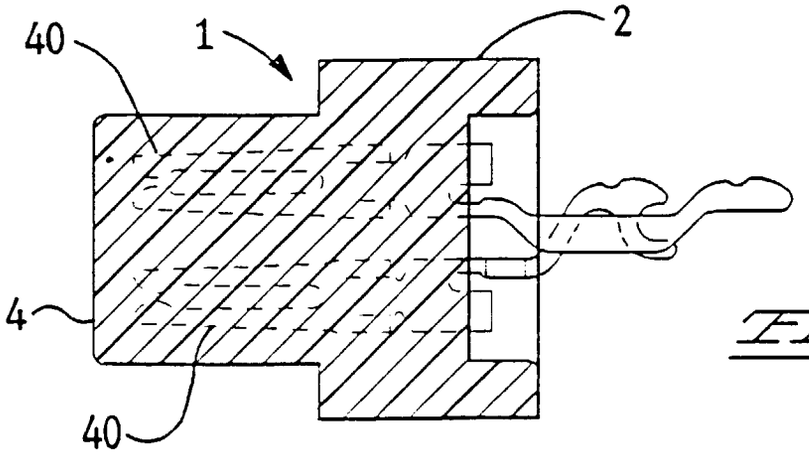


Fig. 4

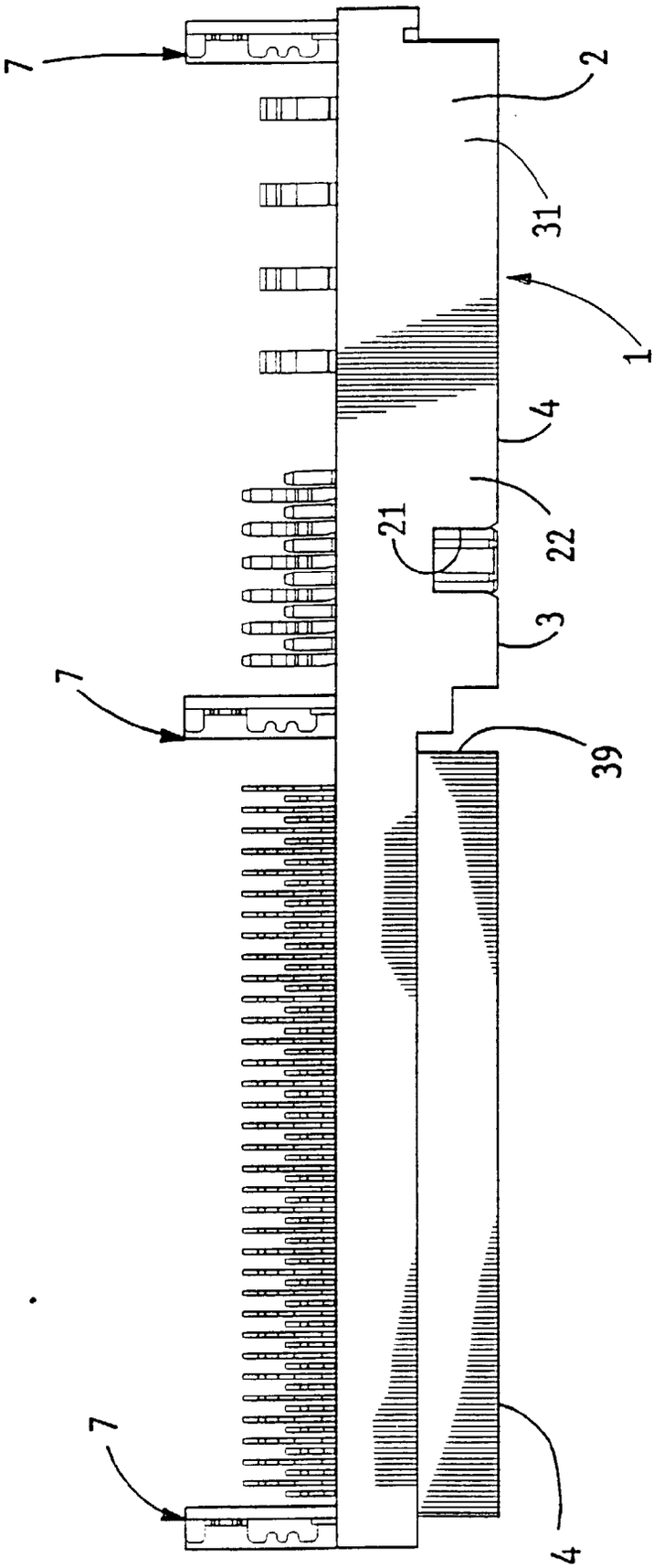


FIG. 5

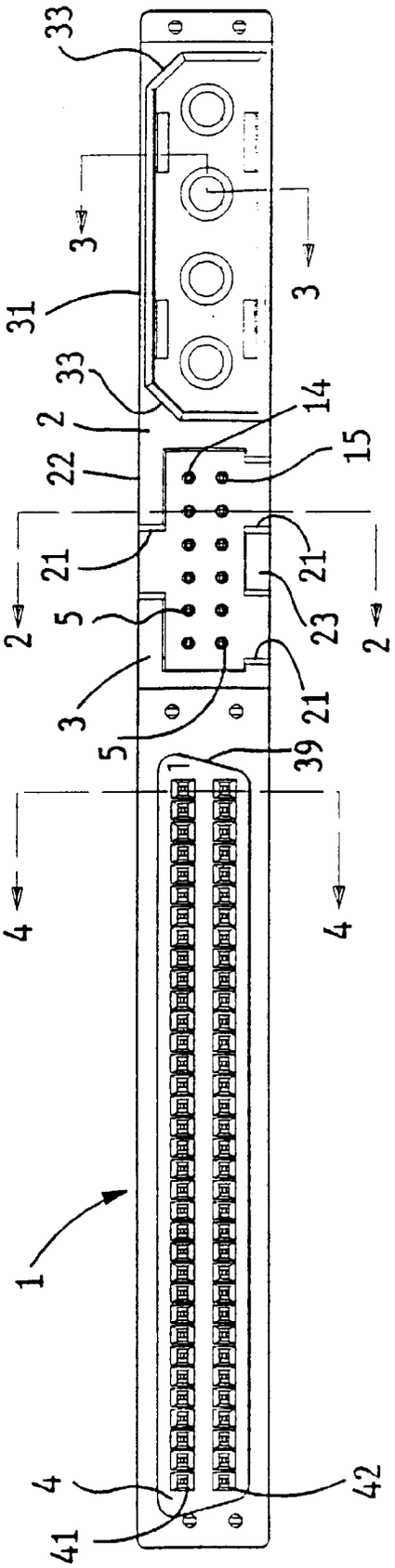


Fig. 6

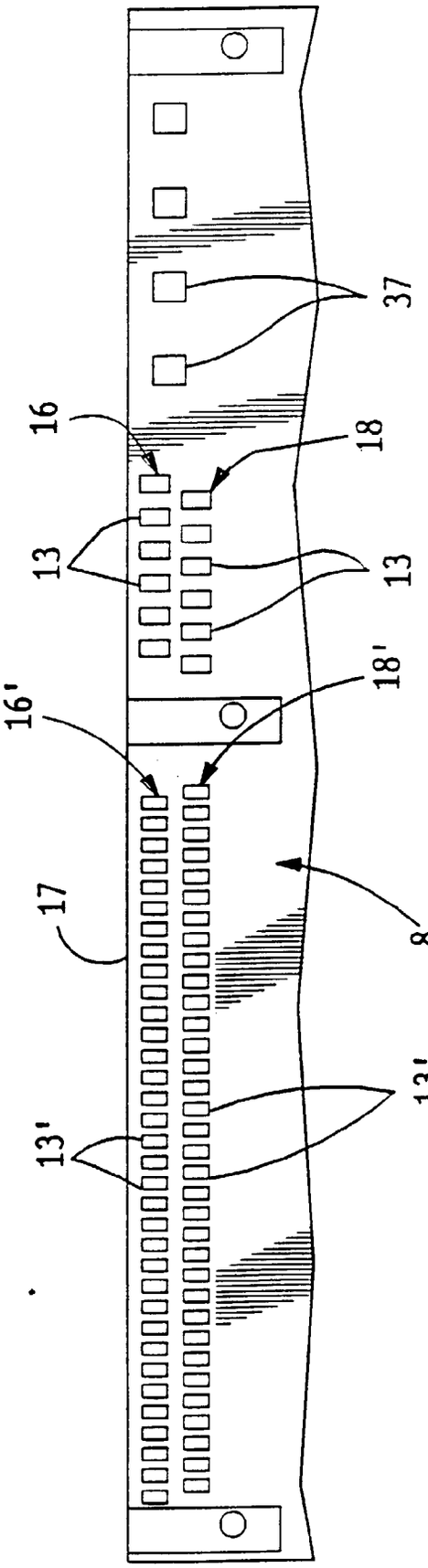


Fig. 7

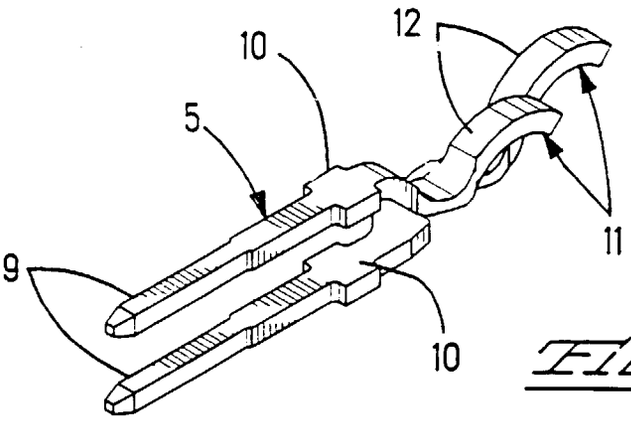


Fig. 8

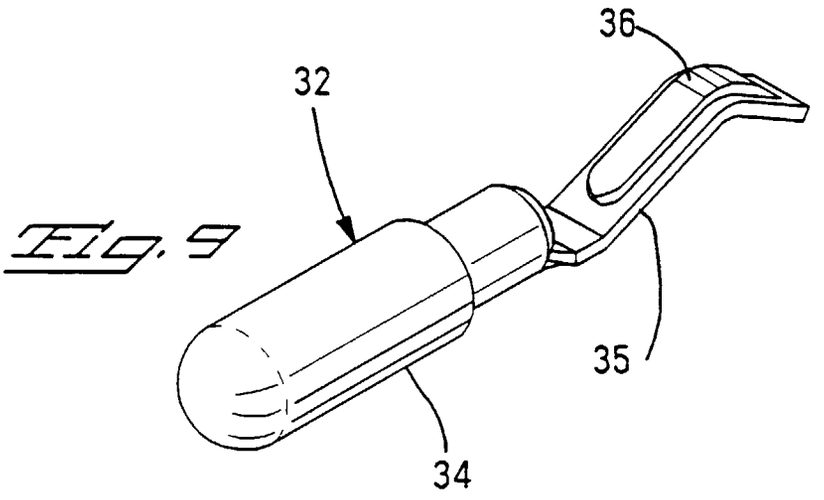


Fig. 9

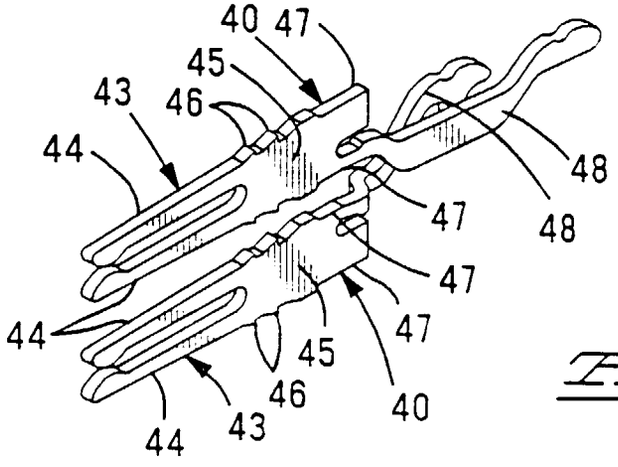


Fig. 10

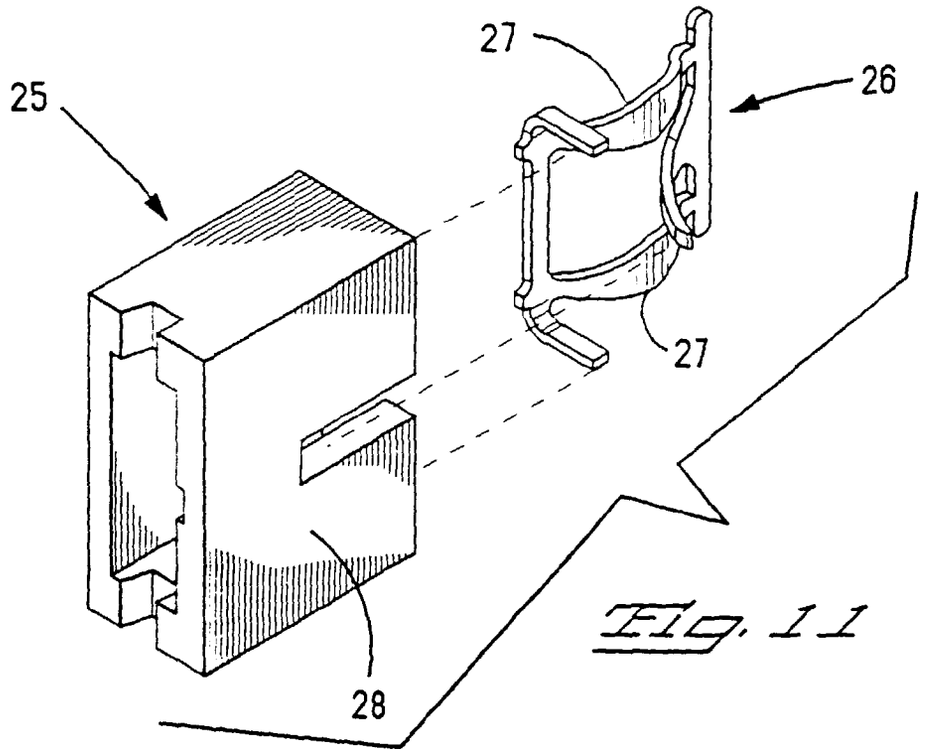


Fig. 11

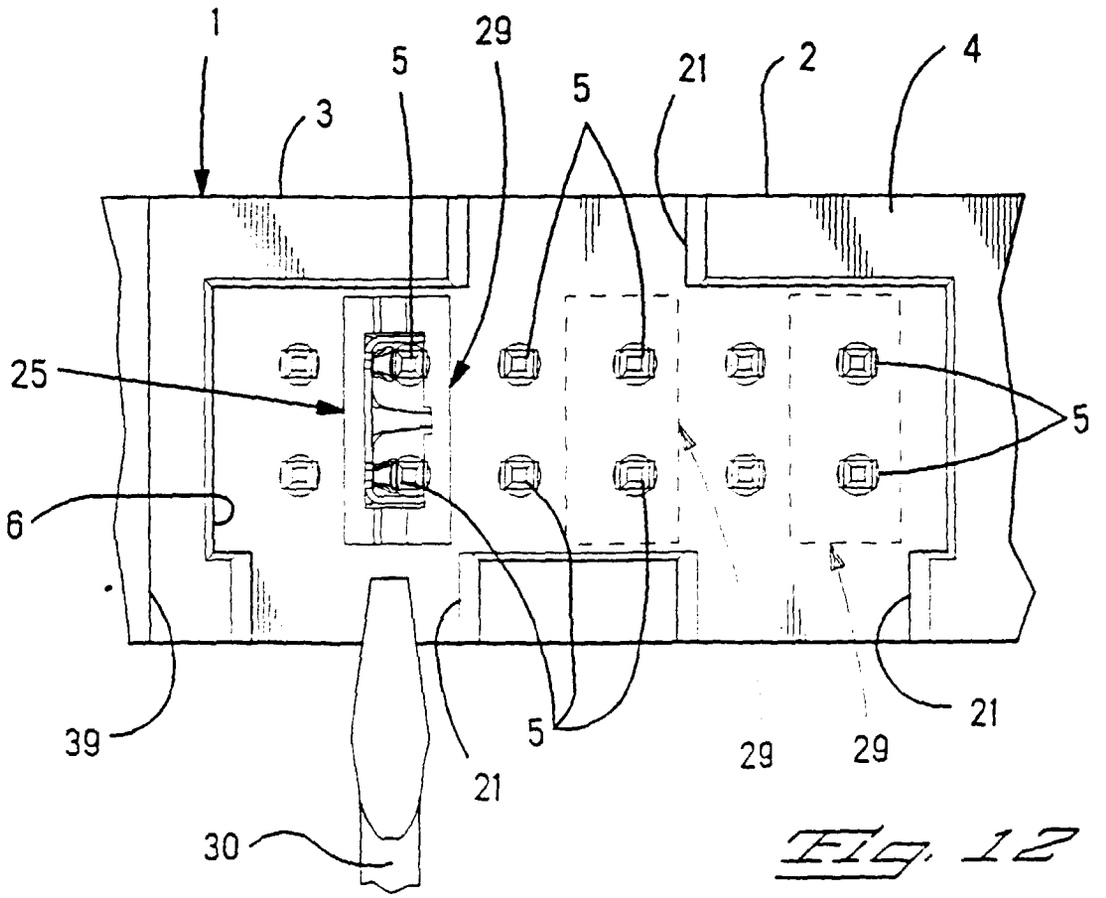


Fig. 12

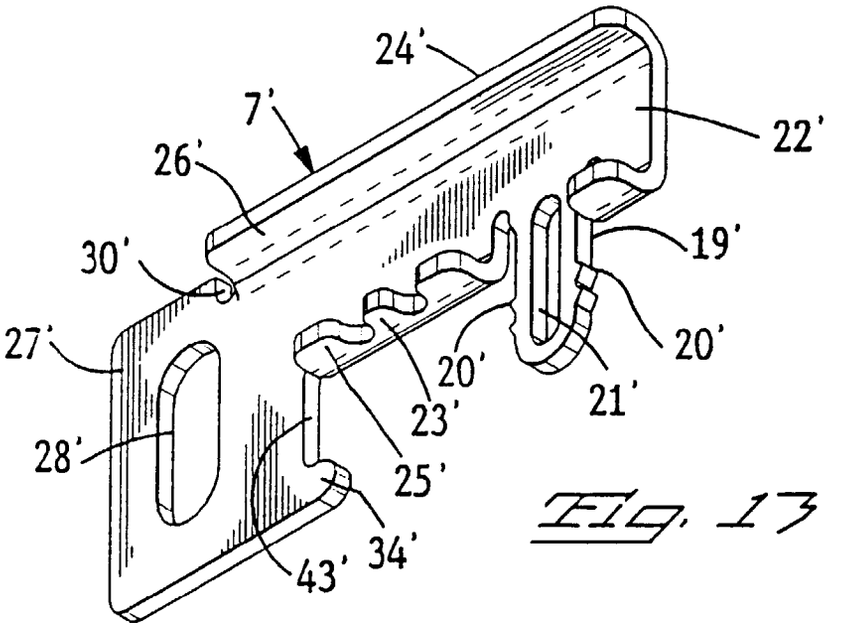


Fig. 13

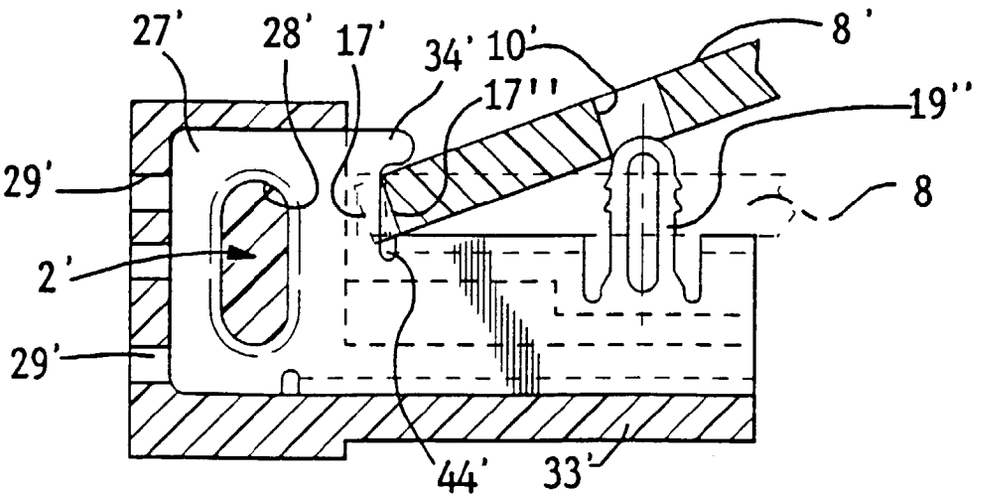


Fig. 14

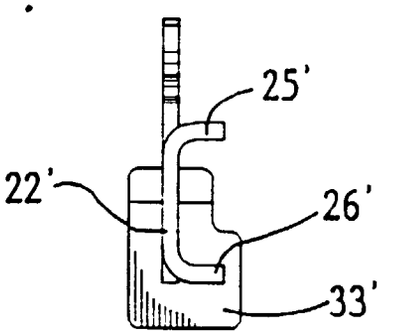
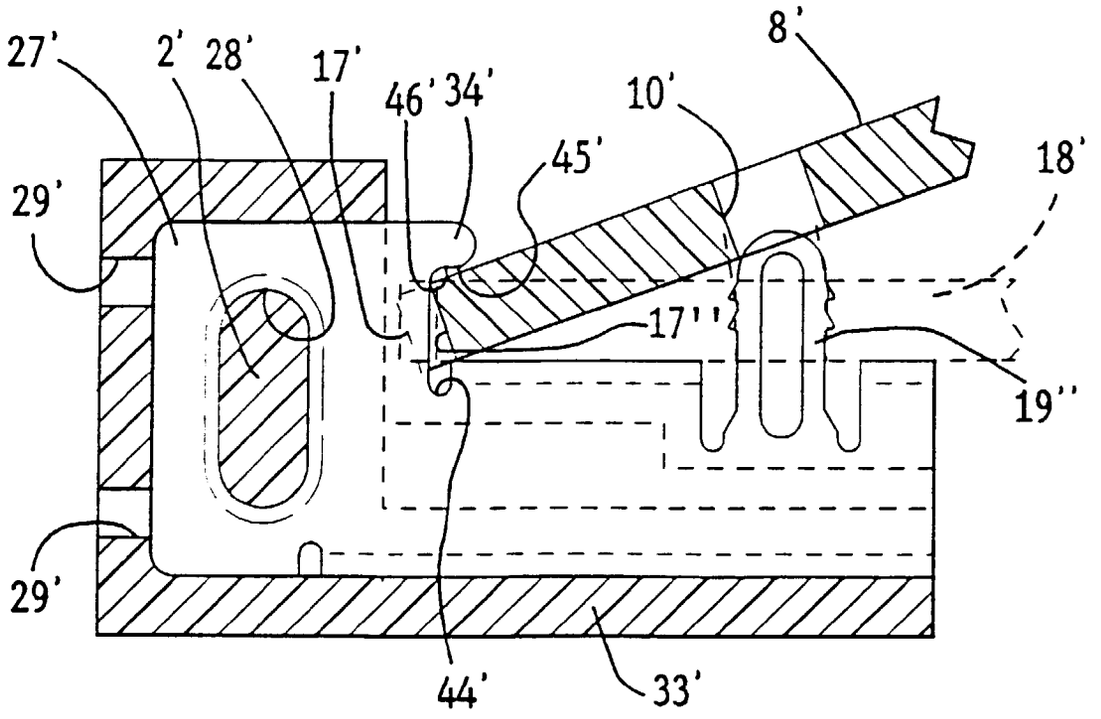


Fig. 15


27'
2'
28'
17'
46'
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10'
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45'
18'
29'
17''
19''
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44'
33'

Fig. 16

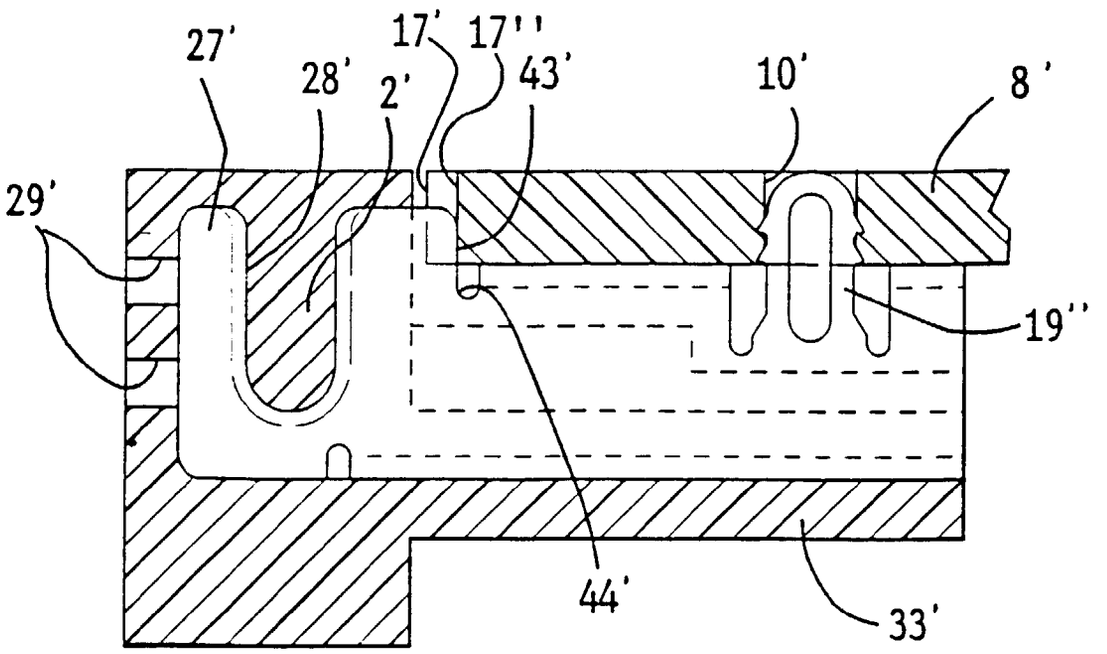
27'
17'
17''
28'
2'
43'
10'
8'
29'
19''
44'
33'

Fig. 17

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 20 2980

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.6)
A	EP 0 214 780 A (DU PONT) 18 March 1987		H01R31/08
A	US 4 482 198 A (CROWLEY DANIEL J) 13 November 1984		
A	US 4 516 817 A (DETERS PAUL M) 14 May 1985		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 November 1997	Horak, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)