(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 659 664 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
24.05.2006 Bulletin 2006/21

(51) Int Cl.:
H01R 43/24 *(2006.01)*

(21) Application number: **04425862.2**

(22) Date of filing: **18.11.2004**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL HR LT LV MK YU

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(54) Connector device for the electrical connection between a towing vehicle and a trailer

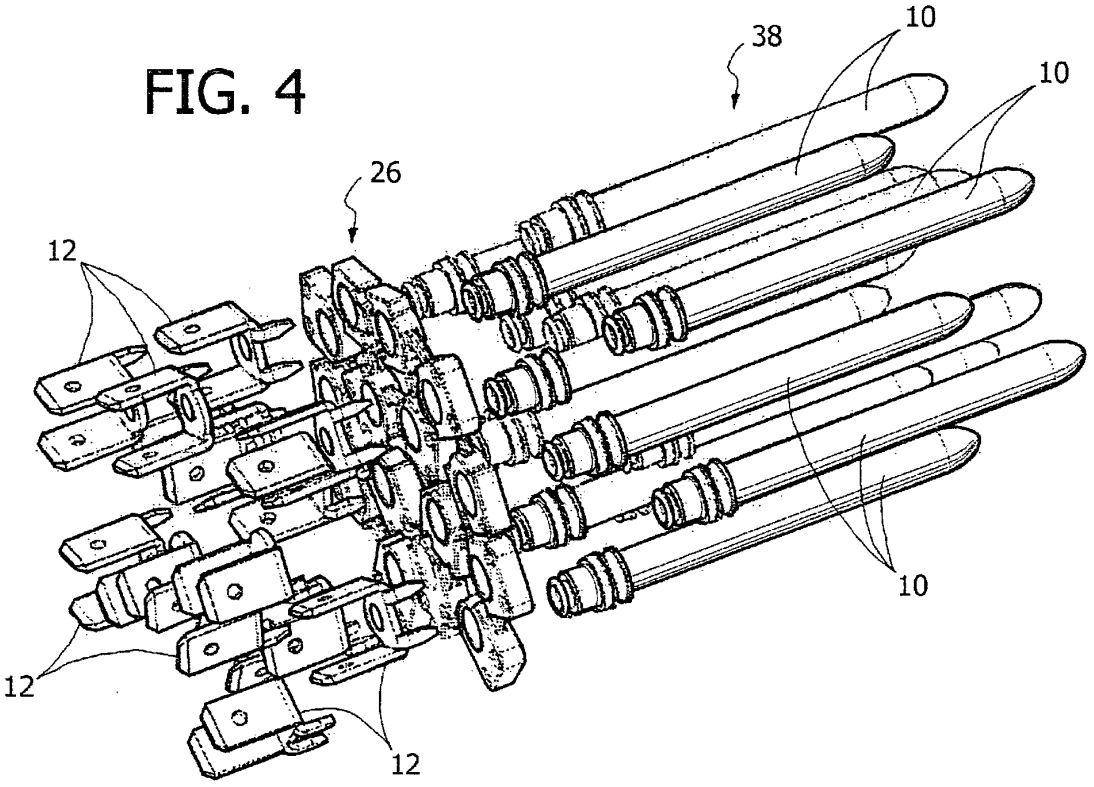
(57)

1. A connector device for the electrical connection between a towing vehicle and a trailer, comprising:

- at least a first and at least a second series of contacts (10, 12),
- a support body of the contacts (26), and
- an outer case of plastic material (48) moulded over the support body of the contacts (26) and around the contacts (10, 12).

The support body of the contacts (26) comprises a plurality of fastening portions of the contacts (28) mutually separated by empty spaces (30) and connected to each other by thin flexible strips (32).

FIG. 4



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Description

[0001] The present invention relates to a connector device for the electrical connection between a towing vehicle and a trailer.

[0002] The document EP 1 401 064 by the same Applicant describes an adapter for the electrical connection between connectors with different number of poles, comprising a first and a second series of contacts fastened to a printed circuit board and electrically connected to each other by means of conducting strips of said board. An outer case of plastic material is moulded over the board and around the contacts to form integral connector bodies.

[0003] In the prior art solution disclosed in EP 1 401 064, the printed circuit board bearing the first and the second series of connectors is a rigid component, not chemically compatible with the over-moulded plastic material. The over-moulding of plastic material on the printed circuit board creates considerable problems from the technological viewpoint due, among other reasons, to differentiated thermal expansions between the printed circuit board and the over-moulded material.

[0004] The object of the present invention is to provide an enhanced connector device which allows to overcome the problems of the prior art.

[0005] According to the present invention, said object is achieved by a connector device having the characteristics set out in the main claim.

[0006] The characteristics and the advantages of the present invention shall become readily apparent in the detailed description that follows, provided purely by way of non limiting example, with reference to the accompanying drawings in which:

- Figures 1 and 2 are two perspective views of two different types of contacts usable in a connector device according to the present invention,
- Figure 3 is a perspective view showing a support body of the contacts of a connector device according to the present invention,
- Figure 4 is a perspective exploded view showing a group of contacts for a connector device according to the present invention,
- Figure 5 is a perspective view of the contact group of Figure 4 in an assembled position,
- Figures 6 and 7 are perspective views showing a part of a moulding apparatus for the production of a connector device according to the present invention, and
- Figure 8 is a section of a connector device according to the present invention,

[0007] With reference to Figures 1 and 2, the numbers 10 and 12 designate two different types of contacts usable in a connector device according to the present invention.

[0008] The contact 10 has an elongated, pin shaped body made of metallic material, preferably obtained by turning starting from a wire or a round bar on an automatic numerically controlled machine. The contact 10 is preferably made of brass with a superficial coating of electrolytic nickel applied after the turning operation. The contact 10 has a fastening portion 14 with a tang to be riveted 16.

[0009] The contact 12 is a double male blade contact preferably obtained by cold plastic deformation (bending and shearing) of a strip on an automatic oleodynamic press. The material of the contact 12 is preferably brass coated superficially by electrolytic tin after the bending/shearing operation. The contact 12 comprises two parallel blades 18 which project from a base 20. The base 20 is provided with a hole 22 and with two projections 24 which extend from the opposite part relative to the blades 18.

[0010] With reference to Figure 3, a support body for the contacts is designated by the number 26. The body 26 is obtained by injection moulding of thermoplastic material. The thermoplastic material constituting the support body of the contacts 26 is preferably polybutylene terephthalate (PBT) reinforced with glass fibre.

[0011] The support body of the contacts 26 comprises a plurality of fastening portions of the contacts 28 mutually separated by empty spaces 30 and connected to each other by thin flexible connecting strips 32.

[0012] The fastening portions of the contacts 28 and the flexible connecting strips 32 are obtained integrally during the moulding operation. Each fastening portion of the contacts 28 has a fastening hole 34 and two positioning holes 36. In some fastening portions 28 the positioning holes 36 can be opened on a lateral edge of the fastening portion 28.

[0013] Figures 4 and 5 show a contact group 38 for a connector device according to the present invention. The contact group 38 comprises a body 26 for supporting the contacts, a series of contacts 10 and a series of contacts 12 fastened on opposite sides of the support body of the contacts 26. The tang 16 of each of the contacts 10 is inserted through the fastening hole 34 of a respective fastening portion 28 of the support body of the contacts 26. The tang 10 of each contact 10 is also inserted into the hole 22 of a corresponding contact 12. The fastening between the contacts 10, 12 and with the contact-bearing body 26 is obtained by cold plastic deformation of an end part of the tangs 26 of the contacts 10. The projections 24 of the contacts 12 are inserted into the positioning holes 36 of the fastening portions 28. The engagement of the projections 24 in the holes 36 allows to obtain a predetermined orientation of the contacts 12. The positioning holes 36 are not necessary if contacts 12 are used which do not require an orientation around their longitudinal axis.

[0014] Figure 5 shows the complete contact group 38, after the fastening of the contacts 10, 12 to the support body of the contacts 26. The support body of the contacts has the task of positioning and orienting the contacts 10,

12 in determined positions regulated by international ISO standards and its function is to actuate the entire contact group 38. A particularly advantageous characteristic in the subsequent step of the method for producing the connector device is that the contacts are held together in flexible fashion thanks to the deformability of the flexible strips 32 which mutually connect the fastening portions of the contacts 28 of the support body of the contacts 26.

[0015] With reference to Figures 6 and 7, the complete contact group 38 is positioned in an injection moulding apparatus. The reference number 40 designates one of the half-moulds of said moulding apparatus. The half-mould 40 comprises an impression 42 and at least one seat 44 for receiving contacts 10. In the example illustrated in the figures, the half-mould 40 is provided with three seats 44 in which are positioned corresponding contact groups 38 with different number and/or shape of the contacts, to form a connector devices with three different contact groups. However, the invention is not limited to the specific embodiment illustrated in Figures 6 and 7. Each contact group 38 may be subjected to an over-moulding step independently of other contact groups. As shown in Figures 6 and 7, at the contacts 12 is applied a closure element 46.

[0016] After the insertion of the contact group or groups in the half-mould 40, the impression 42 of the half-mould 40 is closed by a complementary half-mould. Thereafter, plastic material is injected into the impression 42 of the moulding apparatus. During this injection step, the injected plastic material is over-moulded on the contact group 38. In particular, the injected material completely surrounds the support body of the contacts 26 and a part of the contacts 10. The injected thermoplastic material over-moulded on the contact group 38 forms an outer case designated by the reference number 48 in Figure 8. The outer case 48 rigidly connects to each other the pair of contacts 10, 12 which before over-moulding were connected to each other in flexible fashion by the support body of the contacts 26. After over-moulding, the support body of the contacts 26 remains fully incorporated in the over-moulded thermoplastic material. The thermoplastic material constituting the support body of the contacts 26 is preferably chemically compatible with the injected material forming the outer case 48, so that during the over-moulding step the support body of the contacts 26 is fully incorporated in the over-moulded material.

[0017] As shown in Figure 8, the outer case 48 has integral connector bodies 50, 52 with shape and dimensions that are compliant with international standards for the specific type of connectors obtained. The connector device is completed with the possible addition of accessory components, such as a lid 54 or a flexible casing 56.

[0018] The empty spaces 30 between the fastening portions of the contacts 32 render each pair of contacts 10, 12 independent from the other pairs of contacts. During the over-moulding operation, the injected material penetrates into the empty spaces 30. Consequently, a regular filling is obtained of the over-moulding region by the injected thermoplastic material and there are additional guarantees against the entrance and the propagation of water/humidity inside the moulding) apparatus. Hence, problems due to the accumulation of humidity during the over-moulding step are overcome; said accumulation could reduce the insulation resistance and, in the worst cases, cause a short circuit between the contacts. Moreover, the flexible connection of the contacts is very advantageous to favour the manual insertion of the complete contact groups 38 in the seats 44 of the half-mould 40.

[0019] The technique for over-moulding the outer case 48 allows to eliminate the step of assembling the contact group on a contact board and the subsequent mounting of the contact board on a connector body. All this simplifies the production procedures and reduce the cost of the production process.

Claims

1. A connector device for the electrical connection between a towing vehicle and a trailer, comprising:

   - at least a first and at least a second series of contacts (10, 12),
   - a support body of the contacts (26), and
   - an outer case of plastic material (48) moulded over the support body of the contacts (26) and around the contacts (10, 12),

   characterised in that the support body of the contacts (26) comprises a plurality of fastening portions of the contacts (28) mutually separated by empty spaces (30) and connected to each other by thin flexible strips (32).

2. Device as claimed in claim 1, **characterised in that** each of said fastening portions of the contacts (28) comprises a fastening hole (34) through which extends a fastening portion (14) of a respective contact (10).

3. Device as claimed in claim 1, **characterised in that** said fastening portions (28) comprise at least one positioning hole (36) engaged by a corresponding projection (24) of a respective contact (12).

4. Device as claimed in claim 1, **characterised in that** the contacts of the first series (10) are fastened to corresponding contacts of the second series by plastic deformation of tangs (16) of the contacts of the first series which extend through respective holes (34) of the fastening portions (28) and through fastening holes (22) of the respective contacts (12) of the second series.

FIG. 1

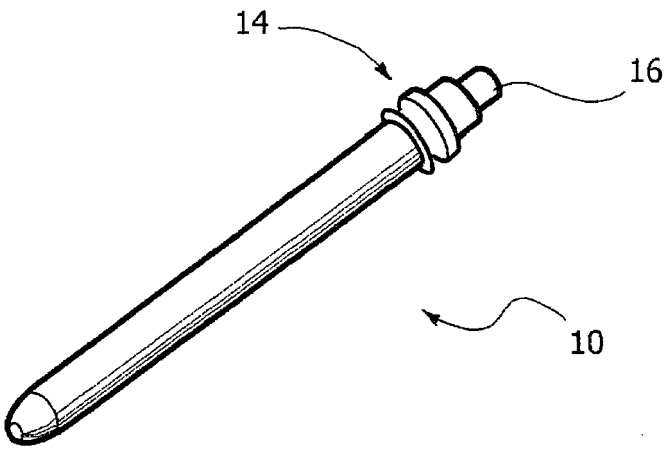

FIG. 2

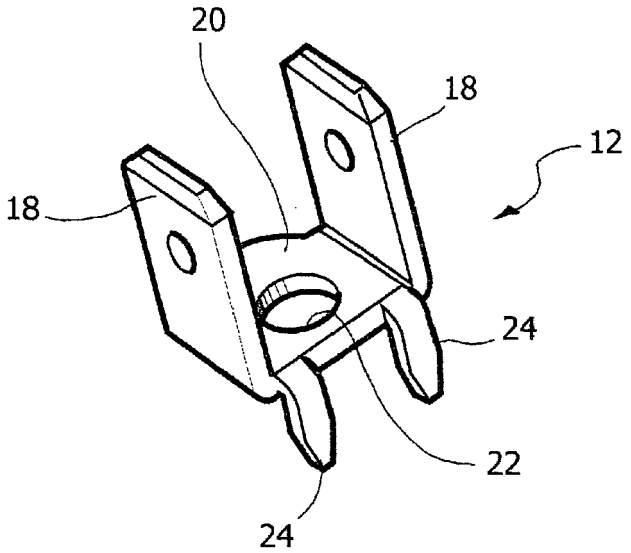

FIG. 3

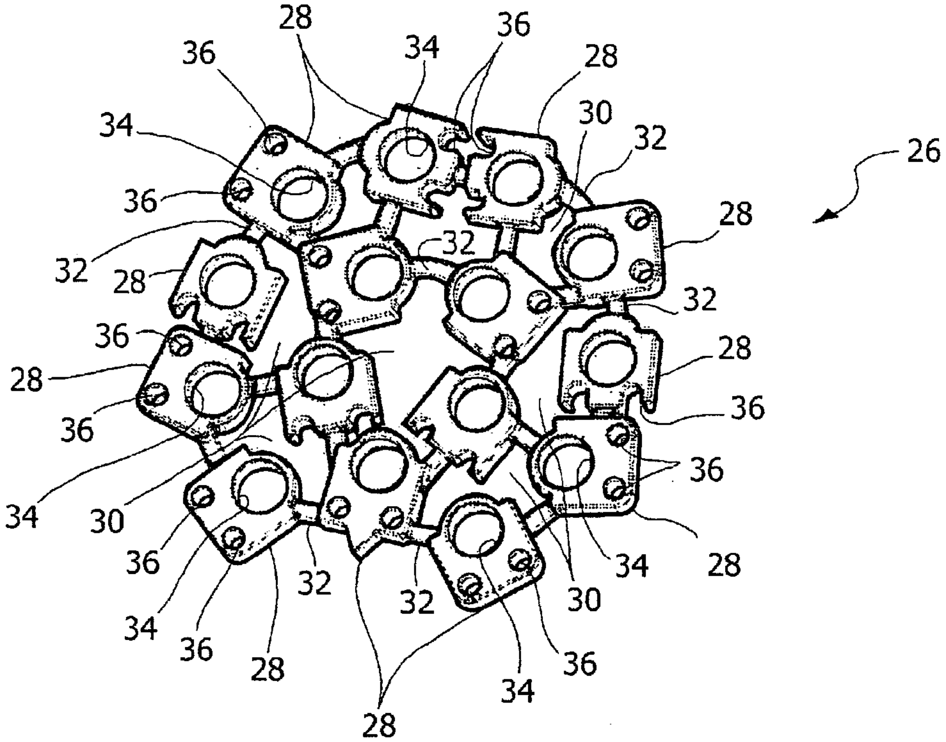
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FIG. 4

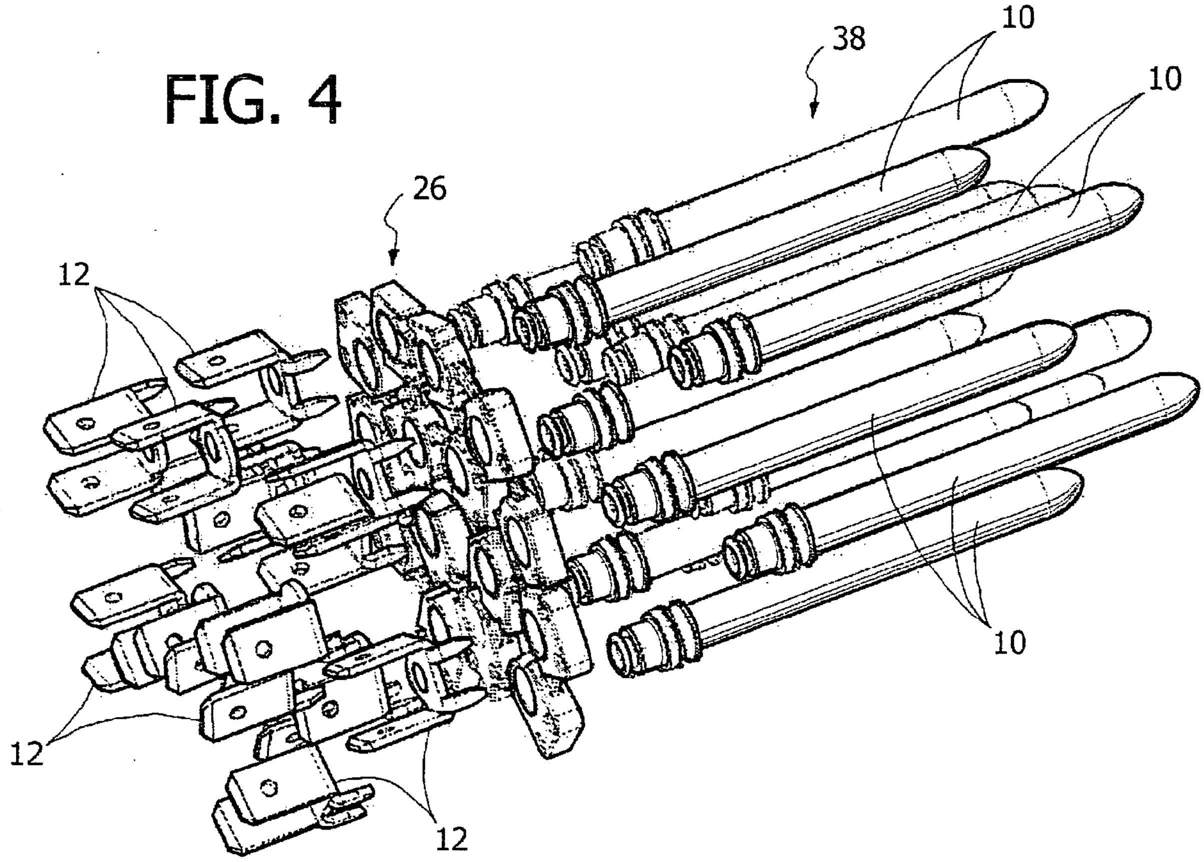
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FIG. 5

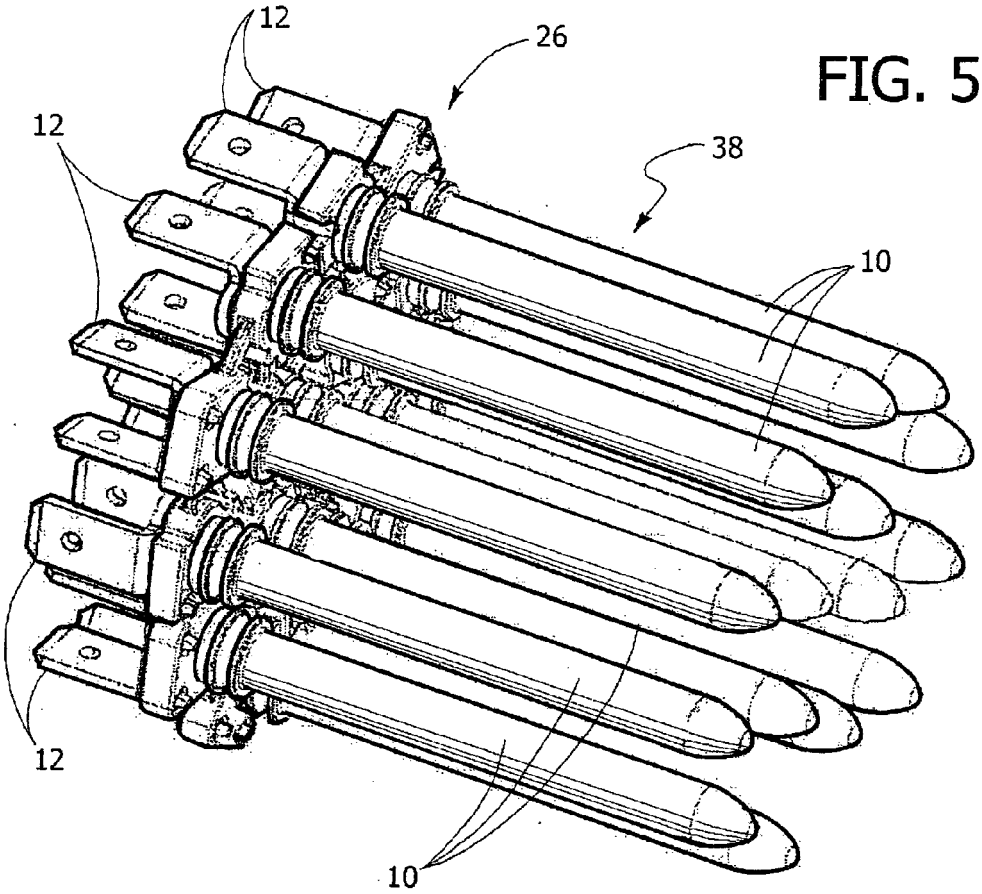
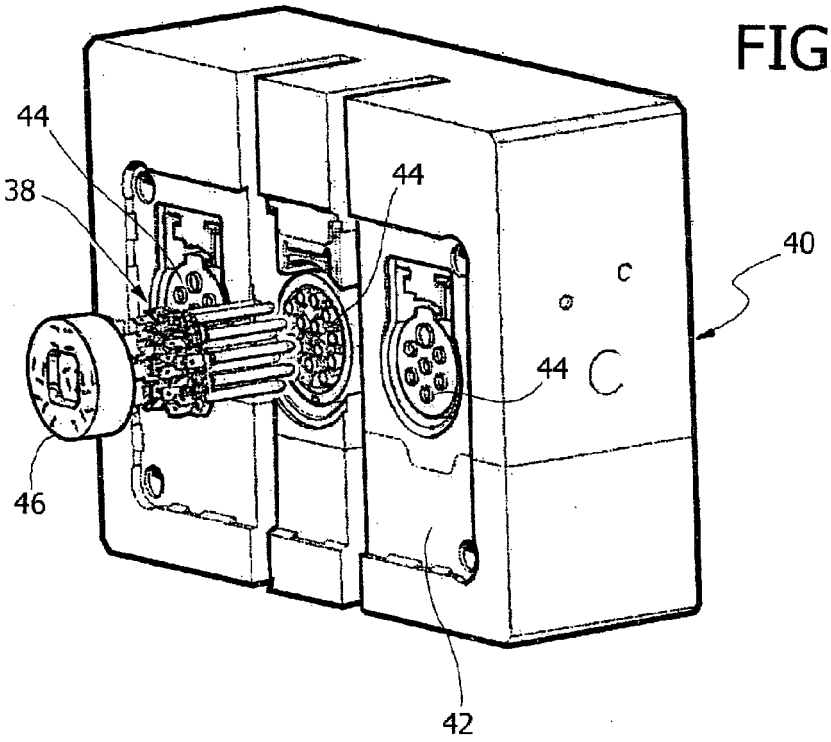


FIG. 6



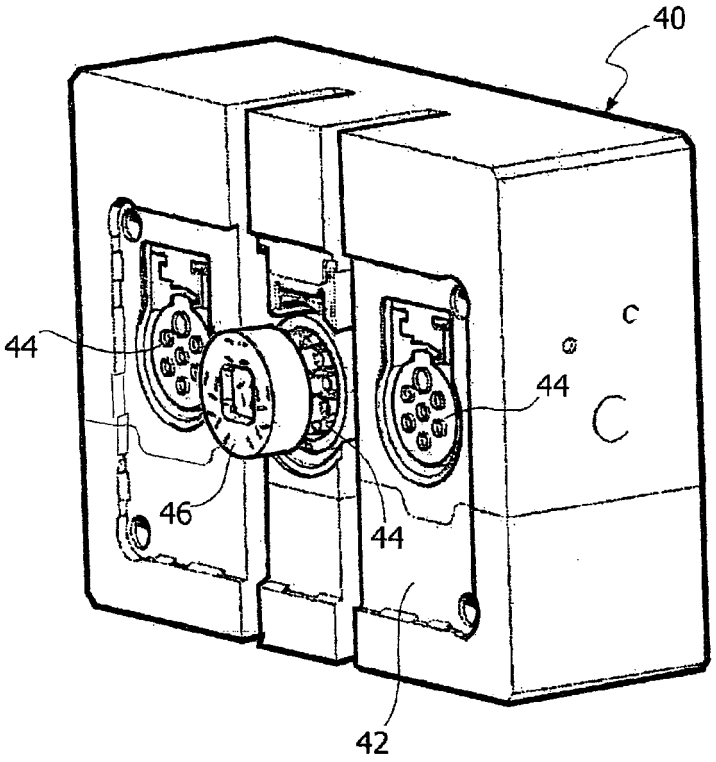
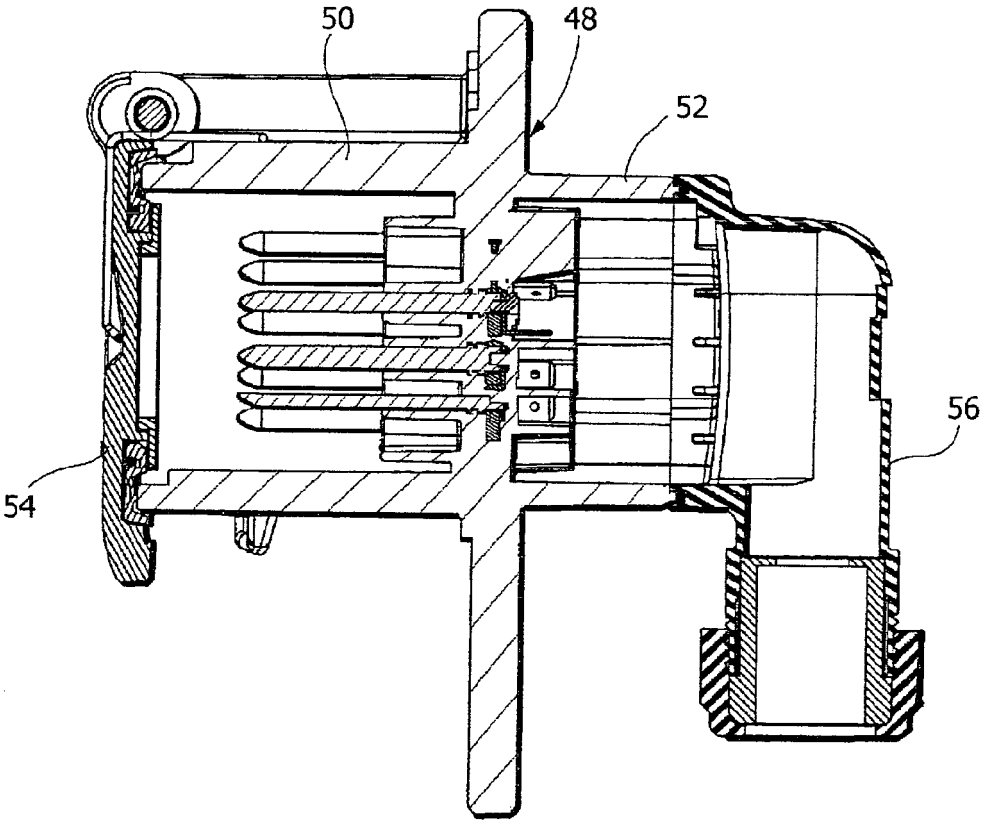


FIG. 7

FIG. 8



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EUROPEAN SEARCH REPORT

Application Number
EP 04 42 5862

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)
Y,D	EP 1 401 064 A (MENBER'S S.P.A) 24 March 2004 (2004-03-24) * column 2, line 27 - column 4, line 17; figures 1-4 *	1,2,4	H01R43/24
Y	PATENT ABSTRACTS OF JAPAN vol. 014, no. 241 (E-0931), 22 May 1990 (1990-05-22) -& JP 02 066865 A (NEC CORP; others: 01), 6 March 1990 (1990-03-06) * abstract; figures 1,2 *	1,2,4	

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	5 April 2005	Stirn, J-P

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 42 5862

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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05-04-2005

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82