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

(11) EP 1 017 136 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
05.07.2000 Bulletin 2000/27

(51) Int Cl.[7]: **H01R 13/24**, H01R 12/22

(21) Application number: **99403083.1**

(22) Date of filing: **09.12.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **10.12.1998 FR 9815618**

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(54) Connector with prestressed contacts and use thereof

(57) In order to increase the precision in the definition of a contact by pressure between a connector (1), designed to be surface-mounted, and a chip card, the connector is provided with a support plane on a plane printed circuit. This support plane is obtained by means of prestresses obtained on conductive elastic tabs (3-8) of the connector. This prestress consists in placing one end (11-13) of the conductive elastic tabs against stops (14-17) aligned in a plane. This improvement induces an ease of implementation of a connector of this kind as well as the possibility of having a statistical control of the quality of the connectors thus made.

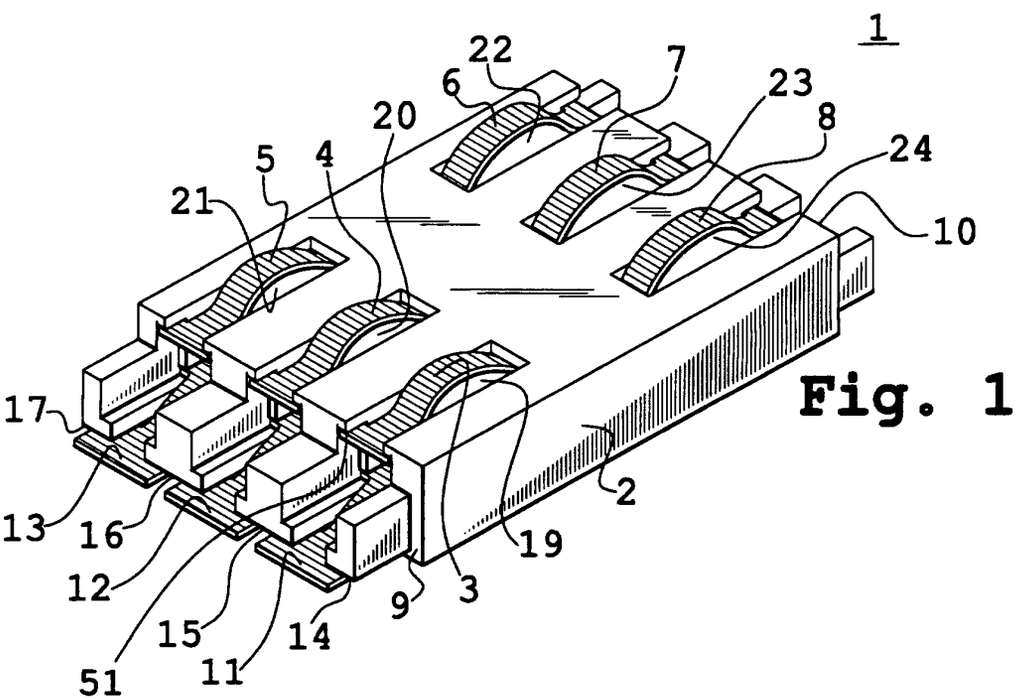


Fig. 1

EP 1 017 136 A1

Description

[0001] An object of the present invention is a connector with prestressed contacts and the use of this connector. A connector of this kind has elastic conductive tabs provided with solder type contact leads and an insulating structure in which the elastic conductive tabs take support. It can be used especially in the mounting of connectors on a printed circuit, especially in the surface-mounting of connectors designed to provide for electrical connection between microcircuits of a chip card and electronic systems. These electronic systems, in a preferred example, are those of chip-card readers or mobile telephones. This type of connector comprises elastic conductive tabs designed to provide for electrical contacts by pressure with metal surfaces or contact zones present on the chip card. Furthermore, the contact between the solder type contact leads of the connector and the surface of the printed circuit on which these leads have to be soldered must be a flat contact. The value of the invention lies in the improvement of the coplaneity of the electrical contact between any solder type contact lead and the surface of the printed circuit.

[0002] The presently manufactured connectors designed for surface mounting comprise solder type contact leads whose free end is cambered to form a contact plane with the printed circuit. Each solder type contact lead defines a local contact plane designed to come into contact with the printed circuit. The local contact planes, taken together, define a distribution, along the thickness, of the connector contacts with respect to the plane of the printed circuit. Indeed, during the manufacturer of the connector, the cambering of the elastic conductive tabs is done according to methods that cannot be used to easily obtain high repeatability with regard to the coplaneity of the solder type contact leads (in surface mounting). This means that, between two elastic conductive tabs, there may be substantial differences in shape and/or dimension. Firstly, it may happen that a solder type contact lead of a tab is not perfectly plane. Secondly, two solder type contact leads, each of which may be plane, may have contact planes that are different and/or are not parallel with one another.

[0003] This type of connector then has problems.

[0004] In general, this type of connector consists of a thermoplastic insulating structure and a certain number of bronze contacts, six in one example. These contacts are treated and receive a triple coating of nickel, then tin-lead allow and finally a thin layer of gold for the part in contact with the chip card. The leads of these contacts are designed to be surface mounted on a printed circuit. Now, in this type of structure, it is appropriate that, during the application of the product and the surface mounting of the connector, as well as throughout the lifetime of the device on which it is mounted, sometimes under harsh handling conditions, all the contacts of the connector should be capable of providing sufficient contact pressure for efficient electrical transmission.

[0005] Indeed, a chip card connector belonging for example to a mobile telephone or to another electronic system that may undergo vibrations will transmit these vibrations to the chip card as well as to the connector. In this case, a reduction of the contact pressure on the chip card will cause problems because, if a vibration is excessive, a contact between the chip card and the connector may be interrupted or defective even for a short instant. This may lead to errors in the reading and writing of information in the chip card.

[0006] Thus it has been observed that, for the contact with the chip card to be deemed to be satisfactory, it is necessary that the pressure-applying plane of the solder type contact leads of the connector should be the same as, or almost the same as, the contact plane of the printed circuit. In fact, this coplanarity thus makes it possible to efficiently meet a requirement known as the coplaneity, necessary for the implementation of the SMC, requirement that implies that any contact should be within a maximum tolerance interval, which is sought to be low, in relation to the pressure-applying plane of the solder type contact leads of the connector on the printed circuit, namely a pressure-applying plane that defines a reference plane for said coplaneity.

[0007] Furthermore, the dimensional constraints of the connector do not provide sufficiently precise guidance for the solder type contact leads. All this clearly means that this pressure-applying plane cannot be determined in a precise and reproducible way. This leads to a major degree of dispersion in the coplaneity.

[0008] More specifically, to provide for efficient SMC soldering, lead-outs of the components, namely the solder type contact leads, must be designed to ensure coplaneity of less than 0.1 mm. This in fact entails a dimension X, representing a distance between the supporting face of the insulator of the component and the soldering face of the CMS lead-outs, whose tolerance interval is 0.1 mm ($X \pm 0.05$ mm).

[0009] This dimension X results from a double cambering of an elastic conductive tab (the contact zone with the chip card has to be elastic) and it is the elasticity of this elastic conductive tab that is the cause of most of the problems encountered, especially those defined here above. This elasticity varies as a function of the material used to make an elastic conductive tab, its thickness or again the surface treatment applied. Thus, there are too many parameters at play to be sure of obtaining large batches of elastic conducive tabs with a tolerance of plus or minus 0.05 millimetres.

[0010] Moreover, this problem induces another one. Since it is known that there is a high probability that the coplaneity of the printed circuit with the plane of the contact will be imperfect, it is necessary to check each connector. In addition to the reject rate that this entails, the checking of each unit is all the lengthier as the number of connectors is great. This leads to a loss of time and hence an increase in the total cost of such a connector.

[0011] It is an object of the present invention to over-

come the problems mentioned by proposing a connector with an insulating structure and a plurality of elastic conductive tabs maintained in this structure, each tab being provided with a solder type contact lead. The insulating structure comprises stops aligned in a plane. The solder type contact leads press on these stops in this plane by the effect of a prestress applied to them. Thus, the contact surface of the solder type contact leads is placed against the plane of the stops with a precision of about 0.02 mm, it being known that it is possible to mould insulator materials with a precision of this degree. Consequently, the contact between the solder type contact leads of the connector and the surface of the printed circuit is a perfectly plane contact. Thus, the contact zones of the elastic tabs with a chip card are also in a plane that is perfectly parallel to the contact plane of the chip card.

[0012] The invention therefore relates to a connector comprising an insulating structure and a plurality of elastic conductive tabs, held in this insulating structure, each elastic conductive tab being provided with a solder type contact lead wherein the solder type contact leads are prestressed and the insulating structure comprises stops aligned in a plane on which the prestressed contact leads apply pressure.

[0013] The invention will be understood more clearly from the following description and the accompanying figures. These figures are given purely by way of an indication and in no way restrict the scope of the invention. Of these figures:

- Figure 1 shows a view of the connector according to the invention;
- Figure 2 shows a view of an elastic conductive tab of the connector according to the invention;
- Figure 3 shows a view of an anchor plate of the elastic conductive tab with its two lateral arms;
- Figure 4 shows a sectional view of the connector according to the invention.

[0014] Figure 1 shows a connector 1 according to the invention. This connector 1 comprises an insulating structure 2 and, in a preferred example, six elastic conductive tabs 3 to 8. They are distributed in groups of three, symmetrically and evenly, along two sides 9 and 10 of the insulating structure 2, these two sides 9 and 10 being opposite. Hereinafter, the description shall be limited to the elements located on the side 9, the elements of the side 10 being deduced from the side 9 by symmetry.

[0015] The elastic conductive tabs 3, 4, 5 respectively are provided with solder type contact leads 11, 12, 13 respectively. In a preferred example, these solder type contact leads are in the form of flat plates located at first ends of the tabs 3, 4 and 5 respectively. Furthermore, the solder type contact leads 11, 12 and 13 are positioned perpendicularly to the side 9 of the insulating structure 2. Furthermore, the insulating structure 2 comprises stops 14, 15, 16 and 17, evenly aligned in a plane. This plane is perpendicular to the side 9. The solder type contact leads 11, 12, 13 have a T-shaped widening. These T-shaped widenings, from the solder type contact leads 11, 12, 13 press on stops 14, 15, 16 and 17. To do this, each solder type contact lead is located between two stops. In a preferred example, the stops 14 to 17 are structures that rise perpendicularly to the side 9 and have at least one plane face. These plane faces are those beneath which the solder type contact leads press. These stops are rigid so that pressures applied by the solder type contact leads are not enough to deform the supporting planes of the stops. Thus, the widenings of the solder type contact lead 11 press on two stops 14 and 15, the solder type contact lead 12 presses on two stops 15 and 16 and so on and so forth. The plane of the stops 14 to 17 is by design (moulding) obtained within the desired tolerance.

[0016] Figure 2 shows the conducive elastic tab 3 outside the connector 1. It comprises an anchor plate 18 placed in an intermediate position. This intermediate position is a position in which the anchor plate 18 is closer to the end comprising the solder type contact lead 11 than the other end of the elastic conductive tab 3. This anchor plate 18 is forcefully inserted into a housing 19 designed for this purpose in the insulating structure 2. Thus, the insulating structure 2 has as many housings as it has elastic conductive tabs. In the example shown, the insulating structure 2 therefore has six housings 19 to 24. This forceful insertion of the anchor plate 18 provides for a fixed link between the anchor plate 18 and the insulating structure 2. This anchor plate 18 extends laterally with two lateral arms 25 and 26. The forceful insertion of the anchor plate 18 into the housing 19 designed for this purpose in the insulating structure 2 has the effect of inserting the two lateral arms 25 and 26 into two lateral grooves made in each housing.

[0017] The contact lead 11 is prestressed so that it gets placed against the stops 14 and 15 once the tab has been inserted.

[0018] This opposition of the stops 14 and 15 therefore induces a holding of a deformation of the elastic conductive tabs 3 which, while being permanent, continues to be an elastic deformation. The prestress provides for the contact of the solder type contact lead 11 on the stops 14 and 15. In the connector of the invention, it is the stops 14, 15, 16 and 17 of the side 9 of the insulating structure 2 that counter the reaction forces applied by the solder type contact leads 11, 12 and 13.

[0019] In the preferred example, the insulating structure 2 is obtained by moulding. The moulding methods currently used make it possible to obtain plane surfaces and dimensions with a precision of about 0.02 mm. This means that it is possible to obtain surfaces whose variations in relief are contained in a space whose thickness may be reduced to about 0.02 mm.

[0020] The elastic properties of the tabs are then used. Indeed, when the solder type contact leads press

on the stops, the reaction force is sufficient to obtain a deformation of the solder type contact leads in such a way that a contact between a solder type contact lead and a stop will be a plane contact. Thus, the planeity obtained in the invention for the solder type contact leads 11, 12 and 13 is greater than the planeity obtained in the prior art.

[0021] Figure 3 shows the anchor plate 18 provided with two lateral arms 25 and 26. These two fixing arms 25 and 26 are extended, parallel to a plane passing through the anchor plate 18, by two lateral fixing toes 27 and 28 respectively. A lateral fixing toe, 27 or 28 has a harpoon shape in which a first flank 29 or 30 is perpendicular to an end 31 or 32 of a lateral arm 25 or 26 respectively. A second flank 33 or 34 is oblique to the end 31 or 32 respectively. The toes 27 and 28 are positioned in such a way that, with respect to the direction of insertion of the anchor plate 18, it is the oblique flanks 33 and 34 of the toes 27 and 28 that first penetrate the grooves 35 and 36 respectively designed for this purpose in the walls 37 and 38 of a housing 39. The flanks 29 and 30 of the toes 27 and 28 penetrate in a second stage.

[0022] At the beginning of the insertion of the lateral arms 25 and 26 in the grooves 35 and 36, the toes 27 and 28 penetrate the walls 40 and 41 of the grooves 35 and 36 respectively facing them. Thus, the two toes 27 and 28 bend the walls 40 and 41 under the effect of an insertion force applied to the anchor plate 18. This bending of the walls 40 and 41 has the effect of producing a compressive stress on the toes 27 and 28 and therefore of fixing the anchor plate 18. At the end of insertion, the anchor plate 18 reaches a position where it abuts the walls 42 and 43 constituting a termination of the grooves 35 and 36 respectively. In this state, the anchor plate 18 can no longer go forward because of the walls 42 and 43. It cannot move sideways because of the compressive stresses applied by the walls 40 and 41 and it cannot return backwards because of the perpendicular flanks 29 and 30 of the toes 25 and 26 which counter any translational movement along this direction of the anchor plate 18.

[0023] The anchor plate 18 is therefore fixed and has no degree of liberty. Furthermore, two front corners 44 and 45 of the anchor plate 18 are bevelled. These two corners 44 and 45 are angles that are formed at the intersection between the ends 31 and 32, of the lateral arms 25 and 26 with sides 46 and 47 respectively. These sides 46 and 47 are those which, at the end of the insertion of the anchor plate 18, come into contact with the walls 42 and 43 of the grooves 35 and 36 respectively. These bevelled corners 39 and 40 further the engagement of the anchor plate 18 in the grooves 35 and 36 respectively.

[0024] Figure 4 shows a section of the connector 1 along a sectional plane passing through the conductive elastic tabs 3 and 8 (the conductive elastic tab 8 is not shown). In a preferred example, a housing 19 receiving the conductive tab 3 comprises a first aperture on the side 9 of the insulating structure 2 as well as a second aperture on a side 48 perpendicular to the side 9 but parallel to the contact plane of the stop.

[0025] Thus, the elastic conductive tab 3 introduced by the side 9 is compressed in the housing 19. For this purpose, the elastic conductive tab 3 has a folded-down shape and a second end 49 that is in a plane parallel to but not the same as the plane passing through the anchor plate 18. A part of the elastic conductive tab 3, located between the end 49 and the anchor plate 18, is cambered in such a way that a piece of this part opens into the second aperture of the side 48 with a humped shape 50. It is this position of the elastic conductive tab 3 that is designed to form an electrical contact between the chip card and the connector 1. This contact zone of the hump 50 with the chip card is movable with respect to the anchor plate.

[0026] Thus, this cambered shape of this part of the elastic conductive tab 3 makes it possible, when a pressure is applied along an axis perpendicular to the side 48, to obtain a spring effect from this part. This spring effect, in a preferred example, provides for electrical contact by pressure between the elastic conducive tab 3 and a metal contact zone on the chip card. Furthermore, the end 49 of the elastic conductive tab 3 is subjected to a second prestress. For this purpose, it is held, by stops between the walls 37 and 38 of the housing 19, at a height such that a distance between a stop 51, made in the wall 38, and the plane passing through the anchor plate 18 is smaller than the gap between this same plane and the end 49 when it is not subjected to any stress. The end 49 therefore cannot move in a housing 52 except in one direction, namely the direction facing the stop 51. A T-shaped widening of the end 49 of the elastic conductive tab 3 makes it possible to press on this stop 51. This last-mentioned prestress is aimed especially at providing approximately a same contact plane for all the contact zones, this contact plane being parallel to the contact plane of the solder type contact leads. The distance between a peak 53 of the hump and the side 48 is such that a penetration of the hump 50 into the housing 19 due to pressure applied by the chip card during the connection always leaves at least the end 53 outside the housing 19. Thus the resultant reaction force provides for sufficient mutual facing contact between the contact zones of the connector 1 and the contact zones of the chip card to have electrical contact by pressure according to the criteria explained here above.

[0027] During the insertion of an elastic conductive tab 3 into the housing 19 of the insulating structure 2, a squeezing force needs to be applied between the anchor plate 18 and the end 49. This enables the end 49 to be inserted into the housing 52. After the relaxing of the squeezing force, the end 49 abuts the stop 51. Furthermore, during the insertion, the contact lead 11 of the elastic conductive tab 3 is positioned as defined here above. In this case, the elastic conductive tab 3 is sub-

jected to two prestresses in reaction with the anchor plate 18. The first prestress is that of the solder type contact leads 11, 12 and 13 on the stops 14, 15, 16 and 17. In the example, two stops are used to make a prestress on a solder type contact lead. Thus, each solder type contact lead is between two stops. One consequence of this placing of the solder type contact leads between the stops is that the tabs are no longer mobile. This limits the risks that a fixing tab might get hooked during the mounting operations.

[0028] In a preferred example, the insulating structure 2 is made out of a moulding through the use of a thermoplastic insulating material. Materials of this kind have properties of elasticity and deformation used especially during the insertion of the anchor elements of the conductive elastic tabs as explained here above. The elastic conductive tabs 3 to 8, in a preferred example, are made of bronze since bronze is an elastic material that is easy to shape. This means that it can be easily deformed. This is one of the aims sought when the contact tabs press on the stops of the insulating structure. The contact tabs thus match the relief features resulting from the stops. Furthermore, the humped structure of an elastic conductive tab, providing contact with the chip card, is covered with nickel, a tin-lead alloy and/or gold in order to improve the contact characteristics of the elastic conductive tab and thus promote efficient electrical contact between the connector 1 and the chip card.

[0029] It must furthermore be noted that in general the contact leads of SMC lead-outs are easily deformable and that, therefore, the stop makes it possible also to provide for the protection of said leads during any handling operation.

Claims

1. Connector (1) comprising an insulating structure and a plurality of elastic conductive tabs (3-8), held in this insulating structure (2), each elastic conductive tab being provided with a solder type contact lead (11), characterised in that the solder type contact leads (11-13) are prestressed and the insulating structure (2) comprises stops (14-17) aligned in a plane on which the prestressed contact leads (11-13) apply pressure.

2. Connector according to claim 1, characterised in that the solder type contact leads are in the shape of plane plates and are located at first ends of the plates.

3. Connector according to claim 2, characterised in that the solder type contact leads pressing on the stops comprise a T-shaped widening.

4. Connector according to one of the claims 1 to 3, characterised in that the elastic conductive tabs are furthermore provided with an anchor plate (18) placed in an intermediate position in the insulating structure (2).

5. Connector according to claim 4, characterised in that the anchor plate comprises lateral fixing toes (27, 28) on the insulating structure, and in that the two lateral toes (44, 45) of this anchor plate are bevelled.

6. Connector according to one of the claims 1 to 5, characterised in that the conductive elastic tabs have a cambered shape and are compressed in housings (19-24) of the insulating structure, a second end (49) of the conductive elastic tabs being subjected to a second prestress in the housing of the insulating structure.

7. Connector according to claim 6, characterised in that the conductive elastic tabs have a width equal to a width of the housing and a second T-shaped end pressing on the stops of both sides of the housing.

8. Connector according to one of the claims 1 to 7, characterised i that the conductive elastic tabs are made of bronze, in that the contact zones are covered with nickel, a tin-lead alloy and gold, and in that the insulating structure is made out of a thermoplastic insulator.

9. Use of the connector according to one of the claims 1 to 8 for its surface mounting, by means of solder type contact leads, on a printed circuit.

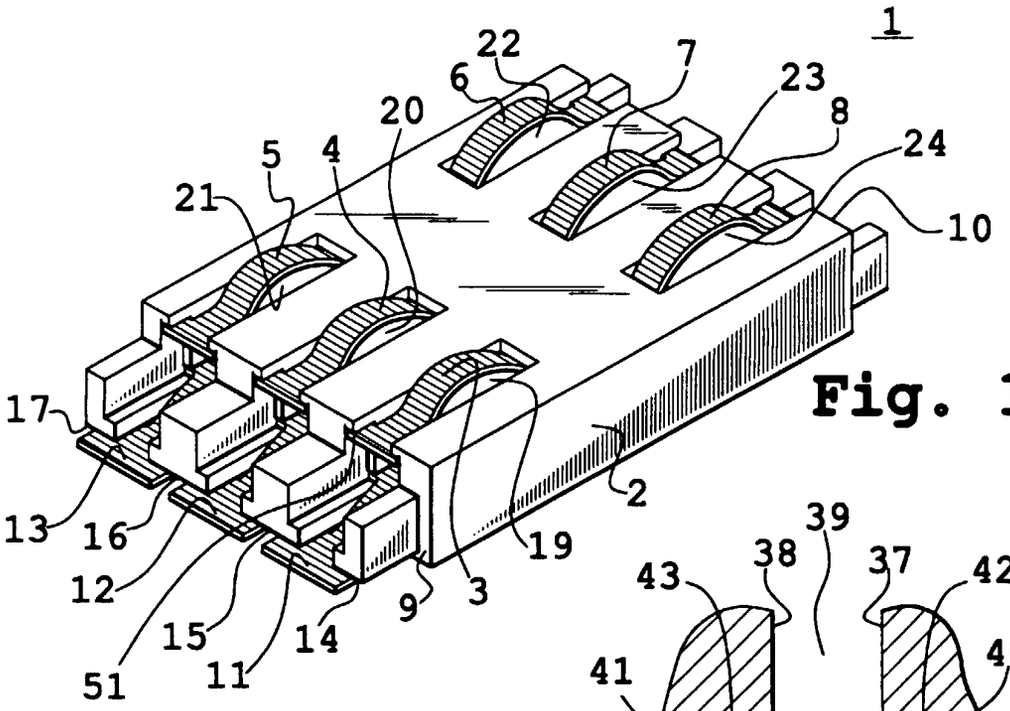


Fig. 1

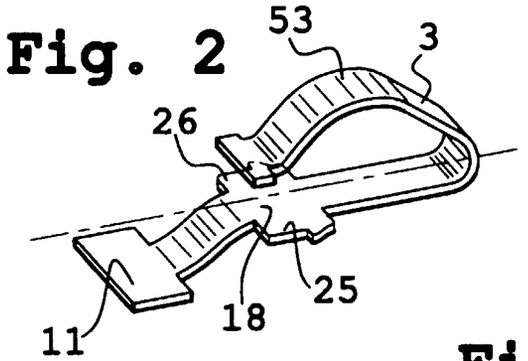


Fig. 2

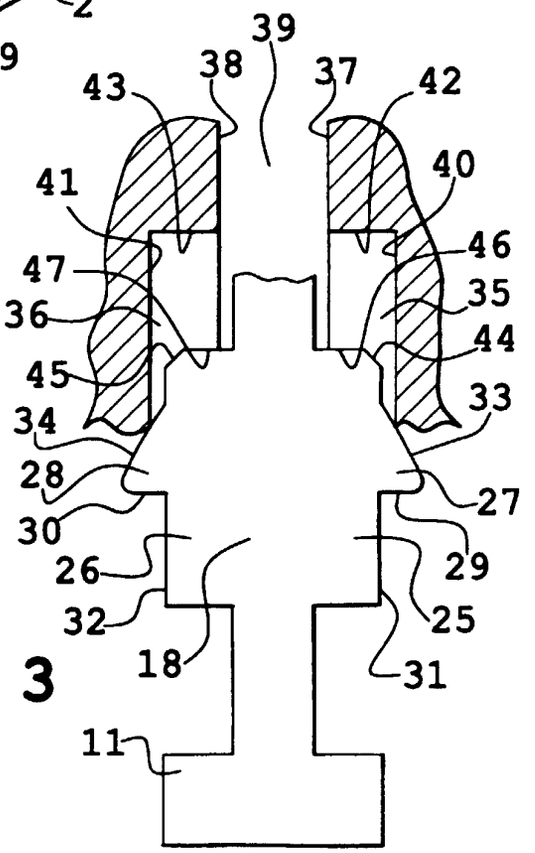


Fig. 3

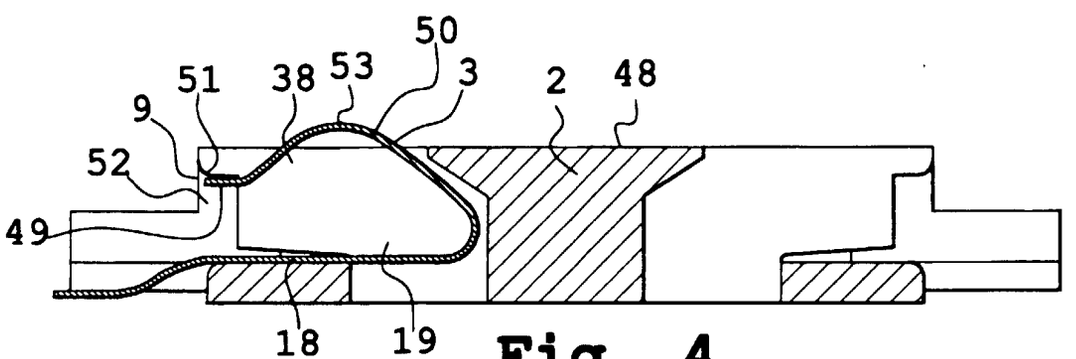


Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 99 40 3083

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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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
THE HAGUE	17 March 2000	Demol, S

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