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(54) Title: ELECTRIC PLUG CONNECTOR FOR INSERTION ONTO A PCB AND FOR BEING AFFIXED TO THE PCB BY MEANS OF A CASTING COMPOUND AND METHOD THEREFOR

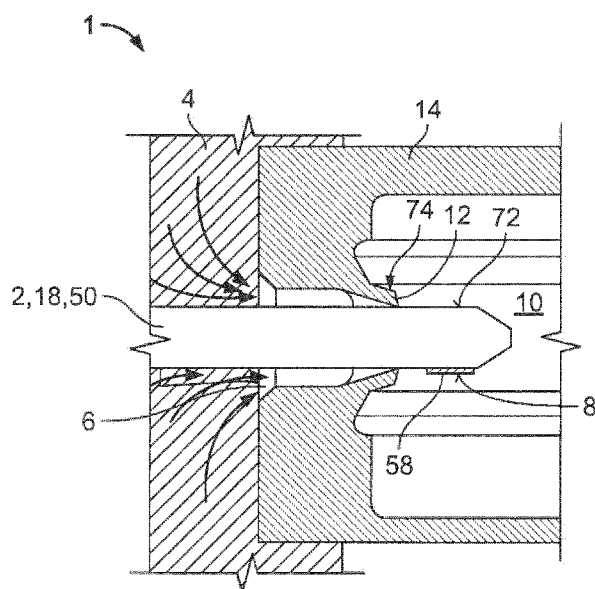


Fig. 11

(57) Abstract: The invention relates to an electric plug connector (1) for insertion onto a PCB (2) and for being affixed to the PCB (2) by means of a casting compound (4), as well as to a method for attaching an electric plug connector (1) to a PCB (2). The objective of the invention is to keep the interior (10) of the connector and in particular an electric contact (8) arranged therein free from the casting compound (4) even if PCBs (2) of different thicknesses are used. According to the invention, this is achieved with at least one casting compound receiving chamber (6) which opens towards an exterior side (28) of the plug connector (1), said casting compound receiving chamber (6) being arranged in front of the electric contact (8) and being at least partly closed by a film hinge (12). By inserting the electric plug connector (1) onto the PCB (2), the film hinge (12) is pierced and thus brought into abutment on the PCB (2) and holds back the casting compound (4).

**Electric plug connector for insertion onto a PCB and for being affixed to the
PCB by means of a casting compound and method therefor**

The invention relates to an electric plug connector for insertion onto a PCB and for being affixed to the PCB by means of a casting compound.

- 5 Such electric plug connectors are inserted onto PCBs and cast there mostly with a low-pressure plastic as casting compound in a mould. At the same time, the contacts of the electric plug connector should not come into contact with the casting compound.

The electric plug connector configured according to the invention in the configuration cited above achieves this objective by at least one casting compound receiving chamber which opens
10 towards an exterior side of the plug connector and at least one electric contact, which is arranged in the plug connector preferably in alignment behind the casting compound receiving chamber, the receiving chamber in front of the electric contact being at least partly closed by a film hinge.

The inventive method for attaching the electric plug connector to the PCB envisages that a
15 section of the PCB is introduced into the casting compound receiving chamber and pierces the film hinge which at least partly closes the casting compound receiving chamber, wherein the film hinge is applied to the section of the PCB, and subsequently the casting compound receiving chamber is filled with the casting compound and the casting compound is held back by the film hinge. The film hinge seals the casting compound receiving chamber whenever the
20 PCB is introduced into the electric plug connector through the casting compound receiving chamber until contact is made. Therefore, additional sealing elements are not necessary. The film hinge to be torn guarantees that sealing of the casting compound receiving chamber in relation to the contact is ensured, even in the case of PCBs of different thicknesses or in the case of a PCB thickness which varies greatly due to production tolerances.

25 A film hinge in the sense of the present invention is meant in principle to be understood as a thin film or thin skin, which at least partly closes the receiving chamber in front of the electric contact. The film can be static, that is to say immovable in relation to the receiving chamber and in the event of an outside force having an effect can be designed so that the electric contact is only exposed if the film deforms. The film hinge for example can be a flow skin. In addition
30 however, a film hinge in the sense of this invention includes movable configurations. Thus the film hinge can be designed so that it can fold away. The skin or film of the film hinge can be arranged on at least one, for example two opposite walls of the receiving chamber, particularly

joined monolithically. It can for example be generally fitted on its periphery, joined and/or held monolithically.

The invention can be improved by the following refinements, which are in each case advantageous alone and combinable with one another as required.

- 5 Thus the film hinge is preferably a monolithic component of a housing of the electric plug connector which forms the casting compound receiving chamber. The film hinge is produced preferably in one production step together with the housing, particularly by means of an injection moulding process. The film hinge preferably can be flexibly penetrated, for example cut through or pierced, and/or is temperature-stable. Temperature-stable means that the material is
- 10 dimensionally stable at the temperatures in the production process, for example injection moulding such as overmoulding. In an embodiment, the material of the film hinge can be polyamide, preferably heat-resistant polyamide. The thickness of the film hinge amounts to less than 0.5 mm in an advantageous configuration. At minimum, the thickness of the film hinge can amount to 0.1 mm. Preferably, the thickness is between 0.2 and 0.4 mm. The film hinge can
- 15 also be formed from a material, particularly a rubber-elastic material, which is different from the housing. Such a film hinge can be easily produced by a multi-component injection-moulding process together with the housing.

The housing can form at least one contact chamber, in which the electric contact is arranged. An electric plug connector can have one or several casting compound receiving chambers.

- 20 In accordance with an advantageous arrangement, the film hinge can completely close the casting compound receiving chamber. In the case of this arrangement the film hinge must heavily deform when pierced by the PCB, in order to make room for the PCB. This leads to particularly good sealing.

- So that the film hinge has a reproducible tearing behaviour with regard to the place where the
- 25 tear forms, it can be provided with a predetermined breaking point at at least one location. At the predetermined breaking point the breaking resistance of the film hinge can be reduced in relation to the surrounding area. In the case of this arrangement, the predetermined breaking point represents a weakened region, at which the film hinge will tear initially. The weakened region can have a longitudinal extension, in order to lead the tear in this longitudinal extension.
- 30 Thus, the predetermined breaking point can extend parallel to a wall of the casting compound receiving chamber particularly transverse to the insertion direction, for example from one wall to the opposite wall. The end of such a particularly linear predetermined breaking point can be

spaced apart from the walls of the casting compound receiving chamber, in order to prevent uncontrolled tearing of the film hinge up to the wall and thus faulty sealing.

The predetermined breaking point can, in accordance with a further advantageous configuration, have a region projecting towards the casting compound receiving chamber and/or
5 a region springing back from the casting compound receiving chamber.

The film hinge can be thickened at the predetermined breaking point and/or have a reduced wall thickness at the predetermined breaking point. The predetermined breaking point can also be configured in the form of a passage connecting the casting compound receiving chamber to the plug connector interior.

10 The predetermined breaking point can be arranged at least approximately centrally in the width and/or height direction of the film hinge. This is particularly expedient if the PCB dimensions roughly correspond to the internal dimensions of the receiving chamber, such that the PCB almost completely fills the casting compound receiving chamber.

If the PCB thickness is significantly less than the height of the casting compound receiving
15 chamber, there is a risk that a film hinge tearing in the centre due to a corresponding predetermined breaking point can only seal the PCB insufficiently whenever the PCB lies against a wall of the casting compound receiving chamber.

In such a case the predetermined breaking point can be arranged off-centre nearer to a preferred broadside of the casting compound receiving chamber.

20 If the film hinge only partly closes the casting compound receiving chamber, it preferably leaves a passage between the contact and the casting compound receiving chamber open. The passage can be arranged centrally between at least two opposite walls of the casting compound receiving chamber. The passage, the clearance of which should be less than the dimensions of the section of the PCB inserted into the casting compound receiving chamber, can facilitate the
25 centring and/or alignment of the PCB in the casting compound receiving chamber when piercing.

It may be advantageous if the passage is arranged nearer to a wall or even in alignment with a wall of the casting compound receiving chamber. In the case of such an arrangement, a PCB, when piercing, is pressed towards the wall located on the passage, which as a result
30 automatically serves as a lead-in face for the PCB.

The thus-achieved guidance by the wall of the casting compound receiving chamber ensures more accurate alignment of the electric plug connector in relation to the PCB.

In order to be able to produce the film hinge as simply as possible in a casting method, it is preferably arranged flush with a wall of the contact chamber.

- 5 The casting compound receiving chamber preferably has a slot-shaped opening on the exterior side of the electric plug connector, so that for example sword- or tab-shaped sections of the PCB can be pushed in.

In order for the PCB to be able to pierce the film hinge without expending a large amount of force, even if the section to be introduced into the casting compound receiving chamber lies
10 against the film hinge at its front rim over a large area, the section preferably tapers towards the electric plug connector. For example the two flat sides of the PCB can be tapered in the end of the section, so that the section tapers towards the electric plug connector. In order to further reduce the force for piercing the film hinge and to define the place where the tear forms, it is advantageous if the section to be introduced or which is introduced into the casting compound
15 receiving chamber tapers to a point from at least two sides, that is to say from its flat and narrow sides.

The section of the PCB to be introduced into the casting compound receiving chamber can be provided with at least one PCB contact. The PCB contact can form a conductive coating on the PCB. In the case of a cast plug connector, the at least one PCB contact contacts the electric
20 contact.

The section of the PCB to be introduced into the casting compound receiving chamber particularly can be a projection, which is spaced apart from an adjacent projection in each case by a gap, whereby the adjacent projection can be introduced or possibly is introduced into a further casting compound receiving chamber of the same or another electric plug connector.

- 25 In order to avoid incorrect mating of the electric plug connector onto the PCB, the section to be introduced into the casting compound receiving chamber can have various spacings to adjacent projections on both sides. The electric plug connector can have correspondingly complementary openings of one or more casting compound receiving chambers and thus can be inserted onto the PCB in a single orientation and/or can only be inserted on a pre-determined projection or
30 only a pre-determined group of projections in one orientation. In such a case the opening can be arranged off-centre in a mating face of the electric plug connector turned towards the PCB.

In the case of the section of the PCB inserted into the casting compound receiving chamber the film hinge, preferably deformed and preferably being deflected in a flexible manner, lies against the section. Thus it forms a seal which can be simply produced.

The pierced film hinge can lie against at least two opposite sides on the section of the PCB introduced into the casting compound receiving chamber. In accordance with a further configuration, a wall of the casting compound receiving chamber can also serve as further sealing. This is for example achieved whenever, due to the arrangement of the predetermined breaking point or the arrangement of the passage of the film hinge, the PCB is brought into abutment against the wall when piercing the film hinge.

The two opposite sides of the PCB, against which the pierced film hinge lies, are preferably the flat sides of the PCB. Thus the thickness fluctuations in the case of PCBs and/or different thicknesses of PCBs can be compensated for by the film hinge. An improved seal is achieved whenever the pierced film hinge lies at all sides against the section or rather its flat and narrow sides.

The invention is described in detail below with reference to the appended drawings on the basis of configurations which are only shown as examples.

In the figures as regards components which correspond to each other with respect to structure and/or function the same reference symbols are used for the sake of simplicity.

The feature combination of the individual exemplary embodiments can be changed in line with the above statements. Thus a feature, on whose technical effect a use does not depend, can be dispensed with, or a feature which is not present but whose technical effect is advantageous for a use, can be added in line with the above statements.

In the drawings:

Fig. 1 shows a schematic sectional view of an electric plug connector and a part of a PCB;

Figs. 2-6 show in each case a schematic sectional view of a part of an electric plug connector according to the invention with a film hinge;

Fig. 7 shows a schematic plan view of a part of a PCB;

Fig. 8 shows a cut along line VIII-VIII of Fig. 7;

Fig. 9 shows a schematic plan view of a part of a PCB;

Fig. 10 shows a schematic sectional view along line X-X of Fig. 9;

Fig. 11 shows a schematic sectional view of an electric plug connector according to the invention attached to a PCB by means of a casting compound.

Firstly, with reference to Fig. 1, the structure of an inventive electric plug connector 1 is described, which is configured to be inserted onto a PCB 2 and to be affixed to the PCB 2 by means of a casting compound 4. The casting compound is only schematically depicted in Fig. 1.

The electric plug connector 1 has a casting compound receiving chamber 6, which, when an electric plug connector 1 is inserted onto the PCB 2, is filled with the casting compound 4.

In addition, the electric plug connector 1 has at least one electric contact 8, which, in the electric plug connector 1, is arranged preferably in alignment behind the casting compound receiving chamber 6 in the interior 10 of the plug connector.

In front of the electric contact 8 the casting compound receiving chamber 6 is at least partly closed by a film hinge 12. The film hinge 12 is preferably monolithically formed from a housing 14 of the electric plug connector 1, particularly by a casting process, for example by injection-moulding of the housing 14.

The casting compound receiving chamber 6 and the electric contact 8 are preferably in alignment in insertion direction 16, in which the electric plug connector 1 is inserted onto the PCB 2.

Thus the PCB 2 or a section 18 of the PCB 2 is first introduced into the casting compound receiving chamber 6. In the course of further insertion, the PCB 2 pierces the film hinge 12 and contacts the electric contact 8 lying behind the film hinge 8.

The pierced film hinge 12 lies against the PCB 8 or rather its section 18 and, in the torn and deformed condition, forms a sealing lip, which prevents the casting compound 4 from penetrating into the connector interior 10.

Figs. 2 to 6 show possible configurations of the film hinge 12. Figs. 2 to 6 only show the housing 14 for the sake of simplicity.

In accordance with Fig. 2, the film hinge 12 can completely close the casting compound receiving chamber 6. Furthermore, it can run flush with a wall 20 of the connector interior 10, particularly a contact chamber 22 which receives the electric contact 8 (Fig. 1).

The opening 26 of the casting compound receiving chamber 6 towards the exterior side 28 of the electric plug connector 1 is preferably slot-shaped.

Figs. 3 to 5 show a film hinge 12, which is provided with a predetermined breaking point 30. The predetermined breaking point 30 can be arranged centrally in the film hinge 12, at least however centrally in firstly a direction transverse to the insertion direction. The predetermined breaking point 30 can be designed in point or linear form. In the case of a linear configuration of the predetermined breaking point 30 this can extend parallel to a wall 32 of the casting compound receiving chamber 6. In this case the predetermined breaking point 30 preferably terminates spaced apart from the nearest wall 32 in each case.

The predetermined breaking point 30, as Fig. 3 shows, can be formed by a projection 34, which protrudes into the casting compound receiving chamber 6. The film hinge 12 can be thickened at the location of the projection 34.

The predetermined breaking point 30 can also be configured in the form of a recess 36, for example a notch in which the thickness 24 is reduced.

In the configuration of Fig. 3, the projection 34 leads to intensified deformation of the film hinge 12, since the PCB 2 firstly only presses against the projection 34, whenever it is introduced into the casting compound receiving chamber 6 and starts to pierce the film hinge 12. This intensified deformation results in tearing of the film hinge around the projection 43.

In the configuration of Fig. 4, due to the reduced thickness 24, the breaking resistance in the recess 36 is lowered, so that tearing will start within this region of the film hinge 12. The recess 36 can be arranged on the side of the casting compound receiving chamber 6, so that the film hinge 12 springs back from the casting compound receiving chamber 6 at this point. Additionally or alternatively, the recess 36 can also be arranged on the side of the connector interior 10.

In both cases, the predetermined breaking point 30 represents a weakened region, which limits a tearing formation during piercing of the film hinge 12 to a specific region.

The predetermined breaking point 30 can also be configured, as Fig. 5 shows, in the form of a passage 38, through which the casting compound receiving chamber 6 is joined to the connector interior 10. The passage 38 can be arranged centrally in the casting compound receiving chamber 6, as Fig. 5 shows. The passage 38 can be a hole which is radially symmetrical, for example a circular or polygon-shaped hole, or have a linear extension for example through a slot-shaped arrangement.

Of course the passage 38 can also be arranged off-centre.

In the case of the configurations in Figs. 3 to 5, the dimension 40 of the predetermined breaking point 30 in thickness direction 42 of the PCB 2 (Fig. 1) preferably only amounts to a fraction, particularly less than a third, of the PCB thickness. In the case of such a dimension, the piercing
5 of the film hinge 12 by the PCB 2 results in heavy tearing and strong deformation of the film hinge 12, since the PCB repels a large part of the film hinge. The strong deformation of the film hinge 12 leads to a good sealing effect.

The passage 38 can, in accordance with a further arrangement as illustrated in Fig. 6, be delimited on one side by a wall 32 of the casting compound receiving chamber 6. The film hinge
10 12 is only arranged on the side, opposite this wall 32, of the casting compound receiving chamber 6. The dimension 40 of the passage 38 in thickness direction 42 of the PCB 10 is again smaller than the thickness of the PCB. The film hinge 12, as moreover also shown in Fig. 5, is connected to the housing 14 of the plug connector 1 everywhere except for its side turned towards the passage 38.

In the case of the arrangement of Fig. 6, the film hinge 12, when pierced, exerts a force directed
15 to the wall 32 onto the PCB 2 and/or the section 18, so that the PCB 2 is pressed against the wall 32 and this wall serves as a guide and at the same time sealing of the PCB 2. In the case of the configuration of Fig. 6, the clearance 40 of the passage 38 in thickness direction 42 of the PCB can be more than half the thickness of the PCB, however preferably less than 80% of the
20 thickness of the PCB.

In Figs. 7 to 10, PCBs 2 are illustrated.

The PCB 2 has at least one projection 50, which protrudes in the plane 52 of the PCB 2. The projection 50 forms a section 18 of the PCB 2 which can be plugged into the casting compound receiving chamber 6. The external dimensions of the section 18 are configured complementary
25 to the inside dimensions of the casting compound receiving chamber 6. Preferably, the casting compound receiving chamber 6 has a loose fit in relation to the section 18.

A PCB 2 can have several sections 18 on one side. The sections 18 are then separated from one another by a gap 54 in each case. The gap 54 can have different dimensions, in order to prevent incorrect insertion. In the case of such a configuration, the section 18 can only be
30 plugged into an electric plug connector 1, the mating face 56 of which (Fig. 2) being matched to the different dimensions of the gap 54. An electric plug connector 1 can receive only one section 18 or several sections 18. The section 18 is provided with at least one contact section

58, which makes an electrical connection to active or passive electric components on the PCB 2. The contact section 58 can also be formed by a lining of the PCB 2. A section 18 can be provided with several contact sections 58 on one or both sides.

In order to simplify insertion of both the PCB 2 and its section 18 into the casting compound receiving chamber 6, preferably the PCB 2 tapers at least at the edge 60 of the section 18 in insertion direction 16. The front rim 62 of the PCB 2 therefore has a height 64, which is smaller than the thickness 66 of the PCB 2. In Figs. 7 and 8, the edge or end 60 of the section only tapers from two sides, so that the front rim 62 extends over the entire width of the section 18 towards the plane 52.

Therefore, in the case of such an arrangement, the section 18 strikes the film hinge 12 over at least almost its entire width 68. In certain circumstances there is a risk here that the place of tearing in the film hinge 12 cannot be reproduced when it is pierced. A section 18 with a level front rim 62 should therefore be used preferably with a film hinge 12, which has a predetermined breaking point 30.

A possibility such as a reproducible place of tearing in the film hinge can be achieved by a corresponding configuration of the section 18 if necessary also without predetermined breaking point 30, is shown in Figs. 9 and 10. Here the section 18 generally tapers off and forms a point 70. The point 70 of the section 18 causes a tear to form in the film hinge 12 in its near surrounding area. Additionally the force necessary to pierce the film hinge 12 is smaller.

Fig. 11 depicts the electric plug connector 1 joined to the PCB 2 by the casting compound 4, wherein the section 18 or projection 50 has pierced the film hinge 12 and the PCB contacts 58 contact the electric contact 8. The receiving chamber 6 is filled with the casting compound 4. The film hinge 12 lies against at least one side 72 of the PCB 12 and is deformed. The film hinge 12 thus forms a sealing lip 74. The casting compound 4 is held back by the pierced and deformed film hinge 12 and does not penetrate the connector interior 10.

Reference symbols

	1	electric plug connector
	2	PCB
	4	casting compound
5	6	casting compound receiving chamber
	8	electric contact
	10	connector interior
	12	film hinge
	14	housing
10	16	insertion direction
	18	section
	20	wall of the connector interior
	22	contact chamber
	24	thickness
15	26	opening of the casting compound receiving chamber
	28	exterior side of the electric plug connector
	30	predetermined breaking point
	32	wall of the casting compound receiving chamber
	34	projection
20	36	recess
	38	passage
	40	dimension of the predetermined breaking point in thickness direction of the PCB
	42	thickness direction of the PCB
	50	projection of the PCB
25	52	plane of the PCB
	54	gap
	56	mating face
	58	contact section of the PCB
	60	edge of the section/projection of the PCB
30	62	front rim of the PCB
	64	height of the front rim
	66	thickness of the PCB
	68	width of the section/projection
	70	point of the section/projection

72 (flat) side of the PCB

74 sealing lip

Claims

1. Electric plug connector (1) for insertion onto a PCB (2) and for being affixed to the PCB (2) by means of casting compound (4), with at least one casting compound receiving chamber (6) which opens towards an exterior side (28) of the electric plug connector (1) and with at least one electric contact (8) which is arranged in the electric plug connector (1) behind the casting compound receiving chamber (6), wherein the casting compound receiving chamber (6) in front of the electric contact (8) is at least partly closed by a film hinge (12).
5
2. Electric plug connector (1) according to claim 1, wherein the film hinge (12) completely closes the casting compound receiving chamber (6).
10
3. Electric plug connector (1) according to claim 1 or 2, wherein the film hinge (12) is provided with a predetermined breaking point (30) at at least one location.
4. Electric plug connector (1) according to claim 3, wherein the predetermined breaking point (30) has a projection (34) protruding towards the casting compound receiving chamber (6), and/or has a recess (36).
15
5. Electric plug connector (1) according to claim 3 or 4, wherein the film hinge (12) is thickened at the predetermined breaking point (30) and/or has a reduced thickness (24) at the predetermined breaking point (30).
6. Electric plug connector (1) according to any one of claims 1 or 3 to 5, wherein the film hinge (12) leaves a passage (38) open between the electric contact (8) and the casting compound receiving chamber (6).
20
7. Electric plug connector (1) according to claim 6, wherein the passage (38) is arranged centrally in at least one direction transverse to an insertion direction (16) or is delimited by a wall (32) of the casting compound receiving chamber (6).
- 25 8. Electric plug connector (1) according to any one of claims 1 to 7, wherein the film hinge (12) is aligned flush with a wall (20) of a connector interior (20) which receives at least one electric contact (8).

9. Electric plug connector (1) according to any one of claims 1 to 8, wherein the casting compound receiving chamber (6) has a slot-shaped opening (26) on the exterior side (28) of the electric plug connector (1).
- 5 10. Arrangement with a PCB (2) and an electric plug connector (1) according to any one of claims 1 to 9, wherein the PCB (2) has a section (18) provided with at least one contact section (58) for inserting into the casting compound receiving chamber (6) and for contacting the at least one electric contact (8) and wherein the section (18) tapers in a direction away from the PCB (2).
- 10 11. Arrangement according to claim 10, or comprising a PCB (2) and an electric plug connector (1) according to any one of claims 1 to 9, wherein a section (18) of the PCB (2) is pushed into the casting compound receiving chamber (6) and the film hinge (12) lies against the section (18) in a deformed manner.
12. Arrangement according to claim 11, wherein the film hinge (12) lies at least against two opposite sides (72) of the section (18).
- 15 13. Arrangement according to any one of claims 10 to 12, wherein the film hinge (12) is torn.
14. Arrangement according to any one of claims 10 to 13, wherein the casting compound receiving chamber (6) is filled with the casting compound (4) and the casting compound (4) is held back by the film hinge (12).
- 20 15. Method for attaching an electric plug connector (1) to a PCB (2), wherein a section (18) of the PCB (2) is introduced into a casting compound receiving chamber (6) of the electric plug connector (1) and pierces a film hinge (12) which at least partly closes the casting compound receiving chamber (6), the film hinge (12) being applied to the section (18) and subsequently the casting compound receiving chamber (6) being filled with a casting compound (4) and the casting compound (4) being held back by the torn film hinge (12).

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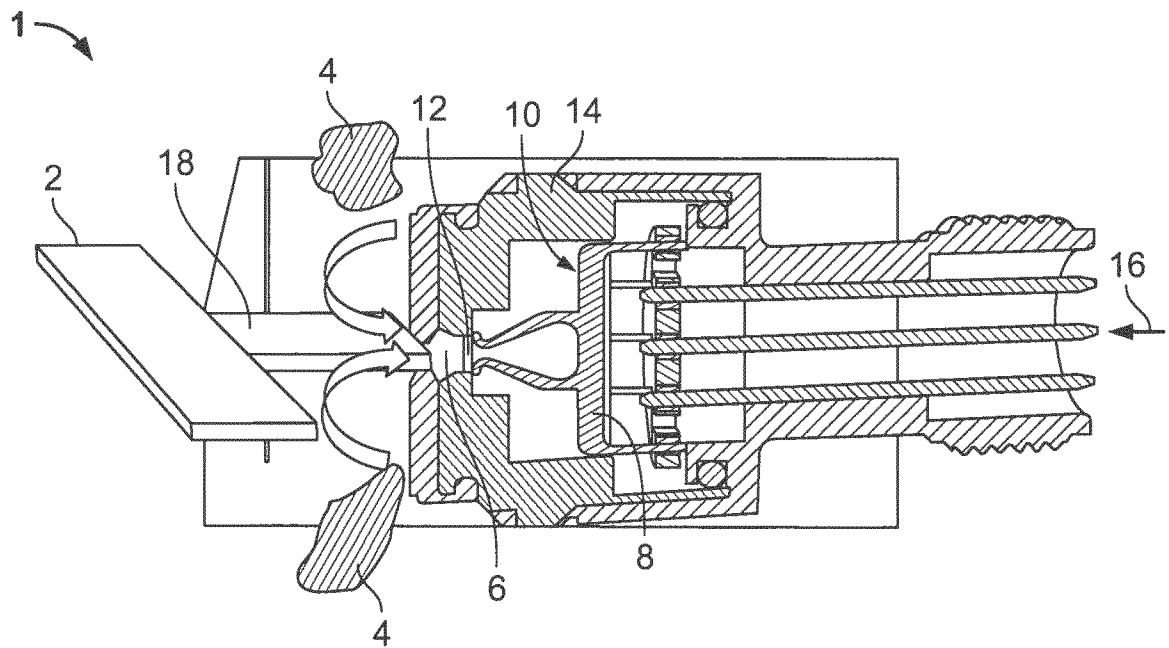


Fig. 1

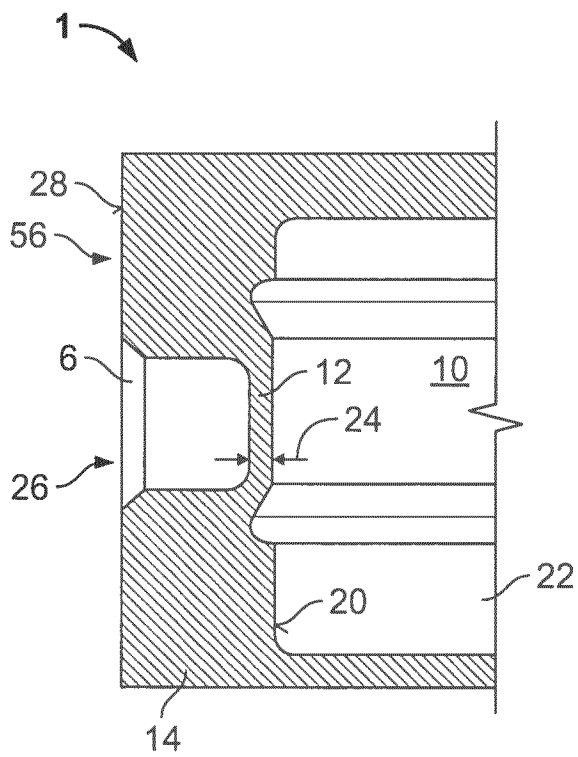


Fig. 2

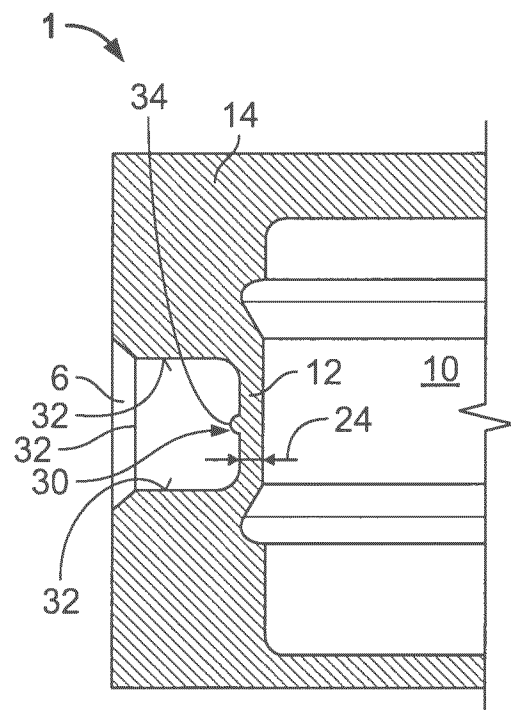


Fig. 3

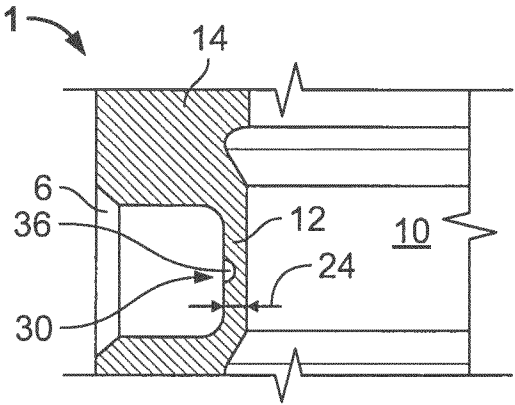


Fig. 4

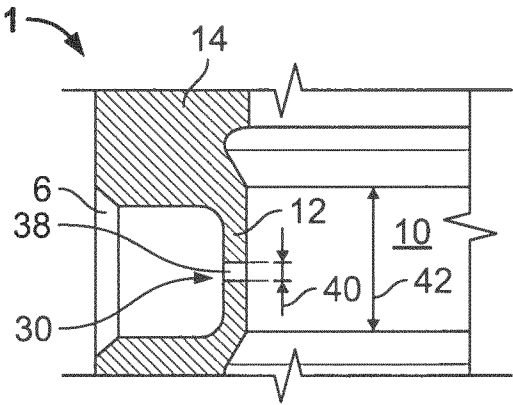


Fig. 5

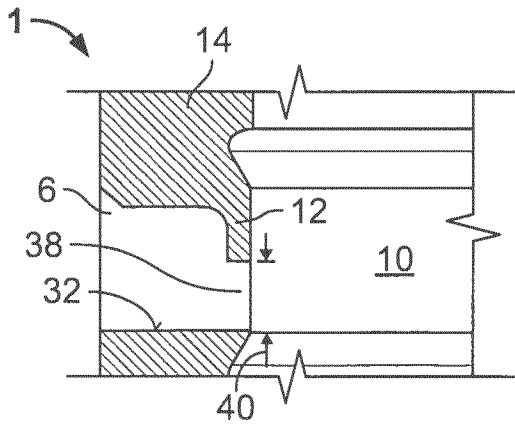


Fig. 6

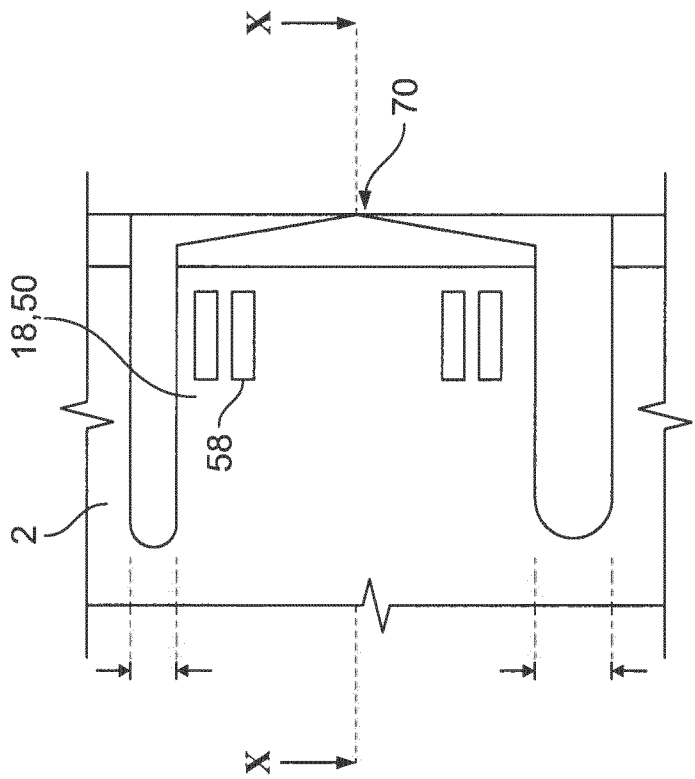


Fig. 9

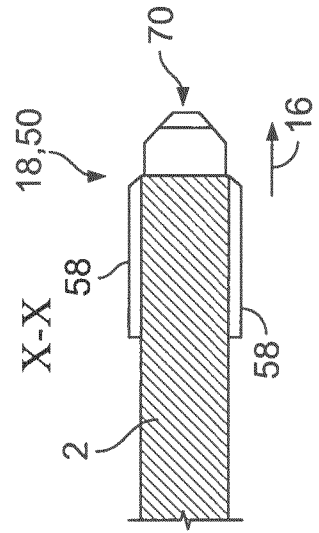


Fig. 10

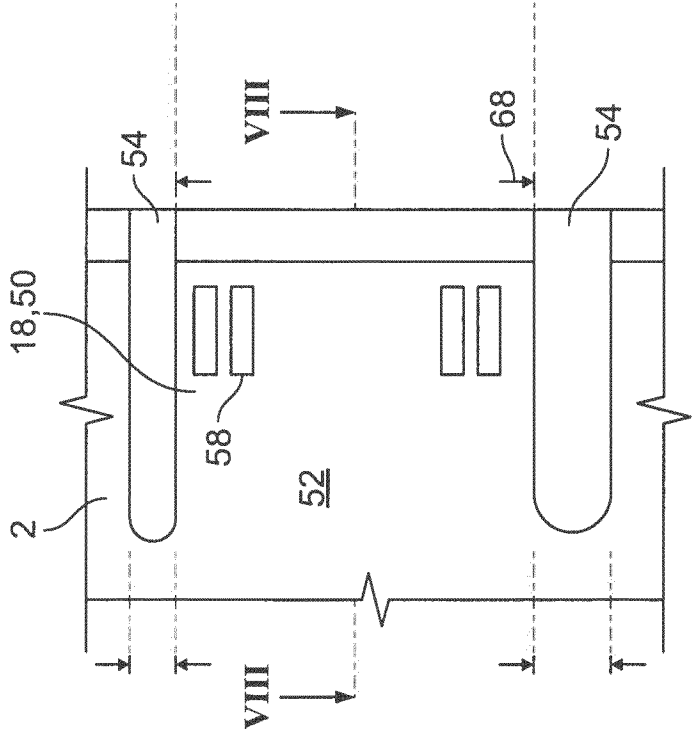


Fig. 7

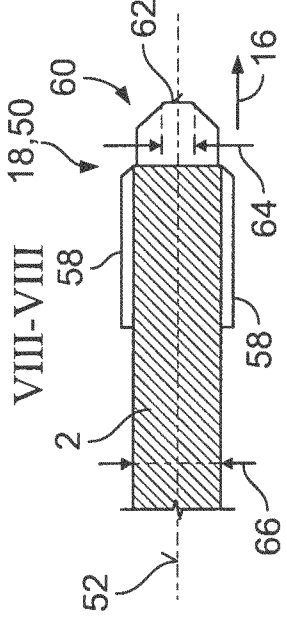


Fig. 8

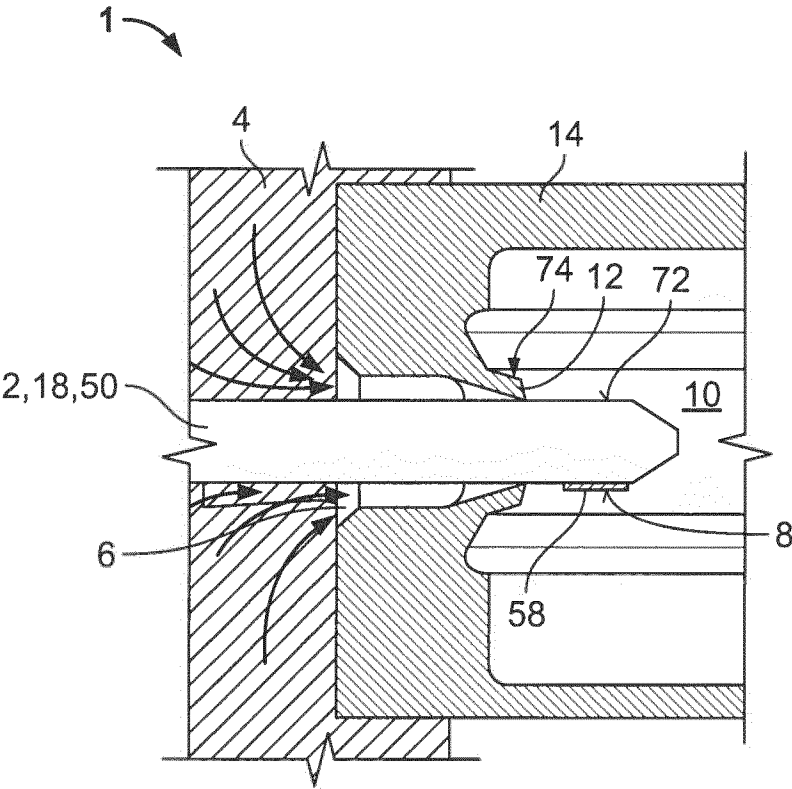


Fig. 11

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/059060

A. CLASSIFICATION OF SUBJECT MATTER
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ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01R H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 795 354 A (OWEN ALEX F [US]) 3 January 1989 (1989-01-03)	1-3,6-15
Y	figure 3	4,5
Y	----- US 3 456 232 A (DUPRE HENRY P) 15 July 1969 (1969-07-15) line 38 - column 2, line 63; figure 3	4,5
A	----- US 5 909 915 A (OKUDA HIROSHI [JP]) 8 June 1999 (1999-06-08) figure 5	1-15
A	----- US 5 244 840 A (KODAI SHOJIRO [JP] ET AL) 14 September 1993 (1993-09-14) figure 3B	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

31 May 2017

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/059060

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4795354	A	03-01-1989	NONE
US 3456232	A	15-07-1969	GB 1188244 A 15-04-1970 US 3456232 A 15-07-1969
US 5909915	A	08-06-1999	JP H0722722 A 24-01-1995 US 5909915 A 08-06-1999
US 5244840	A	14-09-1993	NONE