(19) Europäisches Patentamt
European Patent Office
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(11) **EP 4 016 754 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.06.2022 Bulletin 2022/25

(21) Application number: **20461597.5**

(22) Date of filing: **17.12.2020**

(51) International Patent Classification (IPC):
H01R 13/422 *(2006.01)* ***H01R 13/52*** *(2006.01)*
H01R 13/03 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H01R 13/03; H01R 13/4226; H01R 13/521;
H01R 2201/26

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(54) AN ELECTRICAL CONNECTOR CONTACT, AN ELECTRICAL CONNECTOR HOUSING AND AN ELECTRICAL CONNECTOR

(57) The object of the invention is a contact for providing an electrical connection at an electrical connector, comprising:
- a projection intended to block longitudinal movement of the contact by resting the projection on an edge cooperating therewith of the housing opening intended for the contact,
- a first narrowing with a seal embedded therein,
- a second narrowing, intended to snap-fit the contact in the opening of the housing intended for the contact, by snapping latches located in the opening of the housing and cooperating with the second narrowing,
characterised in that said elements are present in the contact in the following order from the side intended for connecting the contact with the electric conductor:
the projection,
the first narrowing with the seal embedded therein,
the second narrowing.

The object of the invention is also an electrical connector housing and an electrical connector itself.

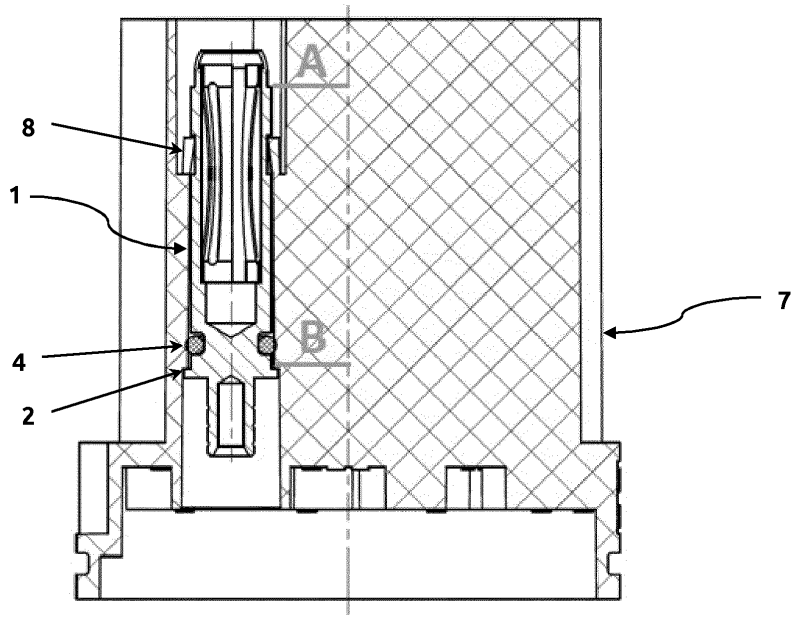

Fig. 2

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Description

[0001] The object of the invention is a contact for providing an electrical connection in an electrical connector, an electrical connector housing, and an electrical connector.

[0002] Publication CN210040659U shows an automotive charging gun that comprises a gun head equipped with multiple openings. One end of the contact is inserted into an appropriate socket, through a contact-mounting opening, and the other end is connected to the wires of the electrical connector. The first contact-mounting portion is positioned on the side wall of the mounting opening of the pins of the contact housing and the second one is positioned on the outer surface of the contacts, the second mounting portion being mated with the first mounting portion to restrict axial movement of the contacts within the contact housing. The pin of the charging gun is rigidly fixed and not easy to loosen, the charging stability is better and the service life is extended. The contacts according to this invention have one recess (no. 23, closer to the free end of the contacts) and two protrusions (no. 22) in the form of peripheral projections. The tightness of the joint is achieved with a seal (no. 6) in the recess 23, and the protrusions 22 and a gap (no. 21) between them ensure the fixing of the contacts by an element (no. 32) - which gives the following sequence of elements starting from the free end of the contacts: first, the seal 6 around the contacts, then, mounting elements 21, 22. The purpose of this design is to prevent water and dust from entering the connector at the front of the plug.

[0003] Another Chinese utility model CN210379629U discloses an electrical connector for cars in which contacts have at least two narrowings used to immobilise them. In contrast, neither of the narrowings is provided with sealing means. The watertight properties of the electrical connector are achieved by using a seal on the outside of the entire connector.

[0004] Chinese utility model CN209709269U discloses a car charging plug with good water tightness, having multiple openings into which first ends of contacts are inserted while the other ends of the contacts are connected with conductive wire conductors. The contacts are mounted in a rubber core located in the gun head. The said contacts have at least two recesses (no. 21 and 23), wherein in the recess 21 a seal (no. 22) is placed, and thus the recess 21 is used to make the device watertight, and the recess 23 is used to snap the contacts into the housing. According to the drawings of document CN209709269U, the recess 21 with the seal 22 is closer to the contact, and then there is the recess 23. There is not any information that the order of the recesses may be different. It is explained, however, that the said order makes the connector watertight and prevents water from entering the connector from the front.

[0005] Therefore, the aim of the present invention is to ensure that the electrical connector is completely watertight and dustproof during operation and after disconnecting the connector from the socket. Water entering the interior of the plug when holding the plug in a vertical position should stop at the seals (O-rings) located on each individual contact and at the seal (O-ring) on the contact housing. In this way, after shaking the plug out, one can plug it back into the socket without fear of a short circuit.

[0006] According to the invention, a contact for providing an electrical connection at an electrical connector, comprising:

- a projection intended to block longitudinal movement of the contact by resting the projection on an edge cooperating therewith of an opening of the housing intended for the contact,
- a first narrowing with a seal embedded therein,
- a second narrowing, intended to snap-fit the contact in the housing opening intended for the contact, by snapping latches located in the opening of the housing and cooperating with the second narrowing,

is characterised in that
said elements are present in the contact in the following order from the side intended for connecting the contact with the electric conductor:

the projection,
the first narrowing with a seal embedded therein,
the second narrowing.

[0007] Preferably, its cross section is substantially circular.

[0008] Preferably, the said projection is in the form of a ring, i.e. an area of increased diameter with respect to the diameters of adjacent areas of the contact.

[0009] Preferably, the first narrowing is in the form of a ring-shaped area of a reduced diameter with respect to adjacent areas of the contact.

[0010] Preferably, the said seal is in the form of a ring, preferably of rubber, most preferably of acrylonitrile-butadiene rubber, especially with a hardness of 70 Shore (trade name: NBR 70).

[0011] Preferably, the second narrowing is in the form of a ring-shaped areaof a reduced diameter with respect to

adjacent areas of the contact.

[0012] Preferably, it is made of a material selected from the group consisting of: CuZn36Pb3 alloy (trade name: MO61z4) and CuZn40Pb2 alloy (trade name: MO58).

[0013] According to the invention, an electrical connector housing surrounding the contacts for providing an electrical connection, configured to cooperate with the contact described above, having:

- openings for contacts, provided with an edge of opening intended for the contact, which constitutes a support for the contact projection for blocking the movement of the contacts along the opening of the housing;

- two or more latches placed inside the housing opening intended for the contact and cooperating with the second narrowing of the contact.

[0014] Preferably, the said openings are circular in cross-section.

[0015] Preferably, it has at least two latches, and preferably three latches, inside the opening.

[0016] Preferably, it has seven openings arranged in the same circle, preferably three latches in each said opening, which are positioned at an angular distance of 135°, 90°, and 135° from each other.

[0017] Preferably, it has fifteen openings arranged on two concentric circles, preferably ten openings on the outer circle, five openings on the inner circle, preferably three latches are positioned at an angular distance of 135°, 90° and 135° from each other in each opening located on the outer circle, while in each opening located on the inner circle, three latches are positioned at 120° from each other.

[0018] Preferably, it is made of plastic, in particular of reinforced polyamide with a glass fibre content in the amount of 30%. A particularly preferred material is reinforced polyamide 6 with a glass fibre content in the amount of 30% (trade name: PA6+30GF).

[0019] According to the invention, an electrical connector including the contacts described above, placed in the housing described above.

[0020] The invention will now be described in greater detail in preferred embodiments, with references to the attached drawings, in which:

Fig. 1	shows a general view of a contact according to the invention in an embodiment,
Fig. 2	shows a cross-section of a contact housing according to the invention in an embodiment, with the contact positioned in one of respective openings of the housing,
Figs. 3 (a, b, c)	show a side view of exemplary contacts according to the invention, having various diameters: a - smallest diameter, c - largest diameter;
Fig. 4	shows an enlarged detail B of the contacts of Fig. 3 a, b, c,
Fig. 5 (a, b)	shows the housing according to the invention with fifteen openings, in top view (a) and in cross-section A-A (b),
Fig. 6 (a, b)	shows the housing according to the invention with seven openings, in top view (a) and in cross-section A-A (b),
Fig. 7	shows a general view of an electrical connector according to the invention in an embodiment,
Fig. 8 (a, b, c)	show the process of inserting contacts into the housing openings - on the example of a housing with seven openings, and
Fig. 9	shows schematically an exemplary arrangement of latches in the openings of the housing, in particular the openings on the outer circle of the housing with fifteen openings.

[0021] The following designations are used in the drawings: 1 - contact; 2 - projection, 3 - first narrowing, 4 - seal, 5 - second narrowing, 6 - opening, 7 - housing, 8 - latch.

Preferred embodiment of the invention

[0022] In the preferred embodiment, a pin 1 for providing an electrical connection in an electrical connector has:

- a projection 2,
- a first narrowing 3 with a seal 4 embedded therein,
- a second narrowing 5,

the order of these elements from the side intended to connect the contacts 1 to the electric conductor being as follows:

1) the projection 2;
2) the first narrowing 3 with the seal 4 embedded therein;
3) the second narrowing 5.

[0023] In the preferred embodiment, the contact 1 is mounted in a housing 7 from below (Fig. 2). Its specific position is ensured by several elements (Fig. 3 - Fig. 6). In each opening 6 of the housing 7, regardless of whether it is a housing with fifteen openings or seven openings, there are three latches 8 that snap onto the second narrowing 5 when the contact 1 is at an appropriate depth in the opening 6. In other words, when inserting the contact 1 into the opening 6, it is guided in an opening with a slightly greater transverse dimension than the dimension of the contact 1, then, when the edge A of the contact 1 (Fig. 2) touches the latches 8, it begins to spread/widen them. When inserting the contact 1 into the opening 6 deeper, the latch 8 will meet the notch/second narrowing 5 in the contact 1. At this point, the elastically deformable latches 8 from the housing 7 will want to return to their natural position from before being "spread" and will lock onto the edge of the contact 1, thus blocking its upward movement. If it were the only mounting element, the contact 1 could be pushed deeper into the opening 6, while the projection 2 (Fig. 1) of the contact 1 abuts the edge of the housing opening (reference B, Fig. 2), thus preventing the contact 1 from sliding further into the opening. In this way, the contact 1 is prevented from moving along the opening 6 of the housing 7 - by blocking the contact 1 in a fixed, desired position, an up and down movement is prevented. The projection 2 is in the form of a ring, i.e. an area of increased diameter with respect to the diameters of adjacent areas of the contact 1.

[0024] The positioning (centring) of the contact 1 in relation to the opening 6 takes place by means of the projection 2 ("ring", "plate", "collar") and thanks to the three latches 8 inside the opening 6 of the housing 7. The latches 8 are not evenly distributed. In the case of the housing with fifteen openings (Fig. 5), in different openings 6, arrangement of the latches 8 is different: in ten openings on the outer circle (of larger diameter), three latches 8 are arranged inside the opening 6 circumferentially at an angular distance of 135°, 90° and 135° (Fig. 9), while each of the five openings on the inner circle (of smaller diameter) has three latches 8 distributed at 120° from each other.

[0025] In the case of the housing with seven openings (Fig. 6), each of the seven openings has three latches 8 spaced at 120° from each other.

[0026] Preferably, it is made of a material selected from the group consisting of: CuZn36Pb3 alloy (trade name: MO61z4) and CuZn40Pb2 alloy (trade name: MO58).

[0027] The housings according to the invention can preferably be made of polyamide, in particular of reinforced polyamide 6 with a glass fibre content in the amount of 30% (trade name: PA6+30GF).

[0028] The electrical connector including contacts and housings according to the invention has the following advantages: Additionally, they protect the wires inside the plug against the influence of liquids and dust, which allows the connectors to be used and serviced even in the most unfavourable weather conditions in the open air.

[0029] The connector according to the invention is applicable in the automotive industry, mainly for tractors and semi-trailers, acting as a connector between the above-mentioned elements. Functions of connectors depend on their design, and here, for example, the EBS connector controls brakes on the trailer, and the 15-pin connector and the cable adapter support the entire lighting on the trailer.

Claims

1. A contact (1) for providing an electrical connection at an electrical connector, comprising:

- a projection (2) intended to block longitudinal movement of the contact (1) by resting the projection on an edge cooperating therewith of an opening (6) of the housing (7) intended for the contact (1),
- a first narrowing (3) with a seal (4) embedded therein,
- a second narrowing (5), intended to snap-fit the contact (1) in the opening (6) of the housing (7) intended for the contact (1), by snapping latches (8) located in the opening (6) of the housing (7) and cooperating with the second narrowing (5),

characterised in that
said elements are present in the contact (1) in the following order from the side intended for connecting the contact

(1) with the electric conductor:

the projection (2),
the first narrowing (3) with the seal (4) embedded therein,
the second narrowing (5).

2. The contact according to claim 1, **characterised in that** its cross section is substantially circular.

3. The contact according to claim 1 or 2, **characterised in that** said projection (2) is in the form of a ring, i.e. an area of increased diameter with respect to the diameters of adjacent areas of the contact (1).

4. The contact according to claim 1, 2 or 3, **characterised in that** the first narrowing (3) is in the form of a ring-shaped area of a reduced diameter with respect to adjacent areas of the contact (1).

5. The contact according to any of the preceding claims, **characterised in that** said seal (4) is in the form of a ring, preferably of rubber or of acrylonitrile-butadiene rubber, especially with a hardness of 70 Shore.

6. The contact according to any of the preceding claims, **characterised in that** the second narrowing (5) is in the form of a ring-shaped area of a reduced diameter with respect to adjacent areas of the contact (1).

7. The contact according to any of the preceding claims, **characterised in that** it is made of a material selected from the group consisting of: CuZn36Pb3 alloy and CuZn40Pb2 alloy.

8. An electrical connector housing (7) surrounding the contacts (1) for providing an electrical connection, configured to cooperate with the contact (1) according to any of the preceding claims, having:

- openings (6) for the contacts (1), provided with an edge of the opening (6) intended for the contact (1), which constitutes a support for a projection (2) of the contact (1), for blocking the movement of the contacts (1) along the opening (6) in the housing (7);
- two or more latches (8) placed inside the opening (6) of the housing (7) intended for the contact (1) and cooperating with the second narrowing (5) of the contact (1);

9. The housing according to claim 8, **characterised in that** the said openings (6) are circular in cross-section.

10. The housing according to claim 8 or 9, **characterised in that** it has at least two latches (8), and preferably three latches (8), inside the opening (6).

11. The housing according to claim 8, 9 or 10, **characterised in that** it has seven openings (6) arranged in the same circle, preferably three latches (8) in each said opening (6), which are positioned at an angular distance of 135°, 90°, and 135° from each other.

12. The housing according to claim 8, 9 or 10, **characterised in that** it has fifteen openings (6) arranged on two concentric circles, preferably ten openings (6) on the outer circle, five openings (6) on the inner circle, preferably three latches (8) are positioned at an angular distance of 135°, 90° and 135° from each other in each opening located on the outer circle, while in each opening (6) located on the inner circle, three latches (8) are positioned at 120° from each other.

13. The housing according to any of claims 8 to 12, **characterised in that** it is made of plastic, in particular of reinforced polyamide with a glass fibre content in the amount of 30%.

14. An electrical connector including the contacts according to any of claims 1 to 7, housed in the housing according to any of claims 8 to 13.

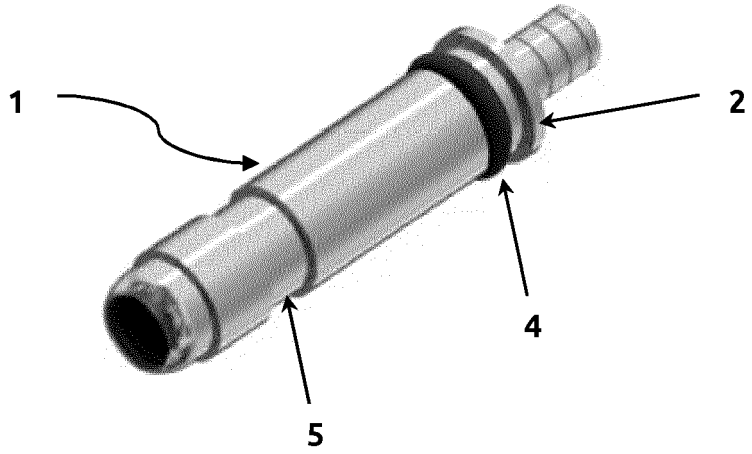


Fig. 1

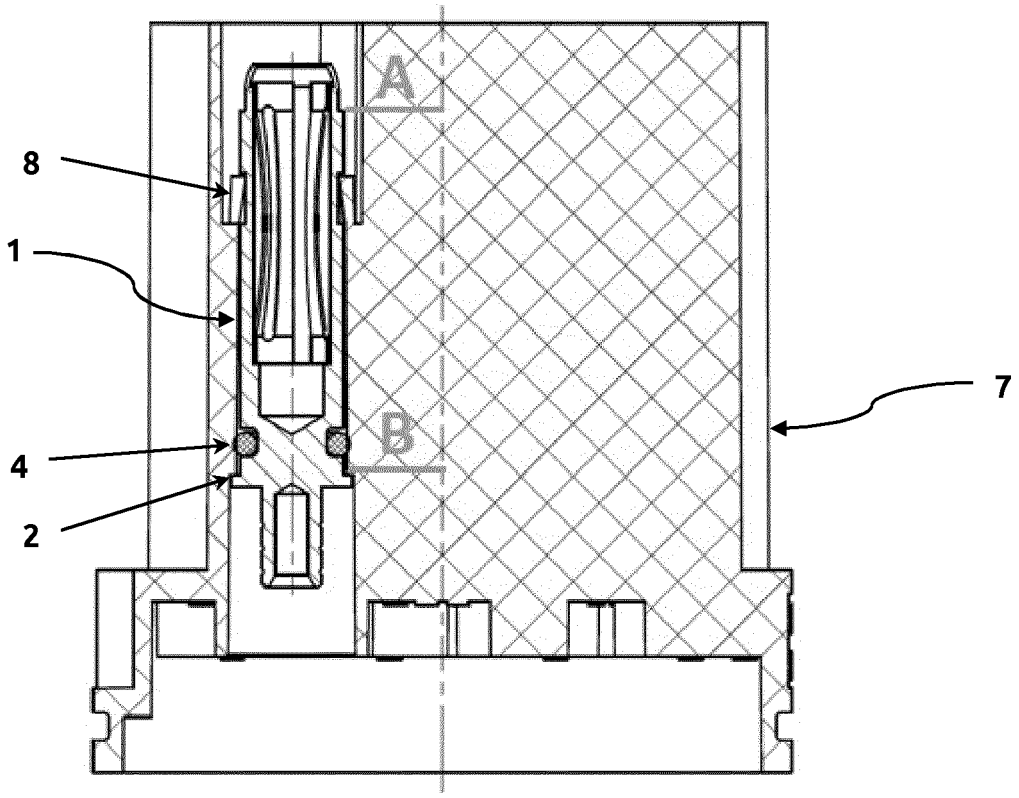


Fig. 2

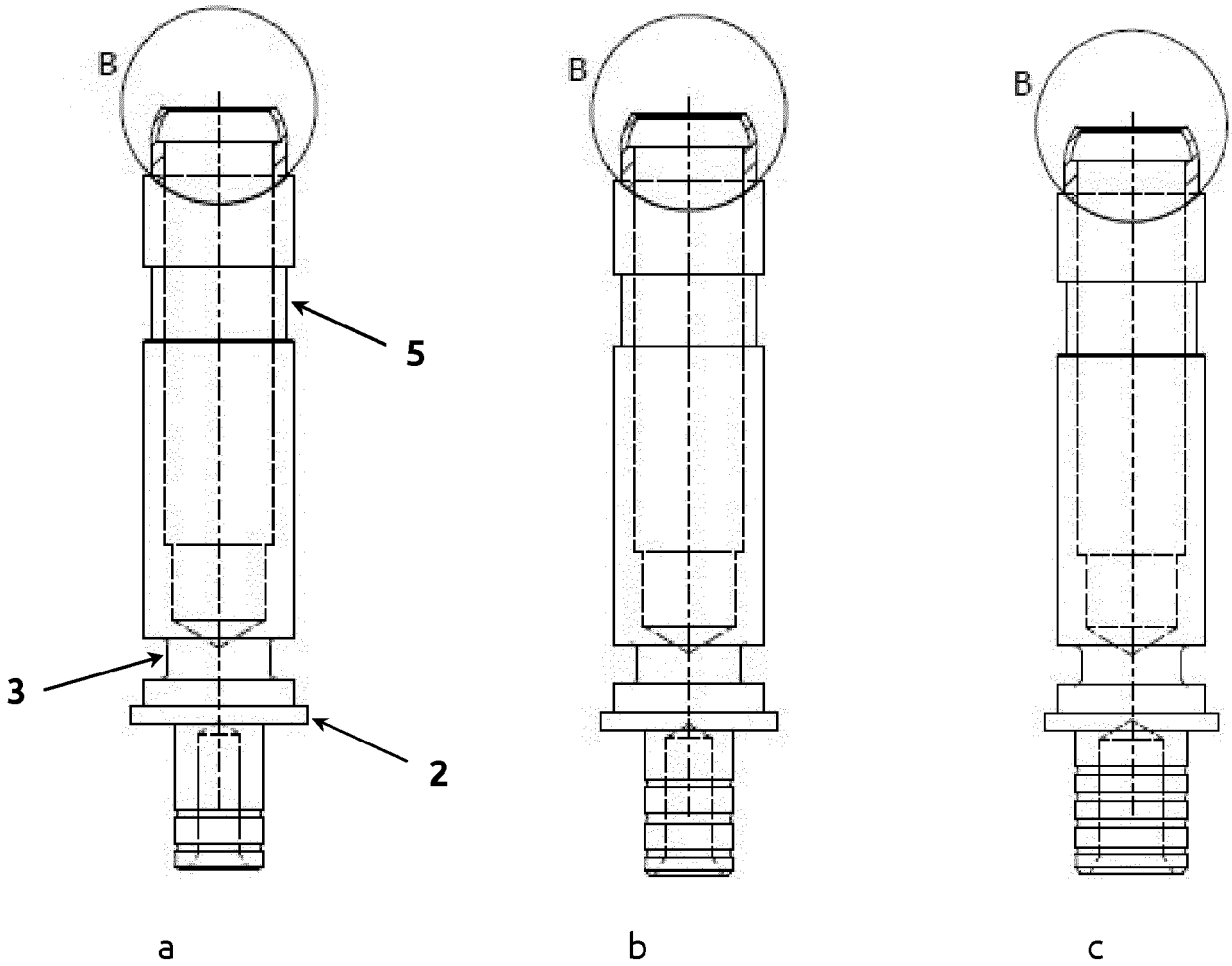
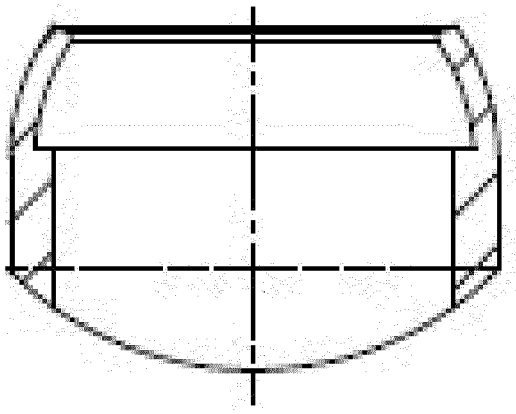
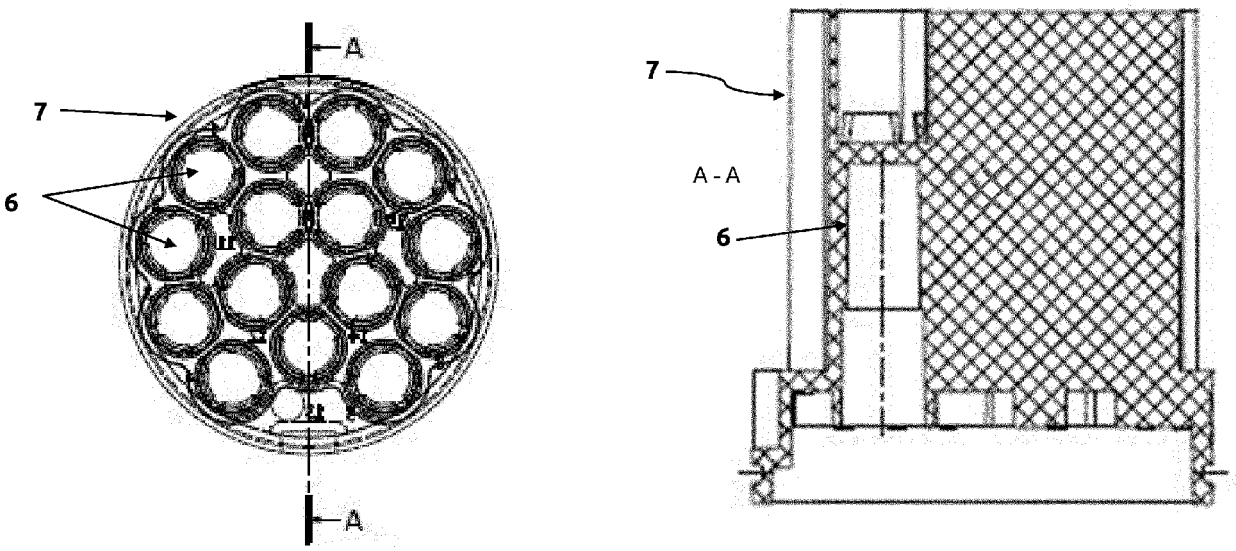


Fig. 3



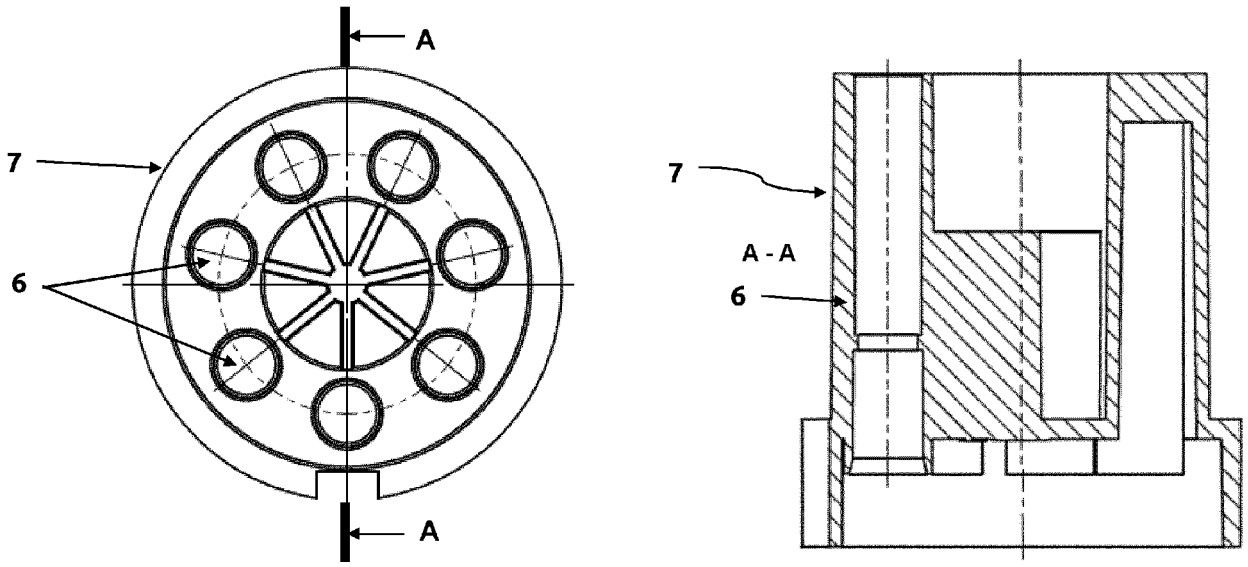
B

Fig. 4



a b

Fig. 5



a b

Fig. 6

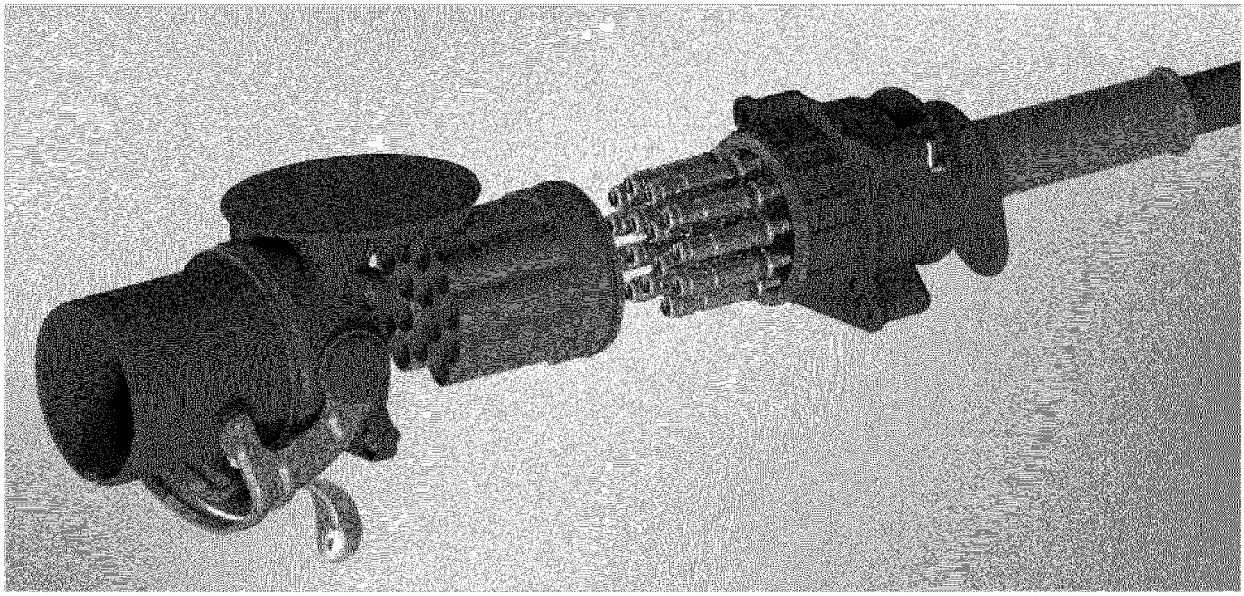


Fig. 7

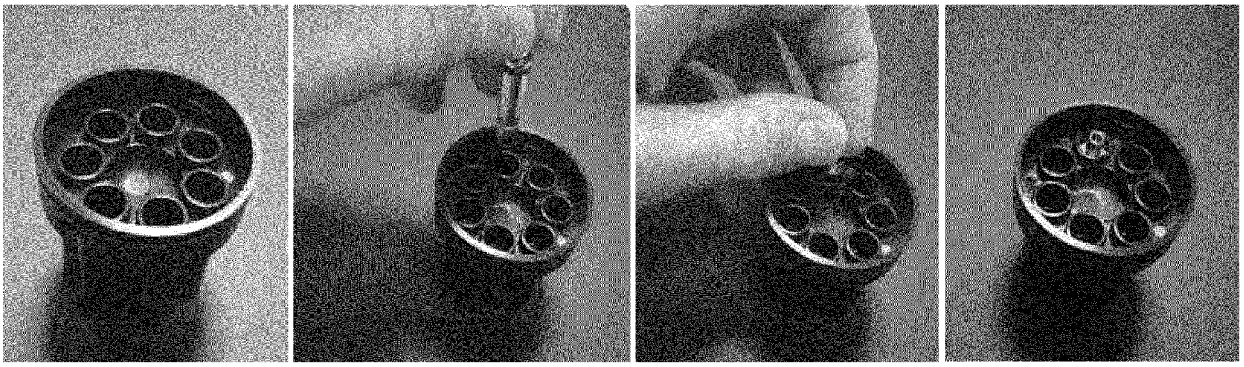


Fig. 8

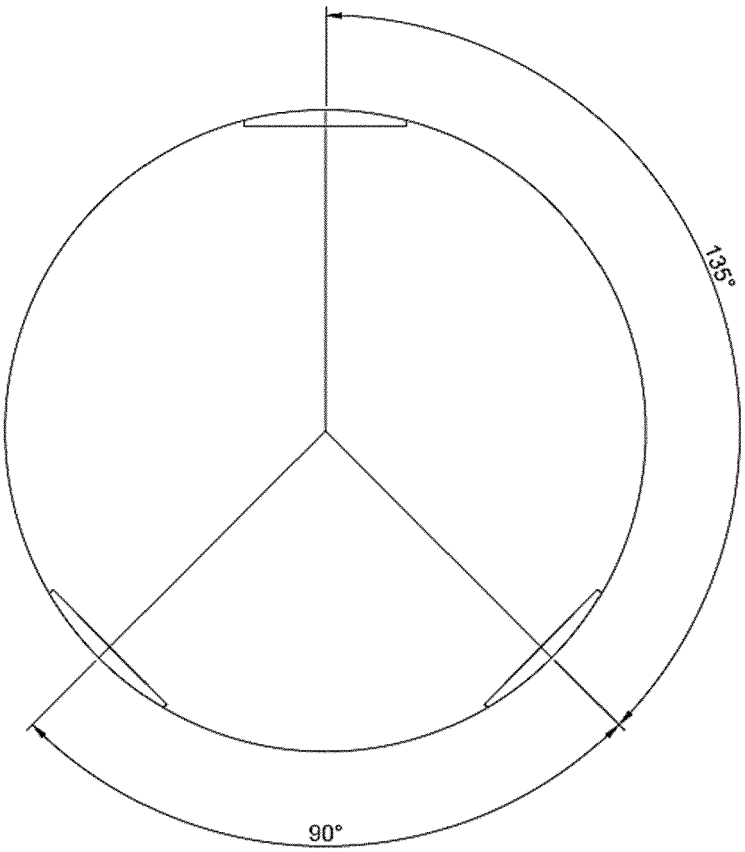


Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 20 46 1597

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 20 2019 101871 U1 (APPBAU KIRCHHEIM TECK GMBH [DE]) 11 April 2019 (2019-04-11) * the whole document *	1-14	INV. H01R13/422 H01R13/52 H01R13/03
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X	EP 2 362 495 A1 (SUMITOMO WIRING SYSTEMS [JP]) 31 August 2011 (2011-08-31) * the whole document *	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 April 2021	Gomes Sirenkov E M.

CATEGORY OF CITED DOCUMENTS

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29-04-2021

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