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(71) Applicant: **TYCO ELECTRONICS AMP GMBH**
[DE/DE]; Amperestrasse 12-14, 64625 Bensheim (DE).

(72) Inventors: **REINHARDT, Marc**; Knodener Str. 7, 64625 Bensheim (DE). **FLITTNER, Frank**; Erlenweg 5, 64665 Alsbach-Haehnlein (DE).

(74) Agent: **HEINZ-SCHAEFER, Marion**; Tyco Electronics Services GmbH, c/o TE Connectivity Solutions GmbH, Amperestrasse 3, CH-9323 Steinach (CH).

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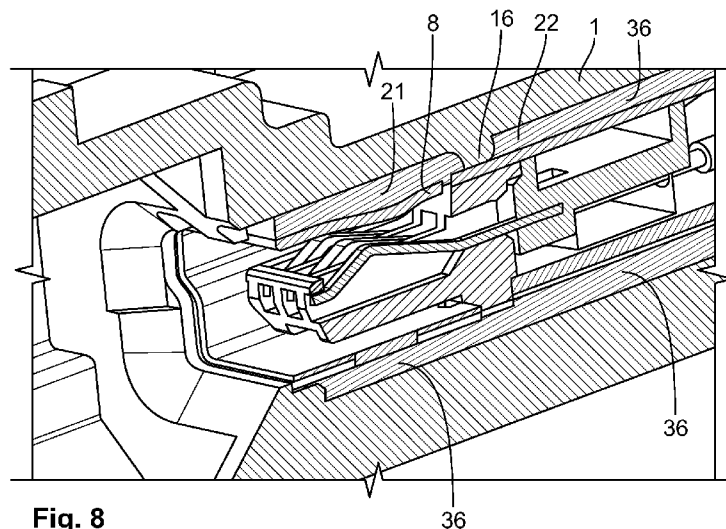


Fig. 8

(57) Abstract: Electrical connector having a housing which has a contact space having a front opening and a rear opening, an electrical contact housing being arranged in the contact space, the contact housing having at least one electrical contact which is connected to an electrical line and which extends into the housing via the rear opening, there being arranged in an intermediate space between the contact housing and the housing an intermediate component which mechanically connects the contact housing to the housing, characterised in that the housing has a sealing rib which protrudes into the intermediate space and which abuts the contact housing, the sealing rib delimiting at least a front portion of the intermediate space from a rear portion of the intermediate space, the intermediate component being arranged in the rear portion of the intermediate space.

Description

Electrical connector having a seal

- 5 The invention relates to an electrical connector according to patent claim 1.

In the prior art, it is known from US 2006/0154516 A1 to injection-mould plastics material around an electrical
10 connector and thereby reliably and securely to assemble the electrical lines on a housing of the connector. In addition to the mechanical securing, sealing with respect to moisture is also an important aspect. To this end, an inner space of the housing is filled with plastics material. To this end,
15 the plastics material is injected at a rear side both into the housing and onto the electrical line at the output of the housing. So that a contact region of the connector which is arranged on a front side of the connector is not filled with the plastics material, there are provided sealing elements
20 which are secured to the electrical line and are pushed into the housing with the line. The seals seal the space between the electrical lines and the housing so that the plastics material cannot flow from a rear region into the front insertion region.

25

EP 2 348 585 A2 discloses a cable connector in which the electrical lines are inserted into a connector housing of the cable connector, sealing elements subsequently being inserted between the electrical lines and the connector housing.

- 30 Plastics material is subsequently injected at the rear side into the intermediate space between the connector housing and the cable. The sealing elements prevent the plastics material from being able to reach the front insertion region.

An object of the invention is to provide an improved electrical connector whose housing is sealed with an intermediate component, the connector being intended to be
5 produced in a simple and cost-effective manner.

The object of the invention is achieved by the connector according to patent claim 1.

10 Other advantageous embodiments of the invention are set out in the dependent claims.

An advantage of the electrical connector is that secure and reliable sealing between a rear portion of the housing and a
15 front portion of the housing is achieved. In the rear portion of the housing a material is introduced. The introduced material is hardened and constitutes an intermediate component which mechanically connects a contact housing to a housing of the electrical connector and additionally seals
20 the intermediate space. The rear portion is divided from the front portion by a sealing rib which is formed on the housing and which protrudes into an intermediate space between the housing and the contact housing and abuts the contact housing. Owing to the formation of the sealing rib on the housing of
25 the connector, precise positioning of the boundary between the front portion and the rear portion is achieved. In addition, secure sealing between the sealing rib and the housing is enabled owing to the single-piece construction of the sealing rib with the housing. Furthermore, the mechanical
30 stability is improved since the sealing rib is constructed integrally with the housing of the connector. In addition, the assembly of the electrical connector is simplified since the contact housing with the electrical lines only has to be

inserted into the contact space of the connector and the intermediate space in the rear portion can be subsequently filled with the material. Positioning of the sealing rib is not necessary.

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In an embodiment of the electrical connector, the contact housing has a contact flap which is arranged in the front portion of the intermediate space. Since no intermediate component is formed in the front portion of the connector,
10 the intermediate space which has not been filled is available for the contact flap to move resiliently from the contact housing into the intermediate space when a contact is inserted. This region of the intermediate space is not impaired by being filled with material since the material is
15 introduced only in the rear portion of the housing.

In another embodiment, the sealing rib is constructed in such a manner that the sealing rib delimits at least a front part-region of a side wall of the contact housing from a rear
20 portion. In this manner, it is ensured that a front part-region of a side wall of the contact housing is not filled with material. Consequently, it is possible to fill other side walls of the contact housing with the material and consequently to achieve reliable and stable mechanical
25 securing of the contact housing in the housing. In addition, sealing is also achieved over a large surface-area, in particular with respect to dust, dirt and moisture.

In another embodiment, the contact housing has four side
30 faces, the contact flap being formed from one of the side faces. In this embodiment, the sealing rib is constructed in such a manner that the sealing rib rests on the side face of the contact housing, on which side face the contact flap is

also formed. Since the sealing rib rests only on one side face, reliable sealing with respect to the penetrating material is achieved.

5 In another embodiment, the sealing rib is constructed with a U-shaped contour and rests in the U-shaped contour on the side face of the contact housing. The U-shape of the sealing rib has a secure and reliable sealing of the rear portion of the front portion. In this embodiment, the material can
10 further be applied to the other three side faces of the contact housing.

In another embodiment, a front opening of the housing has four sides, a lower abutment face for the contact housing
15 being formed on a lower side. The contact housing rests with a front edge of the lower side face on the lower abutment face. In addition, a lateral abutment face is formed on each of the two lateral sides of the front opening of the housing. The contact housing is in abutment with lateral front edges
20 against the lateral abutment faces of the housing. In addition, the housing has an edge sealing rib in the transition from the lateral abutment faces to the upper side of the front opening, respectively. In this manner, reliable positioning of the contact housing in a precisely fixed end
25 position is achieved. In addition, owing to the provision of the abutment faces and the lateral edge sealing ribs, secure and reliable sealing is achieved between the contact housing and the housing of the connector so that no material can flow out of the front opening.

30

In another embodiment, the material is introduced into the connector and hardened to form an intermediate component in such a manner that the intermediate component is in abutment

against a lower face and the two side faces of the contact housing. Consequently, the contact housing is surrounded on three sides by the intermediate component as far as a front end region. Consequently, secure mechanical fixing of the contact housing in the housing is achieved. Good sealing of the front portion with respect to the penetration of moisture, dirt or dust is thereby achieved. This is advantageous since electrical contacts of the lines are exposed in the front portion.

10

In another embodiment, the assembly of the contact housing in the housing of the connector is simplified by the housing having guide rails which are arranged outside the front portion of the intermediate space delimited by the sealing rib. Consequently, when the contact housing is inserted, guiding of the contact housing is already achieved before the contact housing passes over the sealing rib. Consequently, tilting of the contact housing or damage to the sealing rib is prevented. In addition, precise orientation of the contact housing with respect to the sealing rib in the end position is achieved. A secure and reliable sealing function of the sealing rib is thereby ensured.

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In another embodiment, in an initial region, the cross-section of the guide rail increases in the direction towards the front opening. Gentle receiving of the contact housing on the guide rail is consequently enabled.

30

In another embodiment, the guide rail merges into the sealing rib and also continues in the front portion of the intermediate space delimited by the sealing rib. Consequently, further stabilising of the contact housing is also enabled during insertion into the contact space after the sealing rib

has been passed over. Both the position of the contact housing is thereby fixed in a precise manner and the assembly of the contact housing when the sealing rib is passed over is supported in such a manner that the sealing rib is not damaged.

The invention is explained in greater detail below with reference to the Figures, in which:

Figure 1 is a schematic illustration of a contact housing and a connector,

Figure 2 is an enlarged view of the contact housing,

Figure 3 shows a contact housing which is assembled in the connector housing,

Figure 4 is a partial cross-section in a viewing direction towards an upper region of the housing and the sealing rib,

Figure 5 is a partial cross-section of an upper region of the connector housing in a viewing direction towards the sealing rib and guide rails,

Figure 6 is a partial cross-section of the contact housing in the upper region in a viewing direction towards an edge sealing face,

Figure 7 is a partial cross-section of the connector with the contact housing assembled and intermediate component injected,

Figure 8 is a detailed view of the illustration of Figure 7

in a viewing direction towards the sealing rib,

Figure 9 is a schematic cross-section of the cross-section A-A of Figure 7.

Figure 1 is a perspective view of a housing 1, which has a rear opening 4 and a contact space 2 which is formed in the housing 1. In addition, the housing 1 has a front opening 3 which cannot be seen in the view illustrated. The housing 1 is produced from an electrically insulating material, for

example, a synthetic material, in particular plastics material. There is illustrated in a preassembly position a contact housing 5 which is arranged in front of the rear opening 4. The contact housing 5 is connected to electrical lines 6 of a cable 7. The electrical lines 6 are connected to non-visible electrical contacts of the contact housing 5. The cable 7 is secured to the contact housing 5 by means of a tension relief means 9 formed on the contact housing 5. Furthermore, the contact housing 5 has at an upper side wall 10 three contact flaps. The contact housing 5 is produced from an electrically conductive material, for example, a metal sheet. The contact flaps 8 are constructed as portions of the upper side wall 10. The contact flaps 8 serve to electrically contact another connector inserted into the contact housing 5.

Figure 2 is an enlarged view of the contact flaps 8. When an associated contact is inserted, the contact flaps 8 move resiliently upwards out of the plane of the upper side wall 10. In the embodiment illustrated, the contact housing has three contact flaps 8, a central contact flap being wider than the lateral contact flaps. In addition, a free end of the central contact flap is directed in the direction towards a centre of the contact housing, free ends of the lateral contact flaps facing in the direction towards a front edge 11 of the contact housing 5.

Figure 3 is a cross-section of the housing 1, in the contact space 2 of which the contact housing 5 is located in an assembly position. A front edge 11 of the contact housing 5 is guided as far as an edge region 12 of the front opening 3 of the housing 1. The edge region 12 has a lower abutment face 13 on which a lower part-region of the front edge 11 of

the contact housing 5 rests. In addition, the edge region 12 has a lower front abutment face 14, which the front edge 11 of the contact housing abuts at the end face. In this manner, the assembly position of the contact housing 5 is fixed. The edge region 12 also has lateral front abutment faces which lateral portions of the front edge 11 of the contact housing 5 abut at the end face.

The contact housing 5 rests on guide rails which cannot be seen and is arranged with spacing from the housing 1 in the contact space 2. Consequently, an intermediate space 15 is formed between the housing 1 and the contact housing 5 at all four sides of the contact housing 5. The housing 1 has a sealing lip 16 which is illustrated in cross-section in Figure 3 and which is in abutment with an upper side face 16 of the contact housing 5. The sealing rib 16 constitutes a web which is formed on an inner side of the housing 1. The sealing rib 16 separates a front portion 21 of the intermediate space 15 from a rear portion 22 of the intermediate space 15. The rear portion 22 of the intermediate space 15 is provided to be filled with a material, in particular a moulding material, such as, for example, a PVC, a hot-melt adhesive or a plastics material.

In the cross-sectional illustration of Figure 3, a retention element 18 for electrical contacts 19 of the contact housing 5 is arranged inside the contact housing 5. The electrical contacts 19 are connected to conductors of the electrical lines 6. The electrical contacts 19 are directed in the direction towards the front opening 3 of the housing 1 in order to contact an electrical contact of the additional connector. Inside the contact housing 5, a sealing material is introduced between the contact 19 and a connection side

via which the lines are supplied. The sealing material seals the inner space of the contact housing with respect to the infiltration of moisture or dirt and serves to fix the cable in the manner of a tension relief system. The contact housing
5 5 may, for example, constitute a USB connector, in particular a mini-USB connector.

Figure 4 is a perspective sectioned view of a cross-section according to Figure 3, in a viewing direction from the front
10 from below in the direction towards a lower side of the upper side wall 10 of the contact housing 5. In this view, a left-hand side of the edge region 12 of the housing 1 can be seen from the front, at the inner side of which a lateral abutment face is formed. A left-hand side of the front edge 11 of the
15 contact housing 5 is in abutment with the lateral abutment face at the end face. An upper edge region 12 of the front opening 3 is not constructed in a continuous manner, but instead there are provided only abutment projections 20, only one of which can be seen in Figure 4. An upper portion of the
20 front edge 11 of the contact housing 5 is in abutment with the abutment projection 20. In Figure 4, the abutment of a lower region of the front edge 11 against the lower abutment face 13 can be seen clearly. In addition in Figure 4, the delimitation of the front portion 21 from the rear portion 22
25 by the sealing rib 16 can be seen. Furthermore, the arrangement of the contact flaps 8 in the region of the front portion 21 can be seen. In this illustration, the intermediate space 15 between the housing 1 and the contact housing 5 is also not yet filled with material.

30 Figure 5 is a front cross-section in a viewing direction towards an inner upper side 43 of the housing 1 which delimits the contact space 2 in an upward direction. Two

abutment projections 20 can be seen in the region of the front opening 3. In addition, there are arranged at opposing side faces 41, 42 of the contact space 2 a first and a second lateral guide rail 23, only the first guide rail 23 being
5 visible. The first and the second guide rail 23 serve to centrally orientate the contact housing 5. In addition, a third and fourth guide rail 25, 26 are arranged at the upper side of the contact space 2. The third and fourth guide rails 25, 26 are arranged parallel with each other and extend
10 parallel with the side faces 41, 42 of the contact space 2. In an initial portion 27, the third and fourth guide rails 25, 26 have in the direction towards the front opening 3 a thickness which increases in the direction towards the contact space 2. The sealing rib 16 is further formed on the
15 upper side 43 of the contact space 2. In the embodiment illustrated, the sealing rib 16 is constructed in a substantially U-shaped manner. The sealing rib 16 has two portions 28, 29 which are arranged in a parallel manner and which are arranged at opposing sides of the upper side of the
20 contact space 2. The two portions 28, 29 are guided as far as the edge region 12 of the front opening 3. The two portions 28, 29 are connected to each other in a rear region by means of a third sealing portion 30 which is arranged transversely. In the embodiment illustrated, the third portion 30 is
25 constructed in a stepped manner, part-portions 31, 32 being arranged closer to the front opening 3 than a central part portion 33. Depending on the embodiment selected, the third portion 30 may also be constructed in the form of a continuous straight line. In addition, in the embodiment
30 illustrated, the third and fourth guide rails 25, 26 are guided by the sealing rib 16 as far as the front portion 21 and as far as the abutment projections 20. The provision of

the third and fourth guide rails 25, 26 in the front portion 21 provides increased stability for the contact housing 5.

Depending on the embodiment selected, it is possible to

dispense with the formation of the third and fourth guide

5 rails 25, 26 inside the sealing rib 16. In addition, in

another embodiment, the sealing rib 16 may also be

constructed as an annularly extending sealing rib which is

formed on all four sides of the contact space 2. In another

embodiment, the sealing rib 16 may be constructed in such a

10 manner that the first and the second portions 28, 29 are

arranged on the opposing side faces 41, 42 of the housing 1.

In the embodiment illustrated in Figure 5, the front portion

21 is formed only on the inner upper side 43 of the housing 1

15 and consequently only on an upper side wall of an assembled

contact housing. Depending on the embodiment of the sealing

rib 16 selected, the front portion 21 may also be formed in

the region of the side faces 41, 42 of the contact housing 5

or on all four sides of the contact housing 5. The smaller

20 the front portion 21 is, the better the sealing and the

mechanical securing of the contact housing 5 in the housing 1

become. This is the case because the rear portion 22 is

filled with a material and the material hardens to form an

intermediate component between the housing 1 and the contact

25 housing 5.

Figure 6 is a view from the contact space 2 in the direction

towards the inner upper side of the housing. At the first

side face 41 of the housing 1, the first guide rail 23 is

30 formed and extends as far as the front edge region 12.

Between the second portion 29 of the sealing rib 16 and a

front end of the first guide rail, there is formed an edge

sealing rib 34 which extends from the sealing rib 16 as far

as the second guide rail 24. The edge sealing rib 34 has a rounded inner contour to which a rounded outer contour of a corner region of the contact housing is adapted so that relatively little intermediate space is provided between the edge sealing rib 34 and the corner region of a mounted contact housing. The rear portion 22 is formed adjacent to the edge sealing rib 34. Owing to the provision of the edge sealing rib 34, improved sealing of the rear portion 22 is achieved. Owing to the edge sealing rib 34, material which is introduced in the rear portion 22 cannot flow or can flow only insignificantly in the direction towards the front opening 3 owing to the narrow gap between the edge sealing rib 34 and the contact housing 5. A corresponding edge sealing rib is also formed symmetrically at the opposing side. There can further be seen in Figure 6 a part-portion 35 of the front abutment face 14 which a corner region of the contact housing 5 abuts. The part-portion 35 is constructed in a curved manner around the corner portion between the inner upper side 43 and the first side face 41 of the housing 1.

In order to produce the connector, in the arrangement of Figure 3 material is now introduced from the rear, in particular injected. There is thereby formed in the rear portion 22 an intermediate portion 36 between the contact housing 5 and the housing 1. The contact space 2 is filled at the rear side and a reinforcement portion 37 is formed in the region of the rear opening 4 of the housing 1 and the cable 7. The reinforcement element 37 serves to ensure that the cable cannot be excessively bent and cannot be damaged in the region of the rear opening 4.

Figure 7 shows the connector with a filled rear portion 22, the introduced material having hardened to form an intermediate component 36. The intermediate component 36 is formed in the rear portion 22 of the intermediate space and also in the additional region of the rear opening 4 of the contact space 2. The contact housing 5 is filled with the additional material so that the material cannot enter the region of the contacts 19 in the contact housing 5 during the filling operation.

Figure 8 clearly shows that the intermediate component 36 terminates at the sealing rib 16 and the front portion 21 is free from the intermediate component.

Figure 9 shows the cross-section A-A of Figure 7 in the contact region of the contact housing 5. It can clearly be seen that the intermediate component 36 is in abutment below the contact housing 5 and at the lateral regions of the contact housing 5. Only in the front portion 21 which is arranged above the upper side of the contact housing 5 in the region of the contact flaps 8 is no intermediate component 36 arranged. Stable securing of the contact housing 5 in the housing 1 is thereby achieved. Owing to the three-sided arrangement of the intermediate component, secure sealing with respect to infiltration of dust, moisture and dirt is further achieved. At a lower inner side of the housing 1, another guide rail 44 on which the contact housing 5 rests is illustrated.

The contact housing 5 constitutes a metal shielding housing for a USB socket. Depending on the embodiment selected, however, any other type of contacts or connectors can be used. Owing to the intermediate component 36, a sealing and packing

of the housing 1 with respect to the contact housing 5 at the rear side of the contact housing are achieved.

Claims

1. Electrical connector having a housing (1) which has a contact space (2) having a front opening (3) and a rear opening (4), an electrical contact housing (5) being arranged in the contact space (2), the contact housing (5) having at least one electrical contact (19) which is connected to an electrical line (6) and which extends into the housing, there being arranged in an intermediate space (15) between the contact housing (5) and the housing (1) an intermediate component (36) which mechanically connects the contact housing (5) to the housing (1), characterised in that the housing (1) has a sealing rib (16) which protrudes into the intermediate space (15) and which abuts the contact housing (5), the sealing rib (16) delimiting at least a front portion (21) of the intermediate space (15) from a rear portion (22) of the intermediate space, the intermediate component (36) being arranged in the rear portion (22) of the intermediate space (15).
2. Connector according to claim 1, wherein the contact housing (5) has a contact flap (8) which is formed on a side wall (10) of the contact housing (5), wherein the contact flap (8) moves resiliently into an intermediate space between the contact housing and the housing when another contact is mounted on the electrical connector, wherein the contact flap is arranged in the front portion (21) of the intermediate space (15) in which no intermediate component is arranged.
3. Connector according to either claim 1 or claim 2, wherein the sealing rib (16) delimits at least a front part-region of a side wall (10) of the contact housing (5) from a rear portion (22).

4. Connector according to claim 2 and claim 3, wherein the sealing rib (16) rests only on the side face (10) of the contact housing, on which side face the contact flap (10) is arranged.

5. Connector according to claim 4, wherein the sealing rib (16) rests in a U-shaped contour on the side face, wherein the two free ends (28, 29) are associated with the U-shape of a front lateral edge (11) of the side face (10), wherein the lateral edge (11) faces the front opening (3).

6. Connector according to any one of claims 1 to 5, wherein the front opening (3) has an edge region (12), wherein a lower abutment face (13) for the contact housing (5, 11) is formed on a lower side of the edge region (12), wherein the contact housing rests with a lower side face of a front edge (11) on the lower abutment face (13).

7. Connector according to any one of claims 1 to 6, wherein a lateral abutment face (14) is formed on each of the two lateral sides of an edge region (12) of the front opening (3) of the housing (1), wherein the contact housing (5) abuts with lateral front regions of the edge (11) against the lateral abutment faces (14).

8. Connector according to claim 7, wherein the housing has an edge sealing rib (34) in the transition from the lateral abutment faces (14) to an upper edge region, respectively.

9. Connector according to any one of claims 1 to 8, wherein the intermediate component (36) is in abutment against a lower face and the two side faces of the contact housing (5).

10. Connector according to any one of claims 1 to 9, wherein
the housing (1) is filled in a rear portion (22) with a
moulding material, wherein the hardened moulding material
5 constitutes the intermediate component (36).

11. Connector according to any one of the preceding claims,
wherein the housing has at least one guide rail (23, 25, 26)
which is/are arranged outside the front portion (21) of the
10 intermediate space (15) delimited by the sealing rib (16) and
which protrude(s) into the intermediate space (15).

12. Connector according to claim 11, wherein the guide rail
(23, 25) merges into the sealing rib (16) and continues in
15 the delimited front portion (21) of the intermediate space
(15).

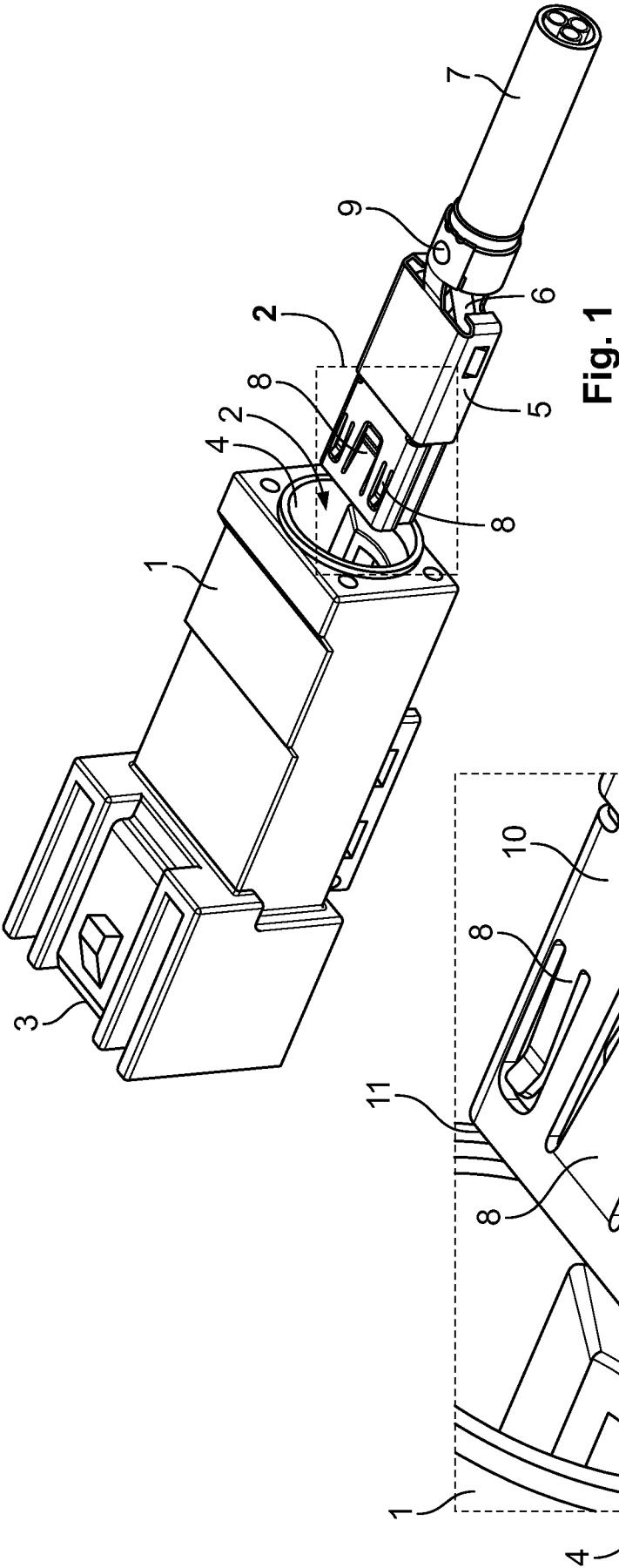
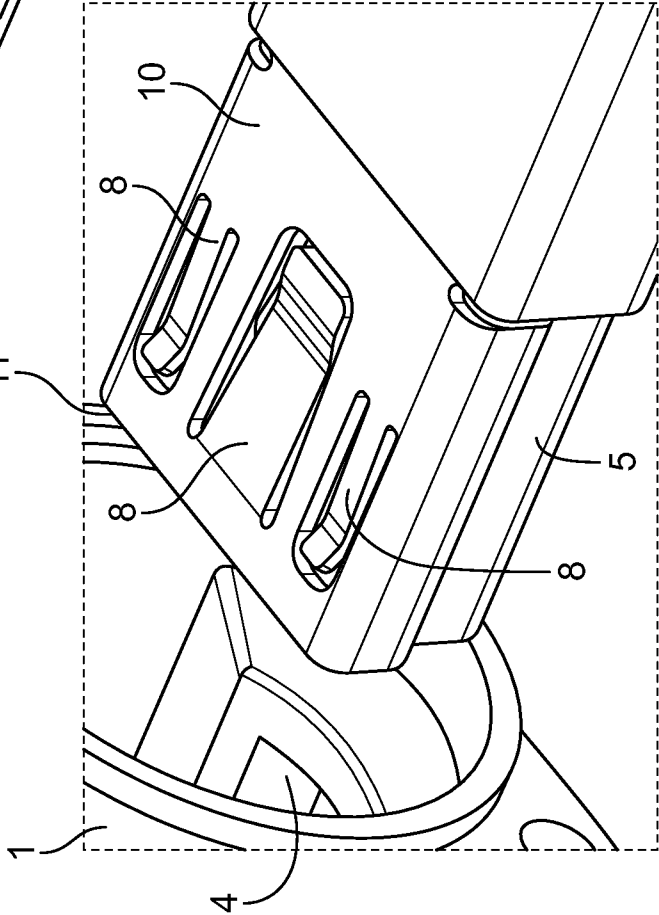


Fig. 2



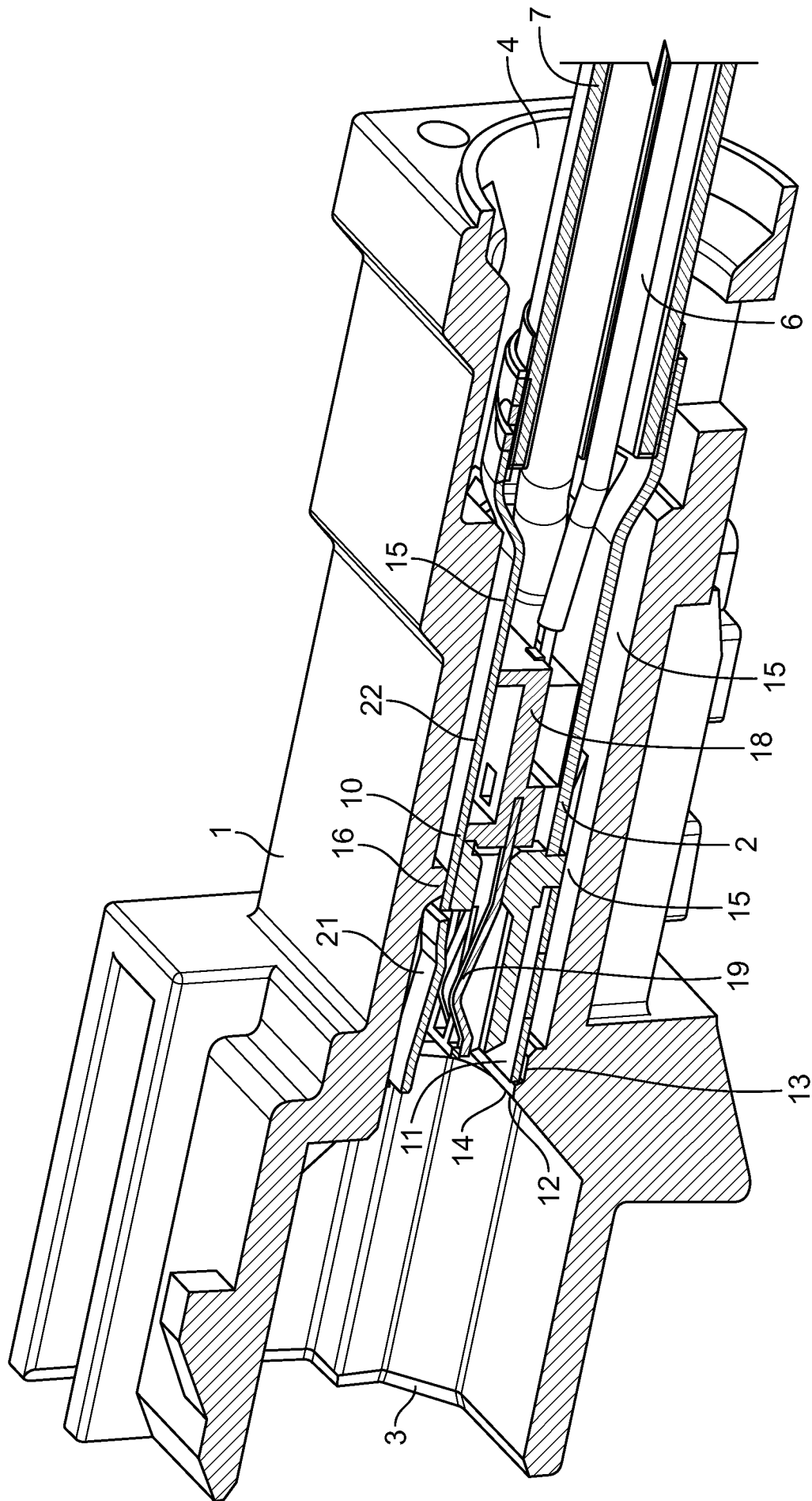


Fig. 3

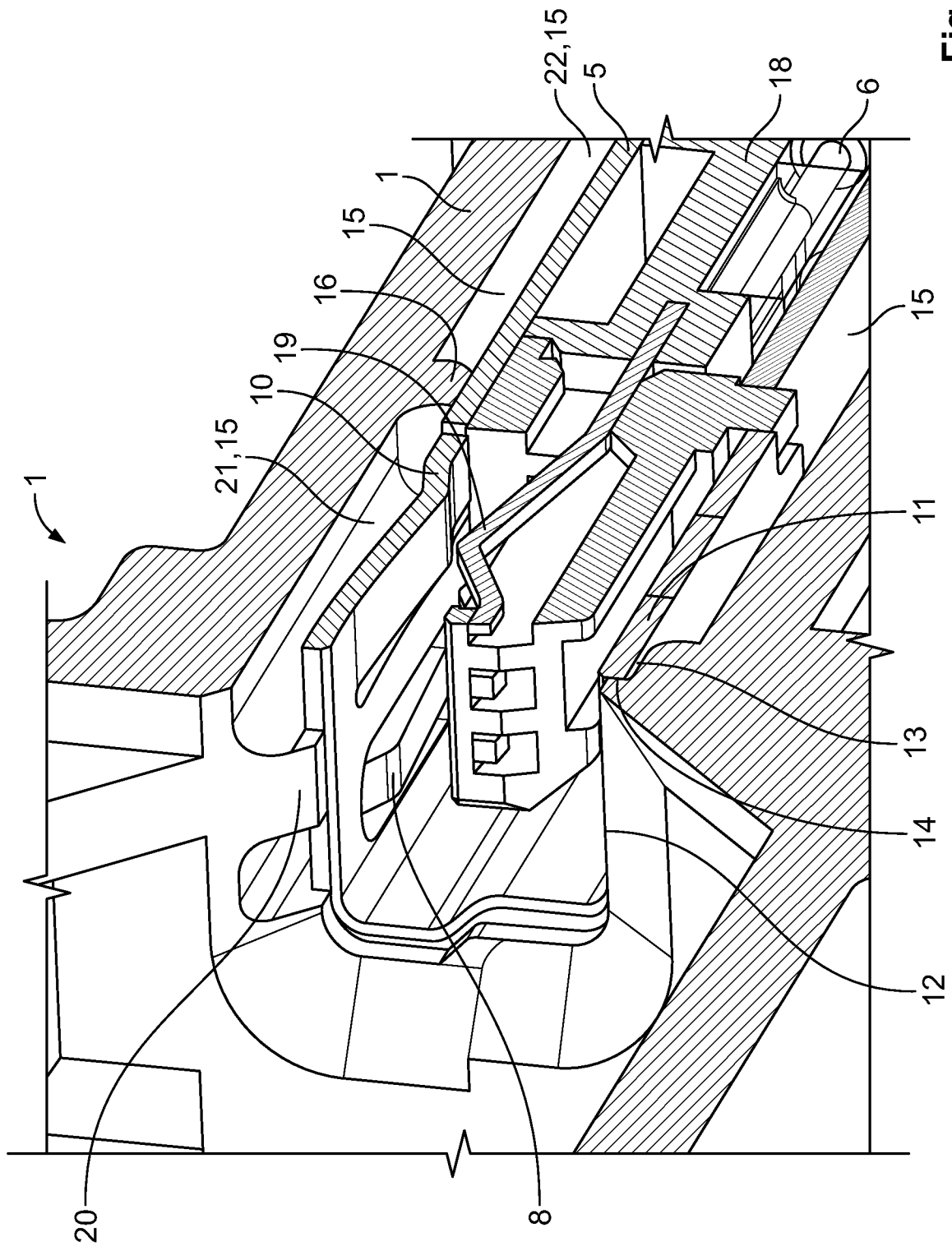
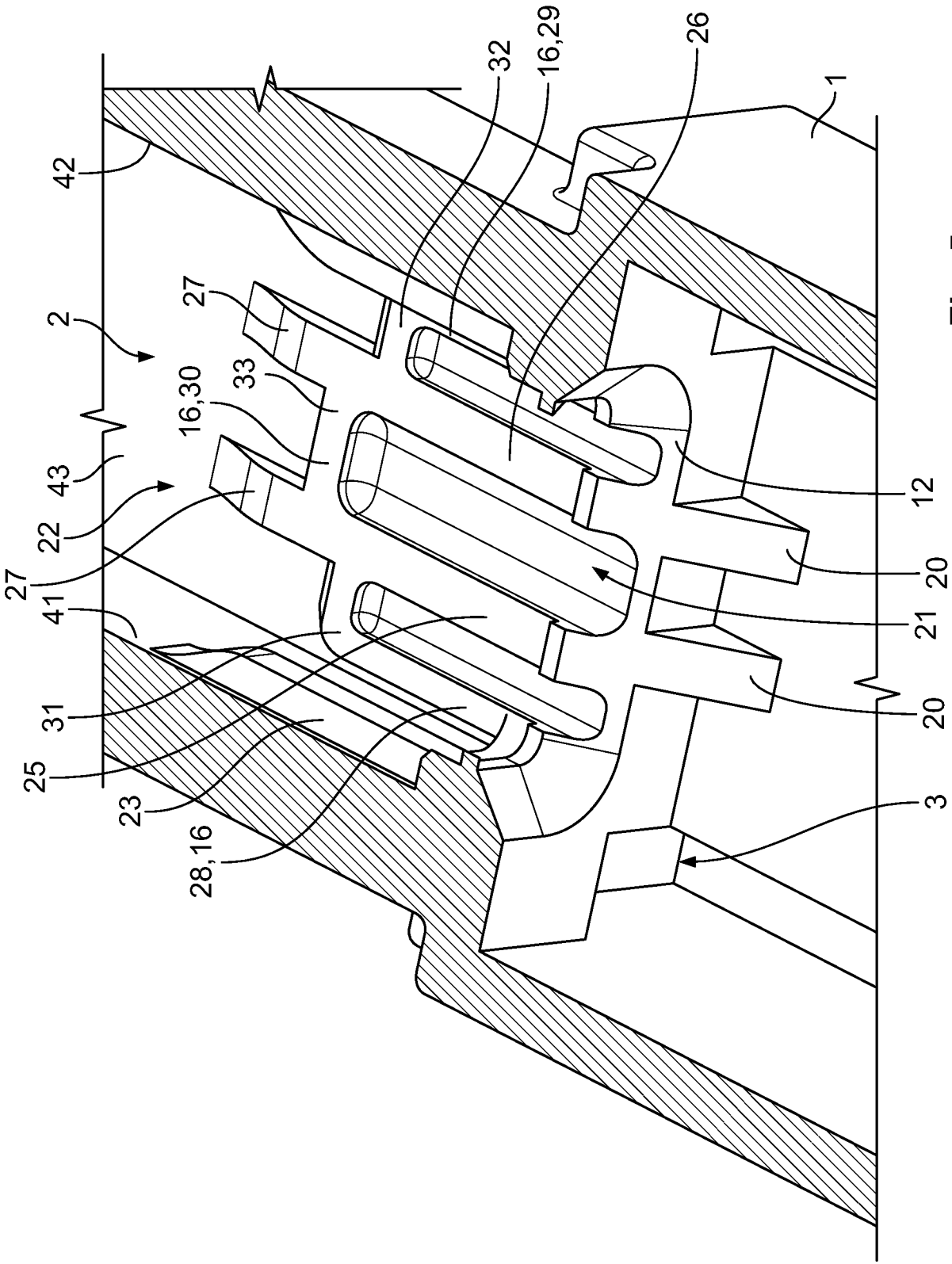
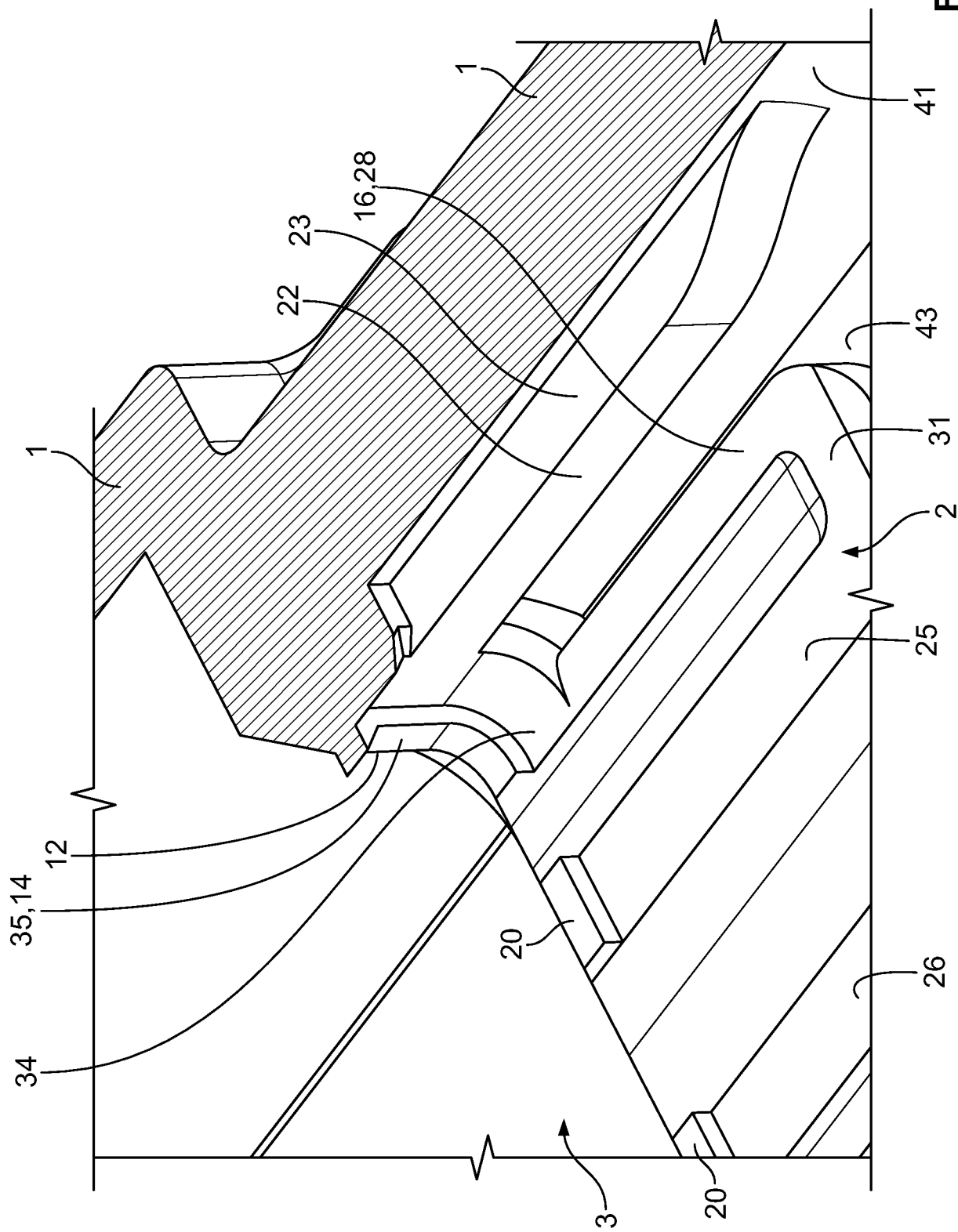


Fig. 4





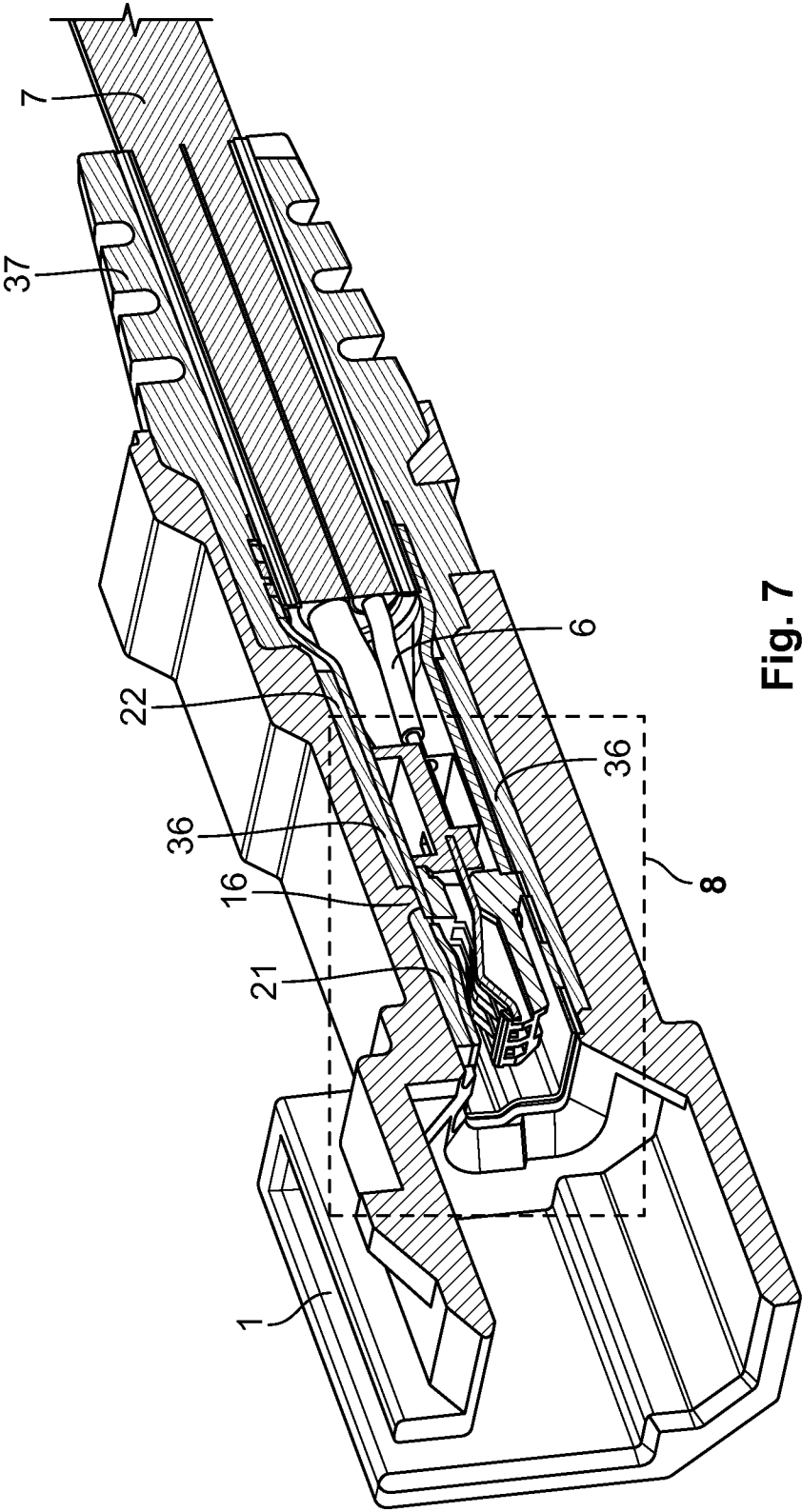


Fig. 7

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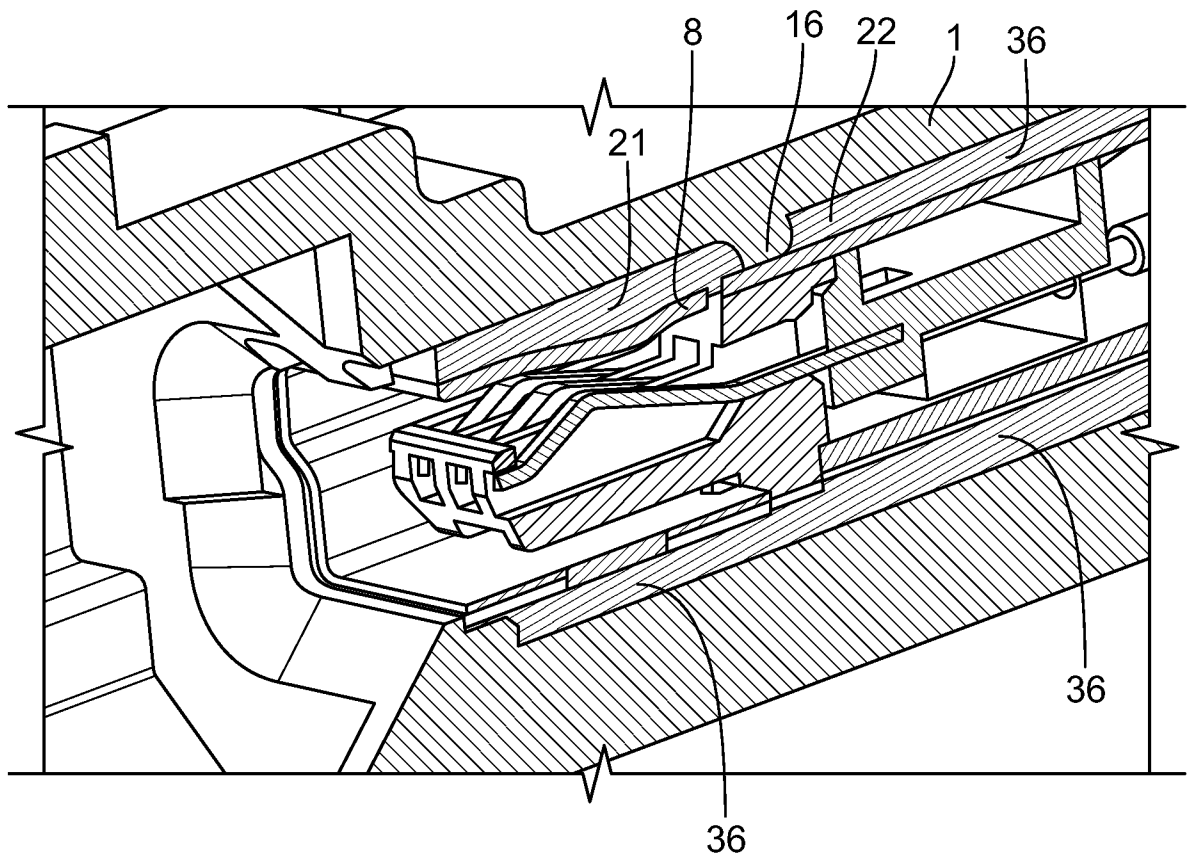


Fig. 8

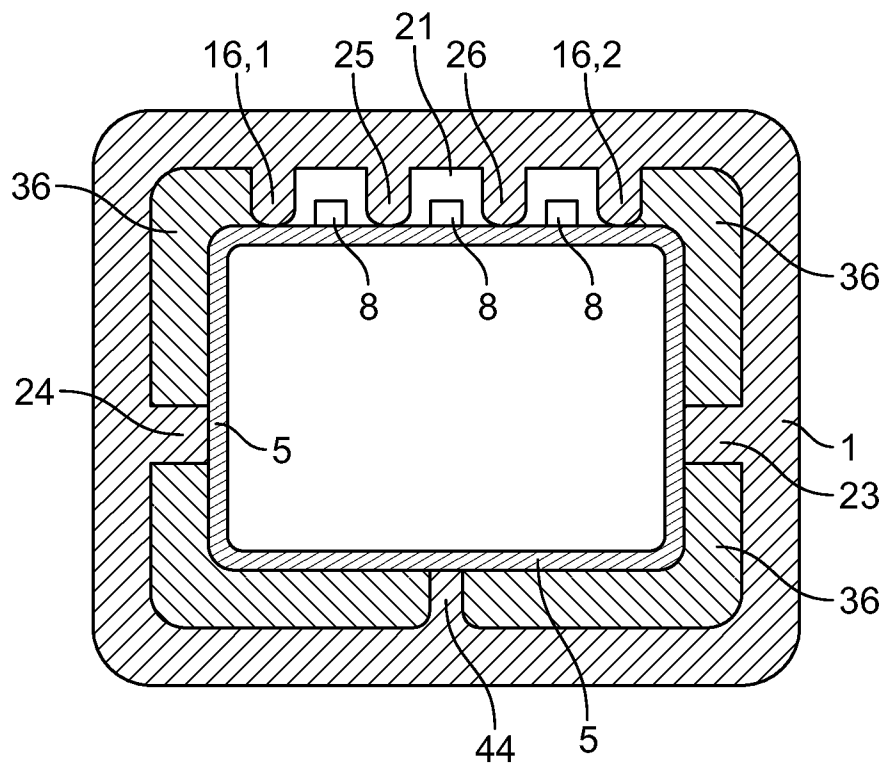


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2013/055704

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R13/504 H01R13/516 H01R13/52
ADD. H01R24/62

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 B29C

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 4 413 875 A (MATTINGLY WILLIAM R [US]) 8 November 1983 (1983-11-08) columns 1,3,5; figure 1 -----	1,2,4,10
X	US 4 927 388 A (GUTTER DAVID H [US]) 22 May 1990 (1990-05-22) column 3; figure 4 -----	1,3
A	EP 0 574 862 A2 (WHITAKER CORP [US]) 22 December 1993 (1993-12-22) the whole document -----	1-12



Further documents are listed in the continuation of Box C.



See patent family annex.

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Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Vautrin, Florent

INTERNATIONAL SEARCH REPORT

Information on patent family members

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