(19) Europäisches Patentamt
European Patent Office
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(11) **EP 4 542 785 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
23.04.2025 Bulletin 2025/17

(21) Application number: **23204419.8**

(22) Date of filing: **18.10.2023**

(51) International Patent Classification (IPC):
H01R 13/639 *(2006.01)* ***H05K 5/00*** *(2025.01)*
H01R 13/631 *(2006.01)* *H01R 13/514* *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H01R 13/6315; H01R 13/639; H05K 5/30;
H01R 13/514

(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 ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

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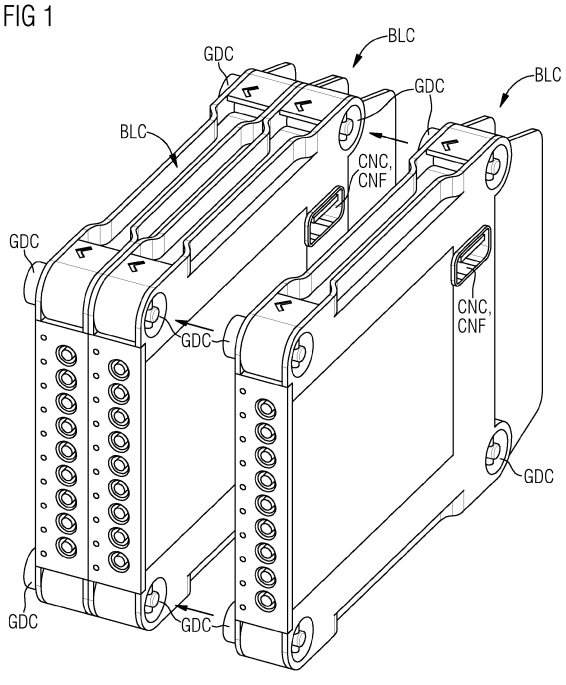
(54) ELECTRICAL MULTIPOLE CONNECTOR ARRANGEMENT, MODULAR BUILDING BLOCK ARRANGEMENT

(57) The invention relates to an Electrical multipole connector arrangement for connecting at least three terminals (TRM) of a first (CNF) connector (CNC) to an equivalent number of terminals (TRM) of a second (CNS) connector (CNC), when both connectors (CNC) are plugged into each other,
wherein the first (CNF) connector (CNC) has a recess (RCS), and the second (CNS) connector (CNC) has a protrusion (PRT), both of which interlock when plugged in,
wherein at least either the protrusion (PRT) or the recess (RCS) or both are so tapered (TPS) that even if both connectors (CNC) are to some extent misaligned during the beginning of the mating process, the protrusion (PRT) meets the recess (RCS). It is proposed, that at least one of both connectors (CNC) is supported (SPT) in a floating manner to enable compensation of a misalignment during the mating process.

FIG 1



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Description

FIELD OF THE INVENTION

[0001] The invention relates to an electrical multipole connector arrangement for connecting at least three terminals of a first connector to an equivalent number of terminals of a second connector, when both connectors are plugged into each other, wherein the first connector has a recess, and the second connector has a protrusion, both of which interlock when plugged in, wherein at least either the protrusion or the recess or both are so tapered that even if both connectors are to some extent misaligned during the beginning of the mating process, the protrusion meets the recess.

SUMMARY OF THE INVENTION

[0002] The object of the invention is achieved by the independent claims. The dependent claims describe advantageous developments and modifications of the invention.

[0003] More specifically the invention proposes a method of the in-cipiently mentioned type comprising the additional steps of:

> Proposed is an electrical multipole connector arrangement for connecting at least three terminals of a first connector to an equivalent number of terminals of a second connector, when both connectors are plugged into each other,
> wherein the first connector has a recess, and the second connector has a protrusion, both of which interlock when plugged in,
> wherein at least either the protrusion or the recess or both are so tapered that even if both connectors are to some extent misaligned during the beginning of the mating process, the protrusion meets the recess.

[0004] Essential is that that at least one of both connectors is supported in a floating manner to enable compensation of a misalignment during the mating process.

[0005] According to one embodiment it is proposed, the floating support of the connector is provided by an elastic or spring-loaded support of the connector against at least one alignment element defining an alignment position of the floatingly supported connector by restricting the movement of the connector by at least one degree of freedom of the connector so that the connector is held in a predefined position at the beginning of the mating process.

[0006] According to one embodiment it is proposed, the spring-loaded support is provided by at least one tapered spring.

[0007] According to one embodiment it is proposed, at least two springs are provided for the spring-loaded support of the connector against said at least one alignment element,

> wherein a translational movement of the connector in the direction of higher spring load is restricted by a stop element,
> wherein the stop element is essentially located behind the connector in an insertion axis when the mating connector is inserted,
> wherein said stop element is formed in such a way that when the stop contact between the stop element and the connector is established, the stop element is enabling a tilting movement of the connector.

[0008] According to one embodiment it is proposed, said stopping element has a contact surface contacting said connector in a point-like-fashion to enable a two-dimensional-tilting movement along a contact point or in a line-like fashion to enable a one-dimensional-tilting movement along a contact axis.

[0009] According to one embodiment it is proposed, the floating connector on the opposite side of the mating option has a platform essentially orthogonal to the mating direction, for said floating support of the connector in at least three points of the platform laterally to an area of the two mating connectors impinging on each other.

[0010] According to one embodiment it is proposed, the arrangement comprises a mechanically forced guidance of the two connectors,
wherein the mechanically forced guidance is built to guide the mating process's movement.

[0011] According to one embodiment it is proposed, said mechanically forced guidance comprises at least one bayonet-locking mechanism locking the connectors in a mated position.

[0012] According to one embodiment it is proposed, said terminals are provided in said protrusion and said recess of the connectors for contacting each other respectively during the mating process.

[0013] Another teaching according to claim 10, which is of equal importance, relates to Modular building block arrangement comprising at least two building blocks comprising a connector arrangement.

[0014] Another teaching which is of equal importance relates to a Modular building block arrangement comprising at least two building blocks comprising a connector arrangement according to at least one previous claim.

[0015] According to one embodiment it is proposed, that a first building block of said building block arrangement comprises said first connector and a second building block of said building block arrangement comprises said second connector to electrically connect the building blocks of said building block arrangement.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Embodiments of the invention are now described, by way of example only, with reference to the accompanying drawings, of which:

Figure 1 shows a 3-dimensionmal illustration of a modular building block arrangement comprising two building blocks according to the invention;

Figure 2 shows a 3-dimensionmal sectional illustration of a mechanically forced guidance of the two building blocks;

Figure 3a, b, c: respectively show a 3-dimensionmal sectional illustration of parts of a mechanically forced guidance of the two building blocks;

Figure 4 shows a 3-dimensionmal illustration of a sectional view of a modular building block arrangement comprising two building blocks showing destails of the mechanically forced guidance;

Figure 5 shows a 3-dimensionmal illustration of a sectional view of a electrical multipole connector of a building block;

Figure 6 shows a 3-dimensionmal illustration of a sectional view of a multipole connector supported in a floating manner;

Figure 7 shows a 3-dimensionmal illustration of another sectional view of two mated electrical multipole connectors supported in a floating manner;

Figure 8 shows a 3-dimensionmal illustration of a platform of an electrical multipole connector.

[0017] The illustration in the drawings is in schematic form. It is noted that in different figures, similar or identical elements may be provided with the same reference signs.

DESCRIPTION OF THE DRAWINGS

[0018] Figure 1 shows a 3-dimensionmal illustration of a modular building block BLC arrangement comprising building blocks BLC according to the invention. With these modular building blocks BLC, an electronic device may be assembled. The modularity enables a flexible creation of e.g., a measurement device for processing measurements of different kinds. Depending on the situation the number of building blocks BLC and the type of building blocks BLC can be changed. The resulting device from the modular building block BLC arrangement profits from two essential functions. A mechanical locking mechanism enables a rough handling without risking a defect. An electrical connection when joining the modular building blocks BLC together via a multipole connector CNC arrangement is safe. The blocks BLC are electrically connected with each other by using an electrical multipole connector CNC arrangement according to the invention. The modular building blocks BLC are of essentially rectangular shape. At each edge of the rectangular shape a mechanically forced guidance GDC enables positioning of the two building blocks BLC in a predefined geometrically relation to each other. Furthermore, said mechanically forced guidance GDC enables fixation of the two building blocks BLC to each other. The modular building block BLC arrangement is made such, that each modular building block BLC comprises a first CNF connector CNC and a second CNS connector CNC such that the building blocks BLC can be stacked electrically connected in a stack of more than two blocks BLC.

[0019] Figure 2 shows a 3-dimensionmal sectional illustration of a mechanically forced guidance GDC of the two building blocks BLC. Each of the mechanically forced guidance GDC devices comprises a bolt BLT extending along an insertion axis IAX which is supported rotatable in a casing CSG of said modular building block BLC. As shown in figure 3 a) the bolt BLT is made with shoulder SHD to keep it in a defined angular position relative to the casing CSG; meaning that the bolt BLT cannot rotate relative to the casing CSG. In axial direction AXL the bolt BLT can be moved relative to the casing CSG and certain limits defined by opinion inserted through the bolt BLT and lateral direction with regard to the longitudinal direction of the bolt BLT respectively the insertion axis IAX. An elastic spring SPR package of disc springs SPR keeps the bolt BLT in a predefined axial position but enables a forced axial movement in an uniaxial direction.

[0020] Around the bolt BLT arrangement, a rotatable sleeve SLV with a handle HND is provided. This sleeve SLV is rotatable relative to the bolt BLT and the casing CSG along the bolt's BLT longitudinal axis respectively belonging the insertion axis IAX. This sleeve SLV protrudes into the direction of said insertion axis IAX essentially orthogonal to a plane defined by the rectangular shape of the building block BLC. When stacking building blocks BLC onto each other this protrusion PRT of the sleeve SLV is inserted into a recess RCS of said casing CSG, wherein said protrusion PRT and said recess RCS are correspondingly tapered TPS leading to an increasingly accurate centering during the mating process of the two building blocks BLC to each other. The laterally inserted pin PIN in the bolt BLT corresponds to an opening in the front face of the sleeve SLV such that the predefined rotational position of the sleeve SLV the pin PIN fits through the opening giving way to insert the sleeve SLV protrusion PRT into the recess RCS of the casing CSG without the front face colliding with the pin PIN of the bolt BLT. Rotating the sleeve SLV by preferably using the handle HND locks that pin PIN into a cavity CVT of the sleeve SLV. The axial pretension of the bolt BLT pulls the pin PIN into the direction of the bottom of the recess RCS such that the sleeve SLV front face is pulled tightly to the bottom of the recess RCS. In the cavity CVT of the sleeve SLV a groove GRV is provided matching the shape of the pin PIN, such that when the sleeve SLV rotated around the bolt BLT relative to the casing CSG and the bolt BLT about 90° the pin PIN is pulled into the groove GRV of the cavity CVT by the disc springs SPR indexing the circumferential position of the sleeve SLV and locking the sleeve

SLV in that position. In that position the handle HND of the sleeve SLV becomes a part of a side face of the building block BLC.

[0021] Figure 3 a), b), c) respectively show a 3-dimensionmal sectional illustration of parts of said mechanically forced guidance GDC of the building blocks BLC. Figures 3a), 3c) show that the bolt BLT is circumferentially locked against rotation in the casing CSG of the building block BLC. Furthermore, the shoulder SHD of the bolt BLT contacting the casing CSG and hindering rotation of the bolt BLT limits axial movement of the bolt BLT relative to the casing CSG.

[0022] A friction ring FRR is pressed by the disc springs SPR against the casing CSG and rotatable around the bolt BLT. The friction ring FRR is provided with dents DNT fitting into cams CAM of a casing's CSG surface such that the cams CAM are pressed into dents DNT by the force of the disc springs SPR locking this sleeve SLV, which is rotationally coupled to the friction ring FRR in angular positions of 90° steps. This makes the sleeve SLV being kept in defined positions even without engagement to any other building block BLC. Furthermore, the handle HND is locked due to the engagement with the friction ring FRR and can only be rotated with some force out of the open and closed position due to the engagement of the dents DNT with the cams CAM.

[0023] Figure 4 shows a 3-dimensionmal illustration of a sectional view of a modular building block BLC arrangement comprising two building blocks BLC showing details of the mechanically forced guidance GDC. This illustration shows that the friction ring FRR keep the sleeve SLV in a predefined position with regard to the casing CSG. Rotating one sleeve SLV by using the handle HND can be done without automatically rotating other sleeves SLV of neighboring building blocks BLC due to the respective friction rings FRR.

[0024] Figures 5, 6 and 7 each show a 3-dimensional illustration of a sectional view of an electrical multi-pole connector CNC of a device in different sectional planes. The connectors CNC are made for connecting at least three terminals TRM of a first CNF connector CNC to an equivalent number of terminals TRM of a second CNS connector CNC. Each building block BLC comprises two multiple connectors CNC, one first CNF connector CNC and one second CNS connector CNC. The first CNF connector CNC has a recess RCS, and the second CNS connector CNC has a protrusion PRT, both of which interlock when plugged in. This makes the first CNF connector CNC a female connector CNC and the second CNS connector CNC a male connector CNC. A mixed arrangement of male and female geometry is possible, too. The terminals TRM are not in detail shown in the figures. Preferably the terminals TRM are provided on the inside of the recesses RCS respectively on the outside of the protrusions PRT. The protrusion PRT and the recess RCS are so tapered TPS that even if both connectors CNC are to some extent misaligned during the beginning of the mating process, the protrusion PRT meets the recess RCS. Optionally, the tapering TPS may be done to only one of the mating partners, too.

[0025] When stacking the building blocks BLC second CNS connectors CNC are plugged into first CNF connectors CNC. The mating of the connectors CNC is done along an insertion axis IAX in an insertion direction. The insertion direction and insertion axis IAX are defined by the mechanical forced guiding mechanism as described above and illustrated in figures 1 to 4.

[0026] While the second CNS connector CNC is basically stiffly fixed to the casing CSG of the building block BLC and directly connected to a printed circuit board PCP, the first CNF connector CNC is mounted to the building block BLC in a floating manner. The floating connector CNC on the opposite side of the mating option may have a platform PLF essentially orthogonal to the mating direction, for said floating support SPT of the connector CNC in at least three points of the platform PLF laterally to an area of the two mating connectors CNC impinging on each other. Here, said platform PLF can be moved in certain predefined limits in axial direction of the insertion axis IAX and lateral to this axis in a two-dimensional manner. Furthermore, the first CNF connector CNC and its platform PLF can be moved in a tilting manner. The floating support SPT of the connector CNC is provided by an elastic or spring-loaded support SPT of the connector CNC against at least one alignment element AEL defining an alignment position of the floatingly supported SPT connector CNC by restricting the movement of the connector CNC by at least one degree of freedom of the connector CNC so that the connector CNC is held in a predefined position at the beginning of the mating process.

[0027] The spring-loaded support SPT is provided by four tapered TPS springs SPR, which press the platform PLF of the connector CNC against the alignment element AEL, and which beneficially reset the lateral position back into a predefined alignment position which has the highest probability to be in alignment with the mating connector CNC during the mating process. However, this alignment position is subject to manufacturing tolerances of all parts involved.

[0028] Preferably - as shown in figures 6, 7, 8 - a translational movement of the connector CNC in the direction of higher spring SPR load is restricted by a stop element SEL. The stop element SEL is essentially located behind the connector CNC and the connector's CNC platform PLF in an insertion axis IAX when the mating connector CNC is inserted. Preferably and as illustrated, said stop element SEL is formed in such a way that when the stop contact between the stop element SEL and the connector CNC is established, the stop element SEL is enabling a tilting movement of the connector CNC. The stop element SEL as shown in figure 8 is part of a support SPT of the springs SPR, wherein said springs SPR are preferably arranged symmetrically around the stop element SEL. The stop element SEL has a contact surface contacting said connector CNC in a

point-like-fashion to enable a two-dimensional-tilting movement along a contact point. Here the contact element is rounded to enable a smooth tilting movement along the rounding radius.

[0029] Optionally the stop element SEL may have a contact surface contacting said connector CNC in a line-like fashion to enable a one-dimensional-tilting movement along a contact axis. This may be preferable in case CSG the connectors CNC are geometrically more tolerant to misalignment regarding the non-tilting direction.

[0030] Although the present invention has been described in detail with reference to the preferred embodiment, it is to be understood that the present invention is not limited by the disclosed examples, and that numerous additional modifications and variations could be made thereto by a person skilled in the art without departing from the scope of the invention.

Claims

1. Electrical multipole connector arrangement for connecting at least three terminals (TRM) of a first (CNF) connector (CNC) to an equivalent number of terminals (TRM) of a second (CNS) connector (CNC), when both connectors (CNC) are plugged into each other,

   wherein the first (CNF) connector (CNC) has a recess (RCS), and the second (CNS) connector (CNC) has a protrusion (PRT), both of which interlock when plugged in,
   wherein at least either the protrusion (PRT) or the recess (RCS) or both are so tapered (TPS) that even if both connectors (CNC) are to some extent misaligned during the beginning of the mating process, the protrusion (PRT) meets the recess (RCS),
   characterized in
   that at least one of both connectors (CNC) is supported (SPT) in a floating manner to enable compensation of a misalignment during the mating process.

2. Electrical multipole connector arrangement according to claim 1, wherein the floating support (SPT) of the connector (CNC) is provided by an elastic or spring-loaded support (SPT) of the connector (CNC) against at least one alignment element (AEL) defining an alignment position of the floatingly supported (SPT) connector (CNC) by restricting the movement of the connector (CNC) by at least one degree of freedom of the connector (CNC) so that the connector (CNC) is held in a predefined position at the beginning of the mating process.

3. Electrical multipole connector arrangement according to claim 1 or 2, wherein in the spring-loaded support (SPT) is provided by at least one tapered (TPS) spring (SPR).

4. Electrical multipole connector arrangement according to one of the preceding claims, wherein at least two springs (SPR) are provided for the spring-loaded support (SPT) of the connector (CNC) against said at least one alignment element (AEL), wherein a translational movement of the connector (CNC) in the direction of higher spring (SPR) load is restricted by a stop element (SEL),

   wherein the stop element (SEL) is essentially located behind the connector (CNC) in an insertion axis (IAX) when the mating connector (CNC) is inserted,
   wherein said stop element (SEL) is formed in such a way that when the stop contact between the stop element (SEL) and the connector (CNC) is established, the stop element (SEL) is enabling a tilting movement of the connector (CNC).

5. Electrical multipole connector arrangement according to one of the preceding claims, wherein said stopping element (SEL) has a contact surface contacting said connector (CNC) in a point-like-fashion to enable a two-dimensional-tilting movement along a contact point or in a line-like fashion to enable a one-dimensional-tilting movement along a contact axis.

6. Electrical multipole connector arrangement according to claim 5, wherein the floating connector (CNC) on the opposite side of the mating option has a platform (PLF) essentially orthogonal to the mating direction, for said floating support (SPT) of the connector (CNC) in at least three points of the platform (PLF) laterally to an area of the two mating connectors (CNC) impinging on each other.

7. Electrical multipole connector arrangement according to one of the preceding claims, wherein the arrangement comprises a mechanically forced guidance (GDC) of the two connectors (CNC),
   wherein the mechanically forced guidance (GDC) is built to guide the mating process's movement.

8. Electrical multipole connector arrangement according to one of the preceding claims, wherein said mechanically forced guidance (GDC) comprises at least one bayonet-locking mechanism (BLM) locking the connectors (CNC) in a mated position.

9. Electrical multipole connector arrangement according to one of the preceding claims, wherein said terminals (TRM) are provided in said protrusion (PRT) and said recess (RCS) of the connectors

(CNC) for contacting each other respectively during the mating process.

10. Modular building block arrangement comprising at least two building blocks comprising a connector (CNC) arrangement according to at least one previous claim,
characterized in
that a first (CNF) building block of said building block arrangement comprises said first (CNF) connector (CNC) and a second (CNS) building block of said building block arrangement comprises said second (CNS) connector (CNC) to electrically connect the building blocks of said building block arrangement.

11. Modular building block arrangement according to claim 9, wherein said modular building block arrangement comprises at least one mechanically forced guidance (GDC) according to claim 7 or 8.

12. Modular building block arrangement according to claim 9 or 10, wherein each modular building block comprises a first (CNF) connector (CNC) and a second (CNS) connector (CNC) such that the building blocks can be stacked electrically connected in a stack of more than two blocks.

FIG 1

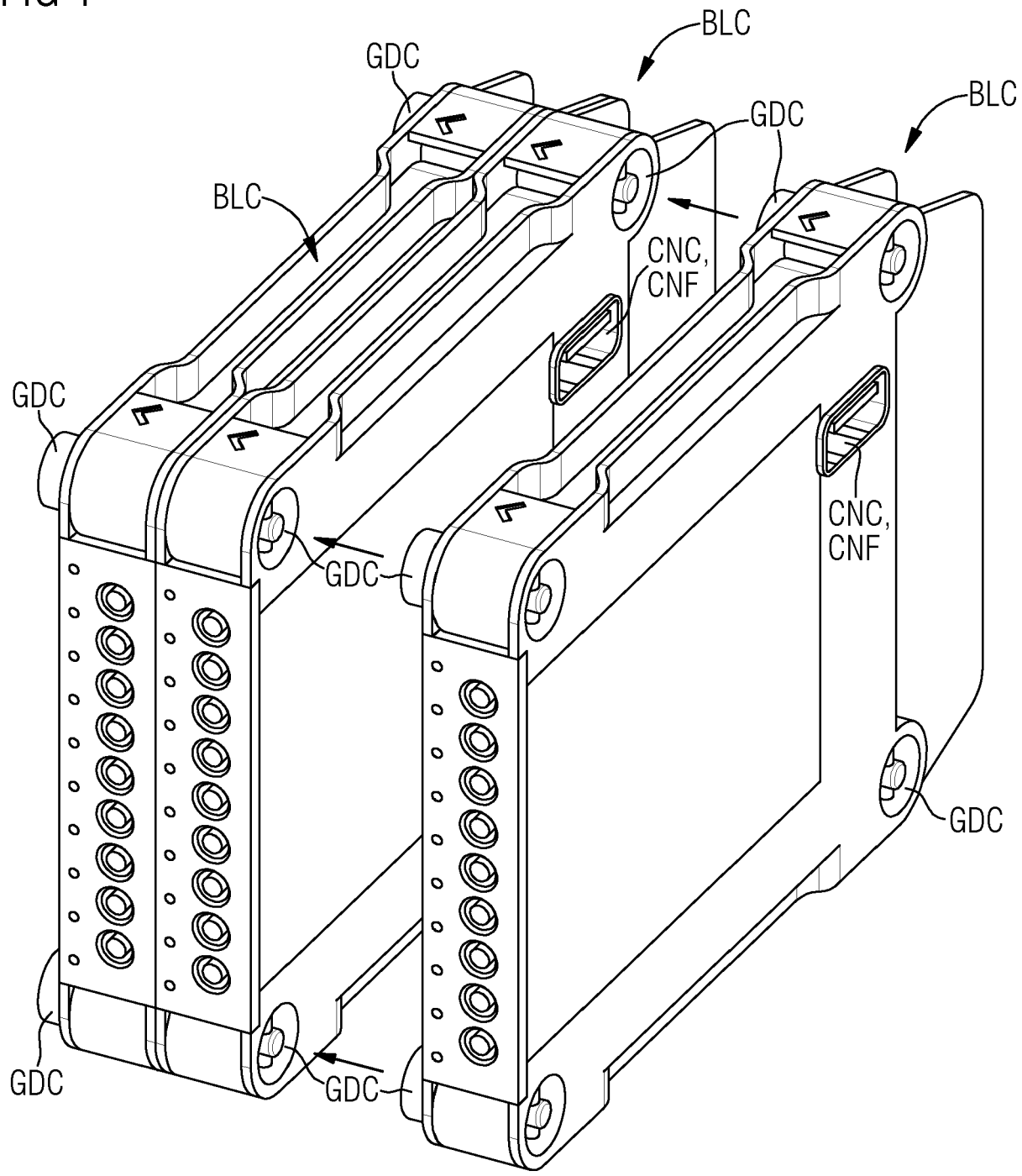
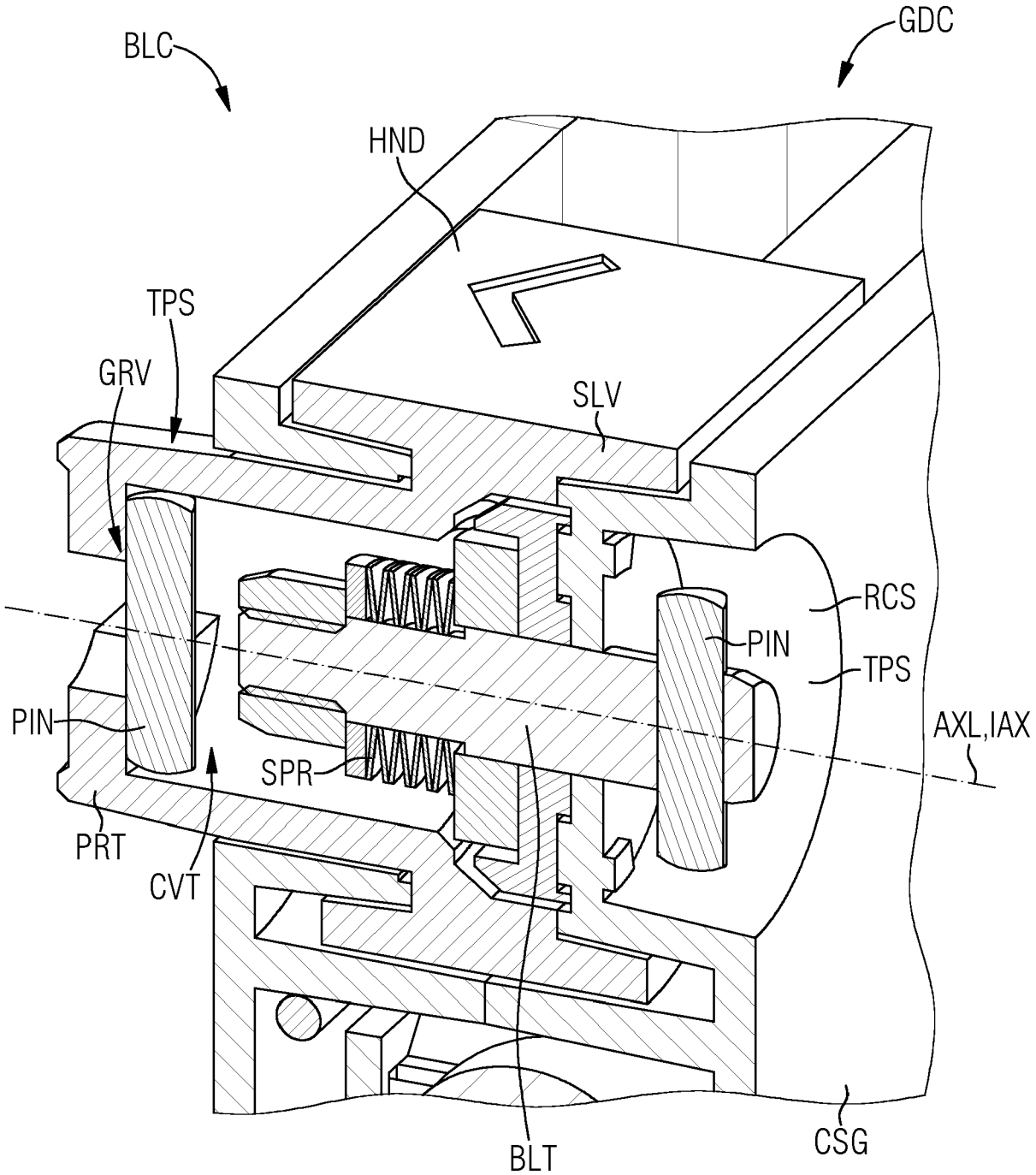


FIG 2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GDC
HND
TPS
GRV
SLV
RCS
PIN
TPS
PIN
AXL,IAX
SPR
PRT
CVT
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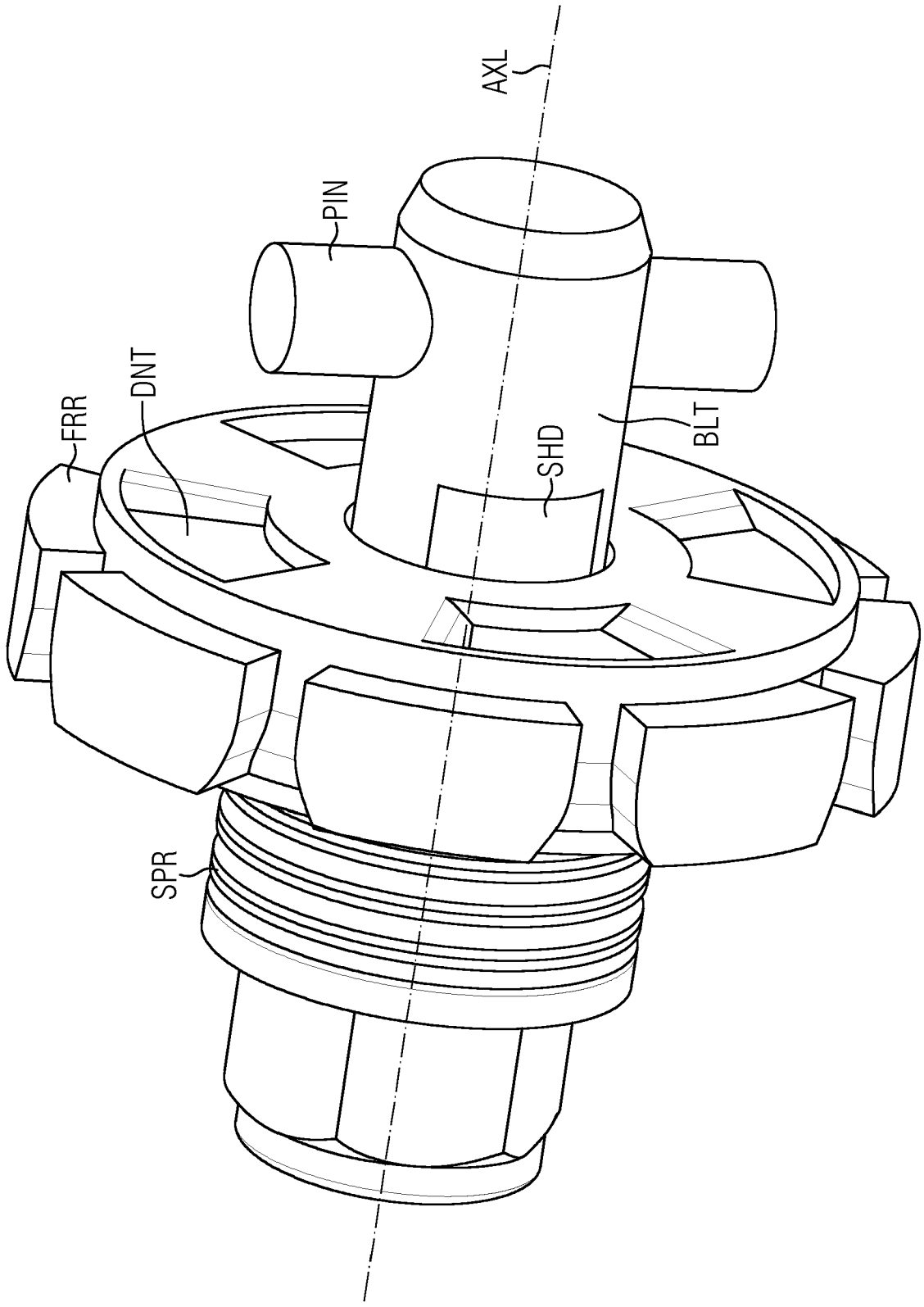


FIG 3A

FIG 3B

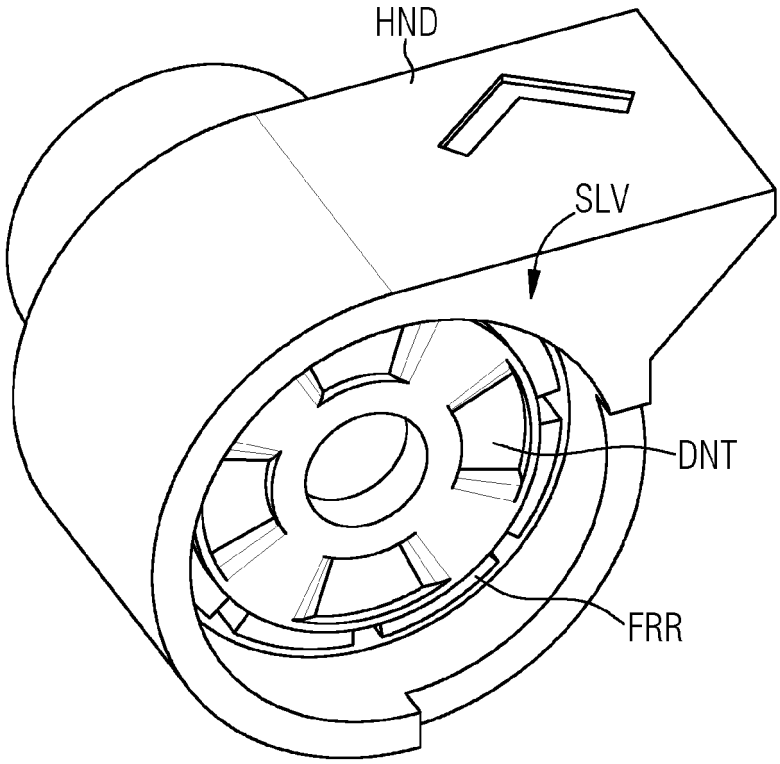


FIG 3C

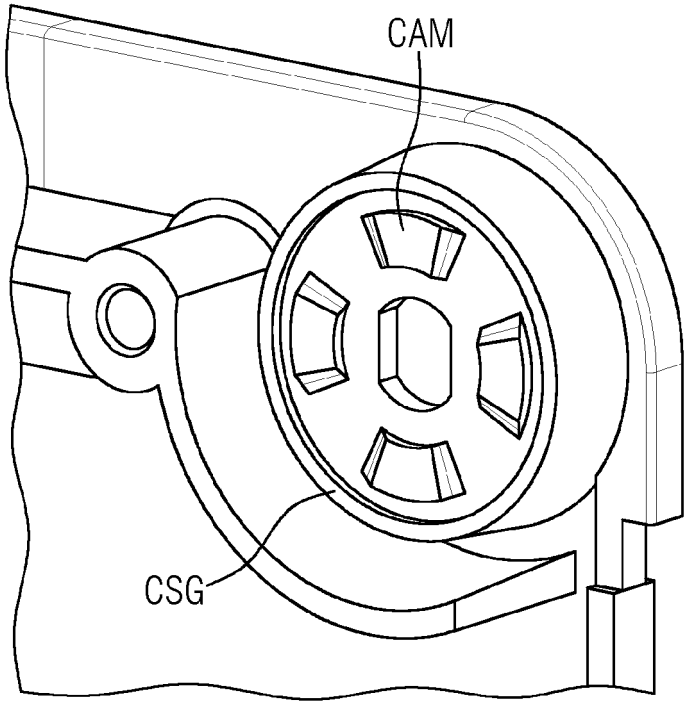


FIG 4

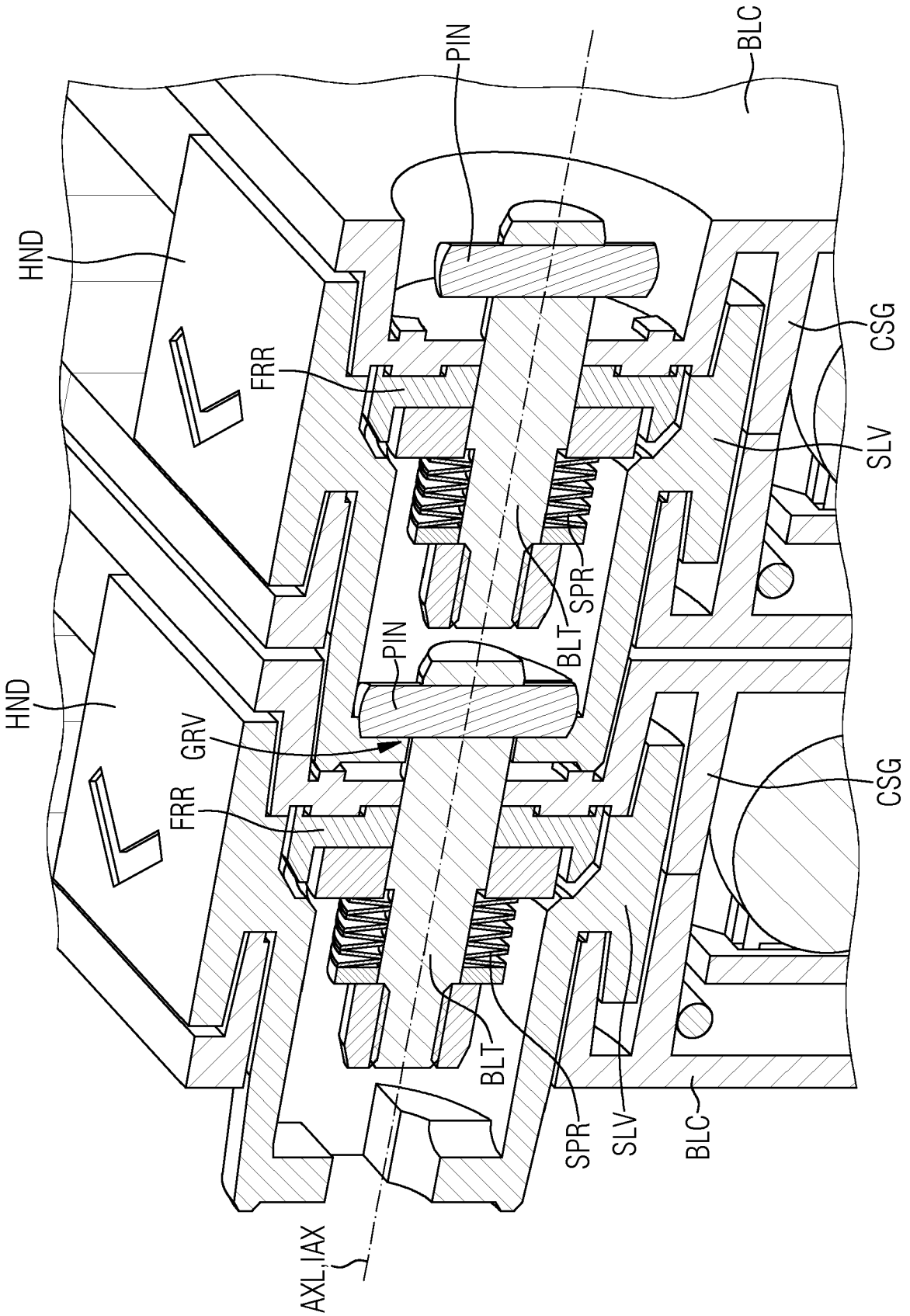

PIN
BLC
HND
FRR
CSG
SLV
SPR
BLT
PIN
HND
GRV
FRR
CSG
BLT
SPR
SLV
BLC
AXL,IAX

FIG 5

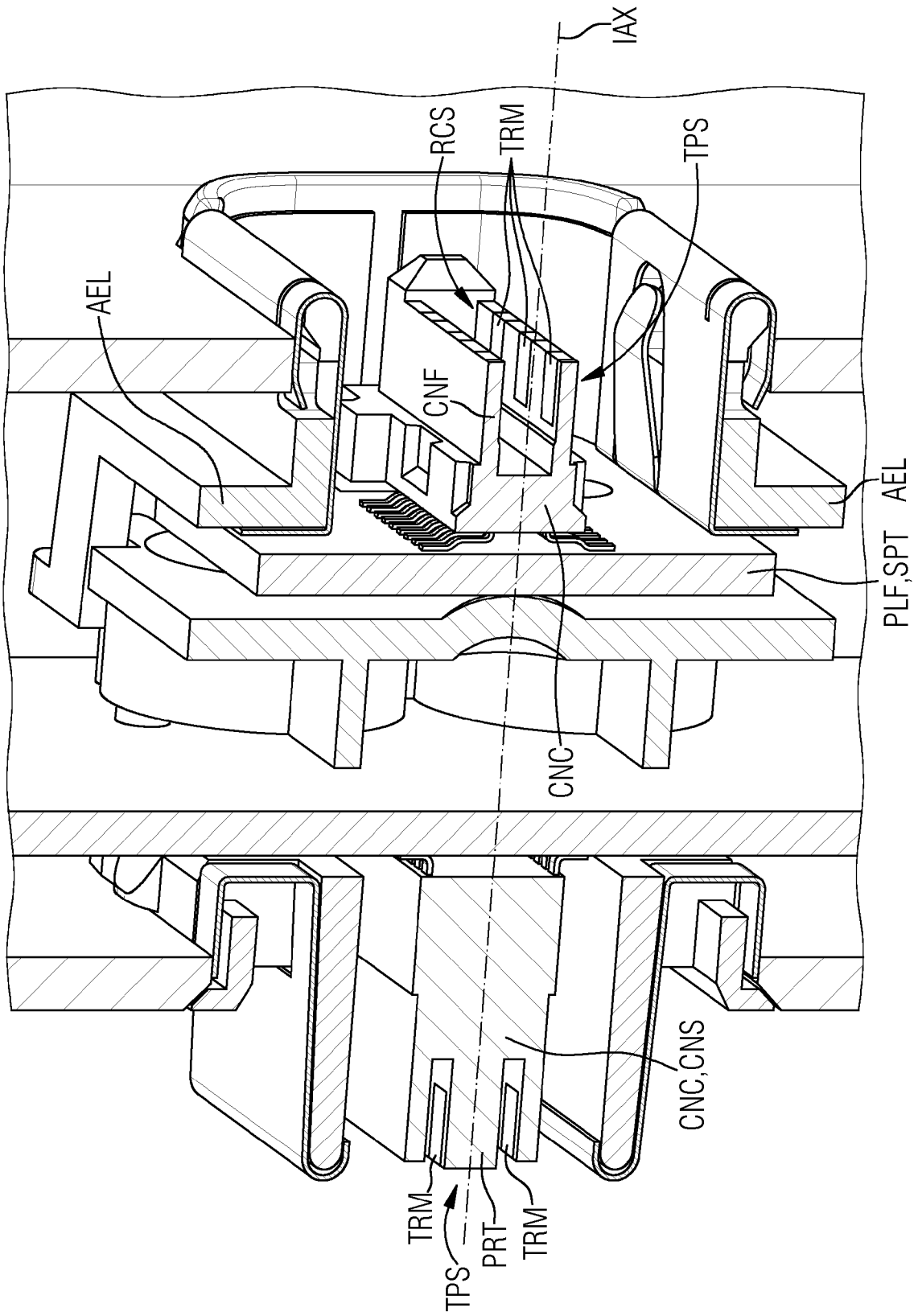


FIG 6

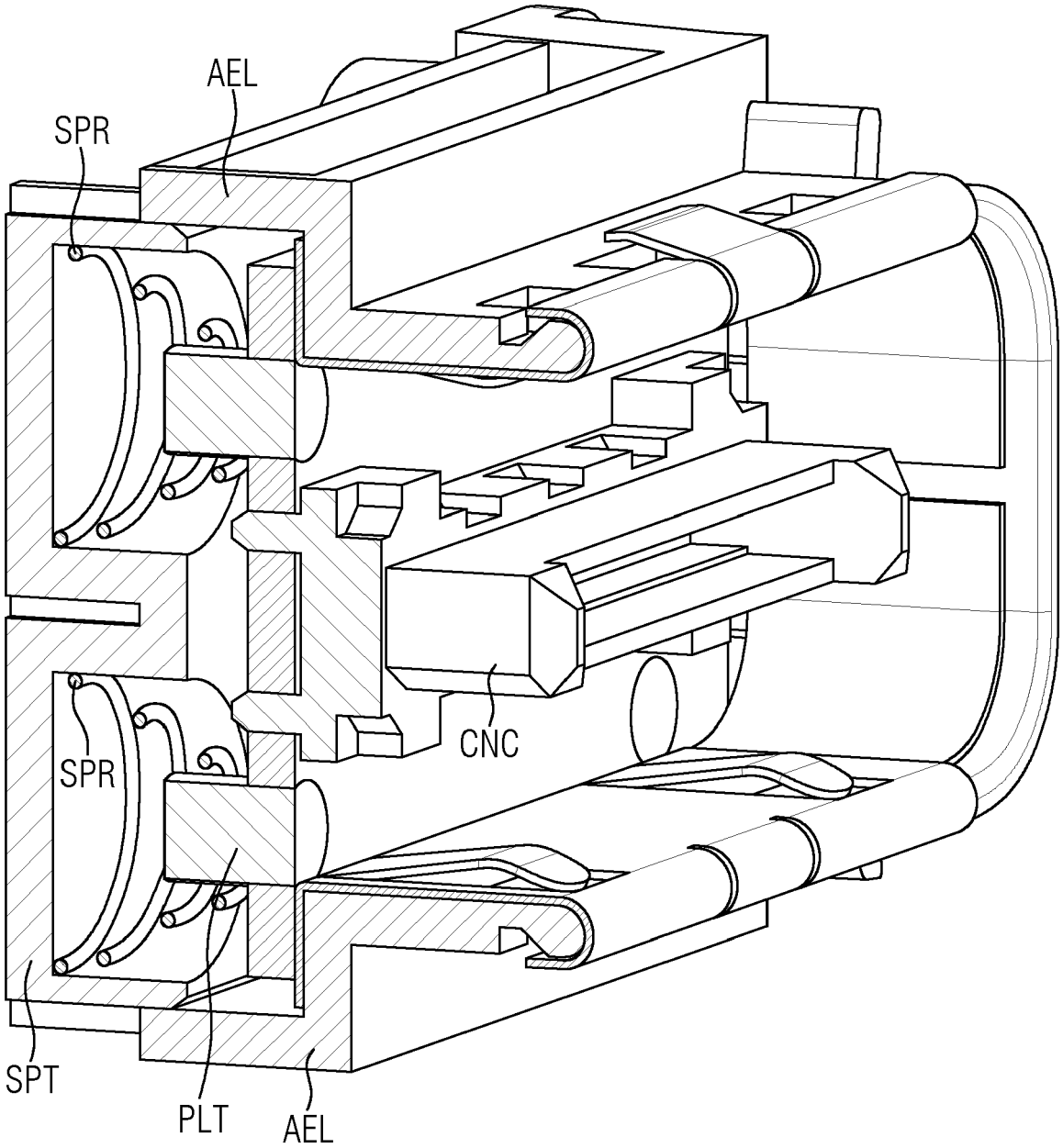


FIG 7

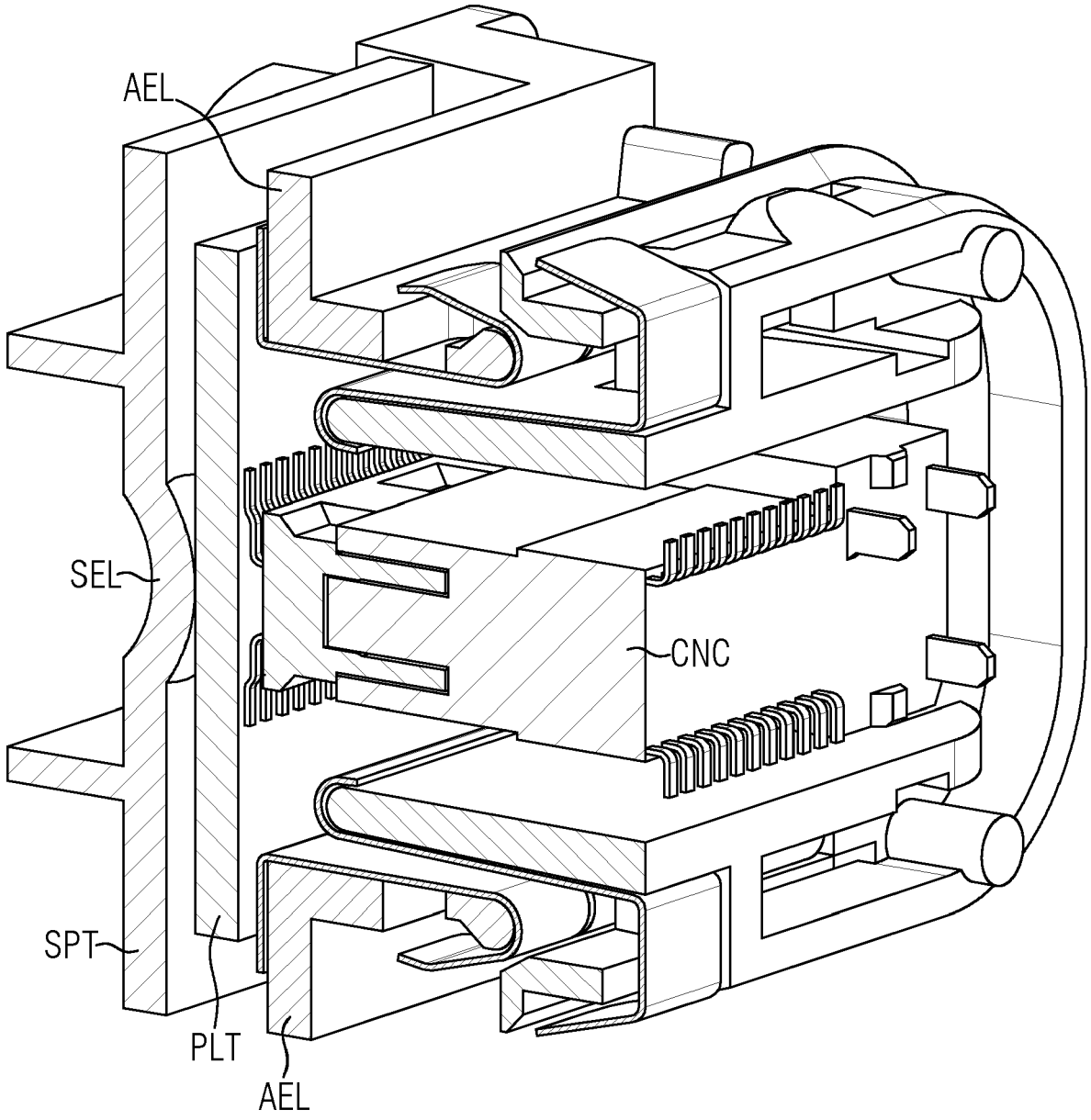
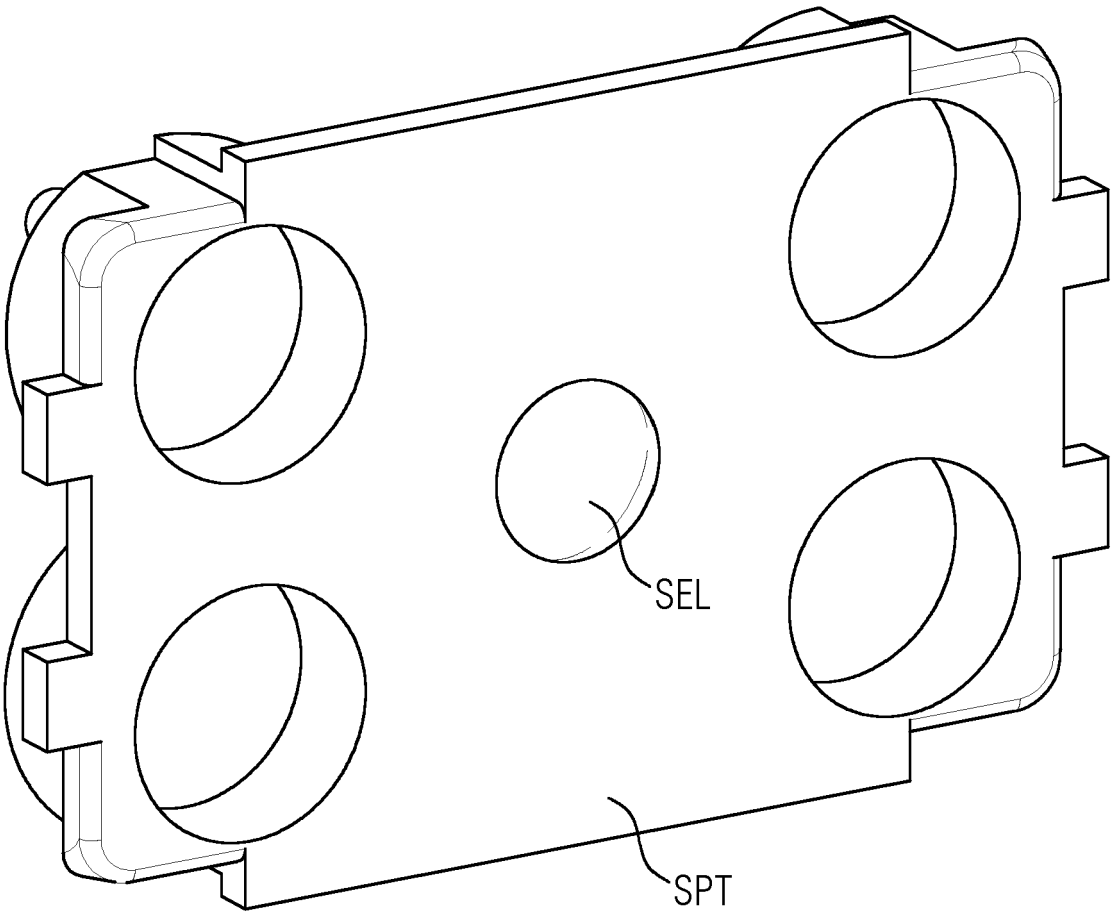


FIG 8



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EUROPEAN SEARCH REPORT

Application Number
EP 23 20 4419

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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	14 June 2006 (2006-06-14)		H01R13/639
Y	* paragraphs [0051] - [0086]; figures *	10-12	H05K5/00
A		5	H01R13/631

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A	* paragraph [0033] - paragraph [0062]; figures 1-6 *	5	

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TECHNICAL FIELDS SEARCHED (IPC)

H05K
H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 April 2024	Gélébart, Yves

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 20 4419

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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03-04-2024

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EPO FORM P0459

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