



- (51) **International Patent Classification:**
H01R 13/436 (2006.01) *H01R 13/502* (2006.01)
- (21) **International Application Number:**
PCT/EP2010/059655
- (22) **International Filing Date:**
6 July 2010 (06.07.2010)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
10 2009 032 393.7 8 July 2009 (08.07.2009) DE
- (71) **Applicant (for all designated States except US):** TYCO ELECTRONICS AMP GMBH [DE/DE]; Ampetesstrasse 12-14, 64625 Bensheim (DE).
- (72) **Inventor; and**
- (75) **Inventor/Applicant (for US only):** SCHUCHT, Olaf [DE/DE]; Schinkelstrasse 32, 60488 Frankfurt am Main (DE).
- (74) **Agent:** HEINZ-SCHAEFER, Marion; c/o Tyco Electronics UK LTD, European Patent Department, Faraday Road, Dorcan, Swindon Wiltshire SN3 5HH (GB).
- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,

CA, CH, CL, CN, CO, CR, CU, CZ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States (unless otherwise indicated, for every kind of regional protection available):** ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- of inventorship (Rule 4.17(iv))

Published:

- with international search report (Art. 21(3))

(54) **Title:** ELECTRICAL PLUG CONNECTOR HAVING A ONE-PIECE CONNECTOR HOUSING AND ASSEMBLY METHOD

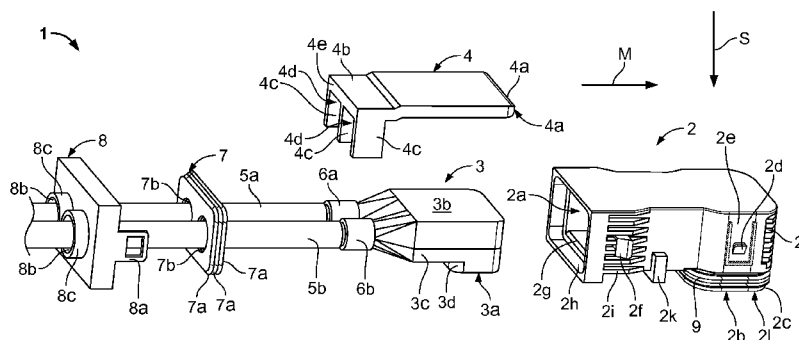


Fig. 1

(57) **Abstract:** The invention relates to an electrical plug connector (1), having a one-piece connector housing (2) which has at least one mounting shaft (2a) comprising a mounting opening (2g) for receiving a contact housing (3) in a mounting direction (M), the contact housing (3) being provided with a holding projection (3d) which extends substantially transversely to the mounting direction (M) and is received, in the mounted state of the plug connector (1), in an indentation (21) of the mounting shaft (2a) running substantially transversely to the mounting direction (M). In order to increase the mechanical stability of the plug connector (1), according to the invention, provision is made for the contact housing (3) and connector housing (2) to delimit, in the mounted state of the plug connector (1), on a side of the mounting shaft (2a) opposing the indentation (21), a compensating gap (10) which opens out into the mounting opening (2g) and is at least partly filled by a fixing element (4) which is configured so as to be able to be inserted into the mounting shaft (2a). Further, the invention relates to a method for mounting an electrical plug connector (1).

ELECTRICAL PLUG CONNECTOR HAVING A ONE-PIECE CONNECTOR
HOUSING AND ASSEMBLY METHOD

The invention relates to an electrical plug connector having a one-piece connector housing which has at least one mounting shaft comprising a mounting opening for receiving a contact housing in a mounting direction, the contact housing being provided with a holding projection which extends substantially transversely to the mounting direction and is received, in the mounted state of the plug connector, in an indentation of the mounting shaft running substantially transversely to the mounting direction.

Furthermore, the invention relates to a method for mounting an electrical plug connector.

Plug connectors of the above-mentioned type have their application for example in the automotive sector for connecting current-conducting cables and are for example used for connecting lamps or batteries in electrically operated motor vehicles or hybrid vehicles.

EP 1 883 135 A1 discloses an electrical plug connector for connecting high-current lines. The plug contacts of the plug connector, which consists of a large number of individual parts, are each provided with electromagnetic shields each consisting of a tubular housing which is divided along its longitudinal axis.

US 4,804,343 discloses a 90° lamp socket comprising a connector housing and a contact housing which is inserted into the connector housing. The contact housing is provided with catching projections which engage with catching depressions of the connector housing when the contact housing is inserted into the connector housing. In order to allow elastic deflection of the catching projections, the catching projections are arranged on elastically deflectable projections of the contact housing.

US 7,063,576 B2 describes a further lamp socket. The contacts of the lamp socket are fastened to a common holder which is inserted, for mounting the lamp socket, into an opening of a socket housing. On reaching a predetermined position, a catching lug on the holder engages with a catching opening on the socket housing. In order to be able to introduce the holder into the socket housing, the socket housing has to be elastically deformed.

A drawback of the plug connectors known in the art is the limited mechanical stability of their housing. In the event of excessively high external forces, which can for example act on the plug connector via conductors connected to the plug connector, parts of the housing can become deformed or detached.

- 5 Accordingly, the invention is based on the problem of providing a plug connector, the mechanical stability of which is increased while being mountable in a simple, tool-free manner.

 According to the invention, for a plug connector of the type mentioned at the outset, this problem is solved in that the contact housing and connector housing delimit, on a side of
10 the mounting shaft opposing the indentation, in the mounted state of the plug connector, a compensating gap which opens out into the mounting opening and is at least partly filled by a fixing element which is configured so as to be able to be inserted into the mounting shaft.

 The solution according to the invention allows much increased stability of the plug connector, as the holding projection and indentation can be designed so as to be any desired
15 size without the forces required for mounting increasing. Furthermore, the fixing element allows a movement play between the contact housing and connector housing to be set or reduced to a predetermined or required degree.

 The plug connector according to the invention can be further developed by various configurations which are independent of one another and each advantageous per se. These
20 configurations and the advantages respectively associated with the configurations will briefly be examined hereinafter.

 In order to prevent altogether a movement of the contact housing in the connector housing and to allow a direct transmission of supporting forces from the contact housing to the connector housing, according to a further advantageous configuration of the plug
25 connector, the width of the fixing element transversely to the mounting direction can correspond roughly to the width of the holding projection and/or the compensating gap.

 In a further advantageous configuration of the plug connector, the holding projection can be rigidly configured. The contact housing and/or the holding projection can be made of a material having a high modulus of elasticity, for example metal. Alternatively or
30 additionally, the holding projection can be designed so as to be appropriately large in order to

produce a rigid structure. This prevents deformations of the connector housing or the contact housing which can be produced for example on account of tensile forces acting on conductors connected to the plug connector. It is thus possible to rule out the risk of accidental release of the connection between the contact housing and connector housing on account of a deformation or a fracture of the plug connector.

The plug connector according to the invention can be used in particular for connecting high-current lines and is particularly suitable for connecting batteries in electrically operated motor vehicles or in hybrid vehicles. These batteries are often provided with a current converter which converts the direct current supplied by the batteries into alternating current which is required for operating the electric drive motors of a vehicle. For this reason, plug connectors connected directly to the alternating current can produce electromagnetic alternating fields or disturbing signals which can disturb other electrical or electronic systems in the surroundings of the plug connector.

In order to prevent electromagnetic disturbances, according to a further advantageous configuration of the plug connector according to the invention, the contact housing can form an electromagnetic shield. In order to completely prevent electromagnetic radiation from escaping, the shield can completely enclose the at least one conductor, which is connected to the plug connector, and the contacts arranged in the contact housing.

In order, according to a further advantageous configuration of the plug connector according to the invention, to further simplify mounting, the shield can be formed by the contact housing. This reduces the number of parts to be mounted. The contact housing can be made of an electrically conductive material, preferably metal and in particular of metal sheet. In order to allow cost-effective large-scale production, the contact housing can be formed from punched metal sheets. For electrical connection to the contact housing, electrical conductors can be fastened to conductor receptacles of the contact housing, preferably via crimp connections.

In order to seal the connector housing from environmental influences, the plug connector can comprise a cover which closes the mounting shaft. The cover can be provided with fastening means allowing holding or sealing forces to be transmitted from the cover to the connector housing. Preferably, a catching connection can be provided, which comprises catches on the cover and mating catches on the connector housing. In order to speed up

mounting, the joining direction of the catching connection can correspond to the mounting direction of the contact housing, so that the cover can be engaged by pressing onto the connector housing in the mounting direction. The cover can for example have a catching tab with which, in the mounted state of the plug connector, a catching projection of the
5 connector housing engages.

In a further advantageous configuration of the plug connector according to the invention, a holding force acting in the mounting direction can be transmittable to the fixing element through the cover. The cover can be connected to the fixing element in a force-conducting manner in that the holding force is transmitted either through a direct face-to-face
10 contact between the fixing element and cover or via intermediate elements. In this way, the position of the fixing element in the connector housing is secured. Alternatively or additionally, the fixing element can have additional fastening means, for example a catching connection via which the fixing means is connected directly to the connector housing.

Furthermore, in an advantageous configuration of the plug connector, the cover can
15 be formed by the fixing element. Thus, the fixing element can serve to fix the contact housing in a force-fitting position and at the same time to close the connector housing. An advantage of this configuration is the reduction of the number of individual parts of the plug connector and a simplification of mounting.

In order to seal the connector housing from environmental influences such as
20 moisture, a seal can be arranged between the cover and connector housing. Furthermore, the seal can be arranged between the cover and fixing element and thus transmit the holding force from the cover to the fixing element. Forces acting on the contact housing, which are for example transmitted to the contact housing via conductors connected to the contact housing, are transmitted to the conductor housing through the holding projection of the contact
25 housing; only low forces can act on the seal.

According to a further advantageous configuration, the fixing element can comprise at least one supporting member which extends substantially transversely to the mounting direction and reaches behind the contact housing on a side of the contact housing pointing counter to the mounting direction. The supporting member increases the size of the area of
30 the fixing element that points counter to the mounting direction, so that the pressure acting in

the mounting direction between the cover and fixing element is greatly reduced. Preferably, the supporting member forms a rest for a seal arranged between the cover and fixing element.

In order to allow a wide rest area even in the case of one or more conductors extending into the contact housing, the supporting member can be configured in a fork-like manner, the at least one conductor being arranged between two prongs of the supporting member. In the case of a plurality of conductors connected to the contact housing, a supporting member configured in a fork-like manner can form a cable holder which defines the position of the conductors in relation to the connector housing and/or the seal and thus prevents accidental rotation or displacement of the conductors.

For the method mentioned at the outset for mounting an electrical plug connector, the problem is solved in that a contact housing is introduced into a mounting shaft of a connector housing in the mounting direction and displaced transversely to the mounting direction in the direction of an indentation of a connector housing, and in that a fixing element is inserted into the mounting shaft between the connector housing and contact housing on a side of the mounting shaft opposing the indentation.

Preferably, the contact housing is pre-mounted prior to integration thereof into the connector housing. Conductors connected to the contact housing can be fastened, for example via crimp connections, to the contact housing preferably prior to the mounting of the contact housing in the connector housing. A cover for closing the mounting shaft, which encloses the conductors, can be slid onto the conductors prior to the mounting of the conductors on the contact housing. Likewise, a seal, which adjoins the cover in the mounted state and can be provided with openings for receiving the at least one conductor, can be slid onto the at least one conductor before the conductors are fastened to the contact housing.

The invention will be commented on hereinafter by way of example based on an embodiment with reference to the figures. In this case, the described embodiment is merely a possible configuration which can be modified for the respective case of application. Individual features which are advantageous per se can be added or omitted in accordance with the foregoing description of the advantageous configurations of the embodiment.

In the drawings:

Fig. 1 is a schematic exploded view of a plug connector according to the invention;

- Fig. 2 is a schematic, partly cut-away side view of a plug connector according to the invention in a first mounting step;
- Fig. 3 is a schematic, partly cut-away side view of a plug connector according to the invention in a second mounting step;
- 5 Fig. 4 is a schematic, partly cut-away side view of a plug connector according to the invention in a third mounting step;
- Fig. 5 is a schematic, partly cut-away side view of a plug connector according to the invention in a fourth mounting step;
- Fig. 6 is a schematic, partly cut-away side view of a plug connector according to the invention in a fifth mounting step; and
- 10 Fig. 7 is a schematic, partly cut-away side view of a plug connector according to the invention in the mounted state.

Firstly, the construction of a plug connector according to the invention will be described with reference to the exemplary embodiment of Fig. 1.

- 15 The plug connector 1 comprises a connector housing 2 which serves to receive a contact housing 3. A fixing element 4, which is arranged, in the mounted state of the plug connector 1, in the connector housing 2 between the contact housing 3 and inner wall of the connector housing 2, is provided in order to fix the contact housing 3 in the connector housing 2. Two conductors 5a, 5b, which are connected to the contact housing 3 via crimp
- 20 connections 6a, 6b, are inserted into the contact housing 3. Even before the mounting of the crimp connections 6a, 6b, a seal 7 was slid onto the conductors 5a, 5b. In the same way, a cover 8, which serves to close the connector housing 2 and to fix the elements received into the connector housing 2, is also slid onto the conductors 5a, 5b.

- 25 The housing 2, the fixing element 4 and the cover 8 are preferably made of plastics material, in particular by injection moulding, in order to allow cost-effective large-scale production of the plug connector.

- The housing 2 comprises a mounting shaft 2a for receiving the contact housing 3. The plug connector 1 shown is configured as a 90° plug connector, the mounting shaft 2a being closed at its end pointing in a mounting direction M. For connecting to a mating plug
- 30 connector, the connector housing 2 is provided with a receiving opening 2b in which, in the

mounted state of the plug connector 1, a plug connector face 3a provided on the contact housing 3 is arranged. The receiving opening 2b is surrounded by an edge 2c which is configured as a collar. On the outwardly pointing circumferential face of the edge 2c, a seal 9, which is configured as a radial seal with three sealing lips, ensures a seal from moisture
5 seeping in from the outside.

Above the receiving opening 2b, the housing is provided with a catch 2d which is configured as a catching projection and engaged, when the plug-in connection is mounted, with a complementarily configured catching receptacle (not shown) of a mating plug connector. In order to simplify an elastic deflection of the catch 2d, the catch 2d is placed on
10 a bending tongue 2e which is formed by a portion of the housing wall of the connector housing 2 and is configured so as to be deflectable in the direction of the mounting shaft 2a.

A further catch 2f, which is configured like the catch 2d as a catching projection, is attached laterally in the region of the mounting opening 2g of the plug connector 2. The catch 2f, which is configured in a substantially wedge-shaped manner, its height decreasing
15 counter to the mounting direction M, engages, in the mounted state of the plug connector, with a mating catch 8a formed by the cover 8. The mating catch 8a, which is configured as an elastically deflectable tab, absorbs the elastic deformation which is necessary for the mounting of the catching connection consisting of the catch 2f and mating catch 8a.

A frame 2h surrounding the mounting opening 2g serves to receive the seal 7. The
20 inwardly pointing face of the frame 2h forms in the mounting direction M a substantially rectangular profile, the corners of which are rounded and which is adapted to the profile of the seal 7 in a direction of projection corresponding to the mounting direction M. In the mounted state of the plug connector, the sealing lips 7a, which are arranged at the circumference of the seal 7, rest uninterrupted on the inwardly pointing face of the frame 2h.

Reinforcing ribs 2i, which run on the connector housing 2 in the mounting direction
25 M, cause a stiffening of the connector housing 2 and reduce a deformation of the connector housing 2 on account of externally introduced forces, are arranged on opposing sides of the mounting shaft 2a. Further reinforcing ribs 2j running substantially transversely to the mounting direction M are provided at the side of the connector housing 2 pointing in the
30 mounting direction M.

A substantially rectangular supporting portion 2k, which extends over the entire width of the connector housing 2, is arranged on the side of the connector housing 2 pointing in the direction of the receiving opening 2b. When the plug-in connection is mounted, the supporting portion 2k is inserted into a complementarily configured depression (not shown) of the mating plug connector. With the depression of the mating plug connector, the supporting portion 2k forms a form-fitting connection which can transmit at least forces in and counter to the mounting direction M. Thus, the form-fitting connection absorbs forces acting externally on the plug-in connection, in particular tensile forces acting on the conductors 5a, 5b. The depression in the mating plug connector can for example be configured in a channel-shaped manner. According to a further advantageous configuration of the plug connector, the supporting portion 2k can be provided with catches which are preferably arranged parallel to the catches 2d and absorb forces which act on the plug connector and act counter to a plug-in direction S.

The fixing element 4, which is introduced into the mounting shaft 2a during the mounting of the plug connector in the mounting direction M, is provided at its end pointing in the mounting direction M on opposing sides with chamfers 4a. As a result of the chamfers 4a, the end of the fixing element that points in the mounting direction M has a substantially wedge-shaped form which facilitates the introduction of the fixing element 4 into the mounting shaft 2a when the contact housing 3 is inserted.

The end of the fixing element 4 that points counter to the mounting direction M forms a supporting member 4b which is configured substantially in a fork-like manner. The fork-like supporting member 4b comprises prongs 4c which extend transversely to the mounting direction M and, in the mounted state of the plug connector, into the mounting shaft 2a. Two prongs 4c each delimit a gap 4d, a conductor 5a or 5b being received in the region of a crimp connection 6a, 6b in the mounted state of the plug connector in each gap 4d. In this way, the conductors 5a, 5b are held in a predetermined position. At the same time, the face of the supporting member 4b that points counter to the mounting direction M forms a supporting face for the seal 7, the supporting face defining the position of the seal 7 between the fixing element 4 and the cover 8. The rest area 4e, which runs perpendicularly to the mounting direction M and extends over the prongs 4c, is designed so as to be sufficiently large to transmit the forces acting on the seal 7 through the cover 8 and the fixing element 4 without

an excessively high deformation of the seal 7, which might lead to an impairment of the sealing effect.

The contact housing 3 consists of a BUG contact housing (not shown) and a shield which does not allow electromagnetic disturbing signals, which can occur in particular during transmission of strong alternating currents, to issue from the plug-in connection or infiltrate the plug-in connection. For this purpose, the shield is preferably formed from an electrically conductive material, for example metal sheet. The shield comprises a first housing half 3b and a second housing half 3c which are joined together even before the mounting of the contact housing 3 in the connector housing 2. The second, lower housing half 3c comprises a plug connector face 3a which forms a holding projection 3d. The holding projection 3d extends substantially transversely to the mounting direction M in the plug-in direction S. In the mounted state of the plug connector, the holding projection 3d thus extends into an indentation 2l of the mounting shaft 2a, the indentation 2l forming at the same time a receiving opening 2b for a mating plug connector. Between the holding projection 3d and indentation 2l, a form-fitting connection is produced that prevents a movement of the contact housing 3 within the connector housing 2 in or counter to the mounting direction M.

The seal 7, which rests as a radial seal against the inner faces of the frame 2h, is provided with openings 7b which serve to receive the conductors 5a, 5b. In the mounted state of the plug connector 2, the crimp connections 6a, 6b are placed in the openings 7b and rest against the edges 7b, thus producing a sealing connection between the seal 7 and crimp connections 6a, 6b.

The cover 8 also has openings 8b which serve to receive or thread-in the conductors 5a, 5b. The edges of the openings 8b are reinforced with projections 8c which extend counter to the mounting direction M and are configured as hollow cylinders.

The embodiment shown of the plug connector 1 is suitable in particular for connecting high-power batteries in electrically driven vehicles. The plug connector according to the invention has many fewer housing separation joints and parts than plug connectors known in the art for applications of this type, such as the plug connector from EP 1 883 135 A1.

Fig. 2 shows a plug connector according to the invention in a first mounting step, the same reference numerals being used for elements corresponding in function and construction to the elements of the exemplary embodiment of Fig. 1.

For mounting the plug connector 1, the conductors 5a, 5b are firstly guided through the openings 8b of the cover 8 and 7b of the seal 7. Subsequently, stripped ends 5c of the conductors 5b are inserted into the contact housing 3 and the contact housing 3 is closed by joining the first housing half 3b and the second housing half 3c.

The pre-mounted contact housing 3 can now be introduced into the mounting shaft 2a of the connector housing 2 in the mounting direction M up to the position shown in Fig. 3, in which the end of the contact housing 3 that points in the mounting direction M abuts the corresponding end of the mounting shaft 2a. The end of the mounting shaft 2a that points in the mounting direction M serves in this case as a stop which indicates the reaching of a predetermined position of the contact housing 3 before the beginning of the following mounting step.

In Fig. 3 the contact housing 3 is completely inserted into the connector housing 2 in the mounting direction M. As the minimum width of the mounting shaft B is greater than the maximum width b of the contact housing, the contact housing can be inserted without resistance. On account of the difference between the width B of the mounting shaft and the width b of the contact housing, the contact housing 3 can be moved transversely to the mounting direction M during the introduction into the mounting shaft 2a.

Fig. 4 shows the plug connector in a third mounting position in which the contact housing 3 has assumed its final position in the connector housing 2. For this purpose, the contact housing 3 is displaced, starting from the second mounting step shown in Fig. 3, transversely to the mounting direction M in the plug-in direction S. In the third mounting step which has now been reached, the plug connector face 3a and the holding projection 3d protrude into the receiving opening 2b of the connector housing 2.

Fig. 5 shows a fourth mounting step in which the fixing element 4 is attached to the conductors 5a, 5b. After the conductors 5a, 5b have been inserted in the gaps 4d shown in Fig. 1 of the fixing element 4, the fixing element 4 can be inserted into the mounting opening 2g of the mounting shaft 2a in the mounting direction M. As the holding projection 3d of the

contact housing 3 is arranged, in the mounted state, in an indentation 2l of the mounting shaft 2a, a compensating gap 10 on the side of the contact housing 3 pointing counter to the plug-in direction S is increased in size. The width a of the compensating gap 10 is thus equal to or somewhat greater than the width c of the fixing element 4 in the region of a compensating member 4f which is received in the compensating gap 10 in the mounted state. The fixing element 4 can accordingly be moved into the mounting opening 2g in the mounting direction M without frictional resistance.

In order to allow frictionless mounting, the width d of the holding projection 3d may be roughly less than or equal to the width a of the compensating gap 10. The proportion A of the width B of the mounting shaft 2a that corresponds to the width of the contact housing 3 in the plug-in direction S laterally of the holding projection 3d is filled out by the contact housing 3 in the mounted state. The width a of the compensating gap 10, which is formed by the mounting shaft 2a, is left for receiving the compensating member 4f of the fixing element 4.

In the fifth mounting step shown in Fig. 6, the fixing element 4 is inserted into the mounting shaft 2a. In this position, the end of the fixing element 4 that points in the mounting direction M adjoins the inner wall of the mounting shaft 2a that points counter to the mounting direction M. As the holding projection 3d is arranged in the indentation 2l of the mounting shaft 2a, a form-fitting connection is produced between the connector housing 2 and contact housing 3, the form-fitting connection preventing the contact housing 3 from slipping into the mounting shaft 2a counter to the mounting direction M. The compensating member 4f serves as a securing element which prevents the contact housing 3 from slipping counter to the plug-in direction S and thus the form-fitting connection on the holding projection 3d from becoming released.

As soon as the fixing element 4 is inserted into the mounting shaft 2a, the seal 7 can be introduced into the housing 2 along the conductor 5b. After the introduction of the seal 7 into the housing 2, the cover 8 is slid onto the end of the housing 2 that points counter to the mounting direction M and the mounting shaft 2a is thus closed.

Fig. 7 is a partly cut-away side view of the plug connector 1 in the mounted state. The mounting shaft 2a is closed by the cover 8 which adjoins the fixing element 4 in a force-transmitting manner via the seal 7. In this way, the cover 8 transmits a holding force H to the

-12 -

fixing element 4. Tensile forces F acting on the conductors 5a, 5b are transmitted to the connector housing 2 via the holding projection 3d at the edge of the indentation 2l. The cover 8 thus does not absorb any tensile forces F acting on the conductors 5a, 5b, but rather serves merely to hold the seal 7 in the connector housing 2 and to secure the position of the fixing element 4.

The above-described embodiment can be further modified. For example, the cover 8 can be formed by the fixing element 4. In order to secure the position of the fixing element 4 in the mounting shaft 2a, the fixing element 4 can be provided with fastening means, for example at least one catching connection, which allow fastening to the connector housing 2.

10 Furthermore, the plug connector 1 can be configured as a 180° plug connector in which the receiving opening 2b and the plug connector face 3a point in the mounting direction M or in the longitudinal direction of the conductor 5a, 5b. For fixing the contact housing in the connector housing, the contact housing can have a holding projection extending separately from the plug connector face transversely to the mounting direction M.

CLAIMS

1. Electrical plug connector (1), having a one-piece connector housing (2) which has at least one mounting shaft (2a) comprising a mounting opening (2g) for receiving a contact housing (3) in a mounting direction (M), the contact housing (3) being provided with a holding projection (3d) which extends substantially transversely to the mounting direction (M) and is received, in the mounted state of the plug connector (1), in an indentation (2l) of the mounting shaft (2a) running substantially transversely to the mounting direction (M), characterised in that the contact housing (3) and connector housing (2) delimit, on a side of the mounting shaft (2a) opposing the indentation (2l), in the mounted state of the plug connector (1), a compensating gap (10) which opens out into the mounting opening (2g) and is at least partly filled by a fixing element (4) which is configured so as to be able to be inserted into the mounting shaft (2a).
2. Electrical plug connector (1) according to claim 1, characterised in that the width of the fixing element (4) transversely to the mounting direction (M) corresponds roughly to the width (d) of the holding projection (3d) and/or the width (a) of the compensating gap (10).
3. Electrical plug connector (1) according to claim 1 or 2, characterised in that the holding projection (3d) and the indentation (2l) are rigidly configured.
4. Electrical plug connector (1) according to one of claims 1 to 3, characterised in that the contact housing (3) forms an electromagnetic shield.
5. Electrical plug connector (1) according to one of claims 1 to 4, characterised in that the plug connector (1) comprises a plug connector face (3a) which points substantially transversely to the mounting direction (M) and forms the holding projection (3d).
6. Electrical plug connector (1) according to one of claims 1 to 5, characterised in that the plug connector (1) comprises a cover (8) which closes the mounting shaft (2a).

-14 -

7. Electrical plug connector (1) according to claim 6, characterised in that a holding force (H) acting in the mounting direction (M) can be transmitted to the fixing element (4) through the cover (8).
- 5 8. Electrical plug connector (1) according to claim 6 or 7, characterised in that a seal (7) is arranged between the cover (8) and fixing element (4).
9. Electrical plug connector (1) according to one of claims 1 to 8, characterised in that the fixing element (4) comprises at least one supporting member (4b) which extends
- 10 substantially transversely to the mounting direction (M) and reaches behind the contact housing (3) on a side of the contact housing (3) pointing counter to the mounting direction (M).
10. Electrical plug connector (1) according to claim 9, characterised in that the
- 15 supporting member (4b) is configured in a fork-like manner, at least one conductor (5a, 5b), which is connected to the contact housing (3), being arranged between two prongs (4c) of the supporting member (4b).
11. Method for mounting an electrical plug connector (1), characterised by the following
- 20 steps:
- introducing a contact housing (3) into a mounting shaft (2a) of a connector housing (2) in the mounting direction (M),
- displacing the contact housing (3) transversely to the mounting direction (M) in the direction of an indentation (2l) of the connector housing,
- 25 inserting a fixing element (4) into the mounting shaft (2a) between the connector housing (2) and contact housing (3) on a side of the mounting shaft (2a) opposing the indentation (2l).
12. Method according to claim 11, characterised in that the mounting shaft (2a) is closed
- 30 by a cover (8).

1/4

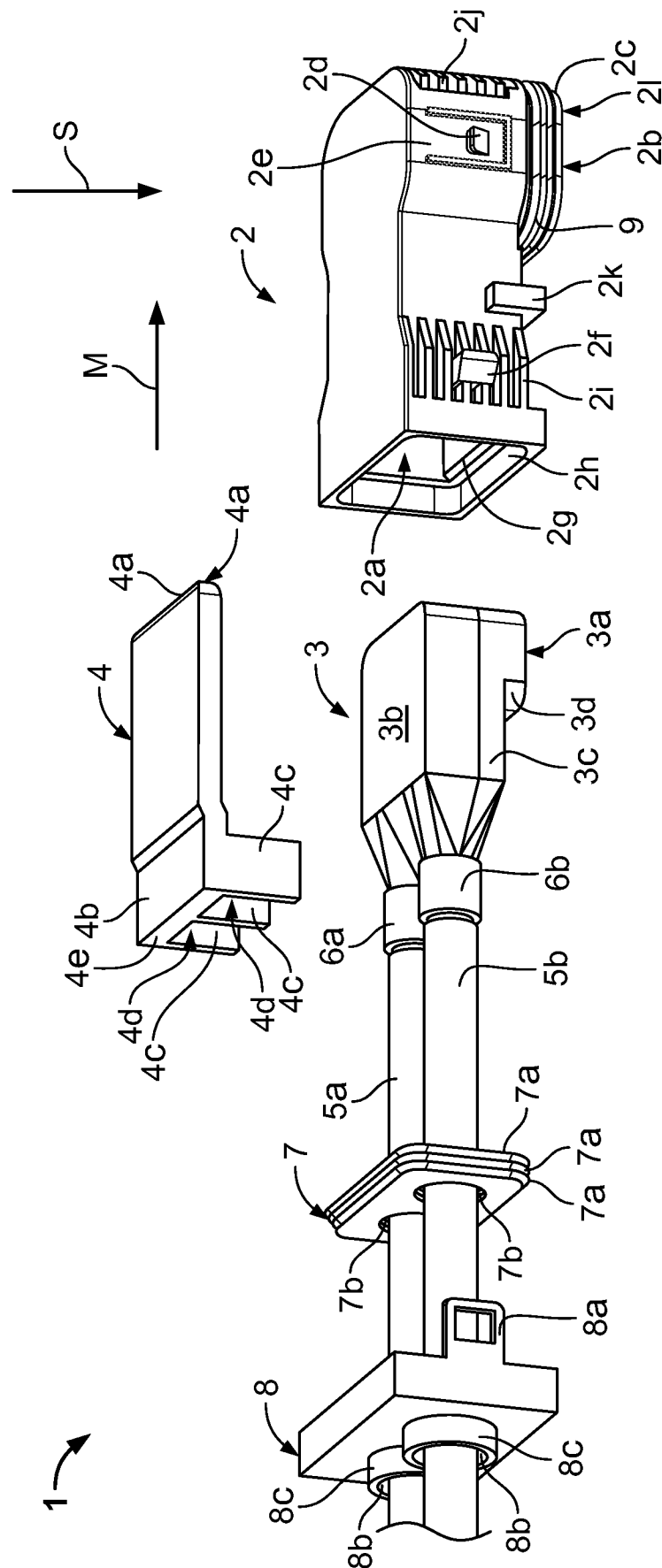


Fig. 1

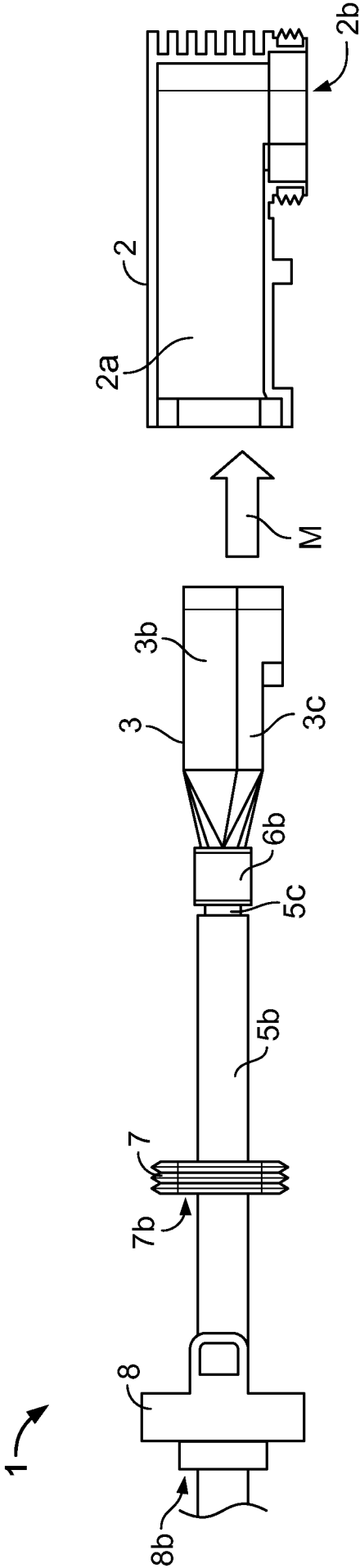


Fig. 2

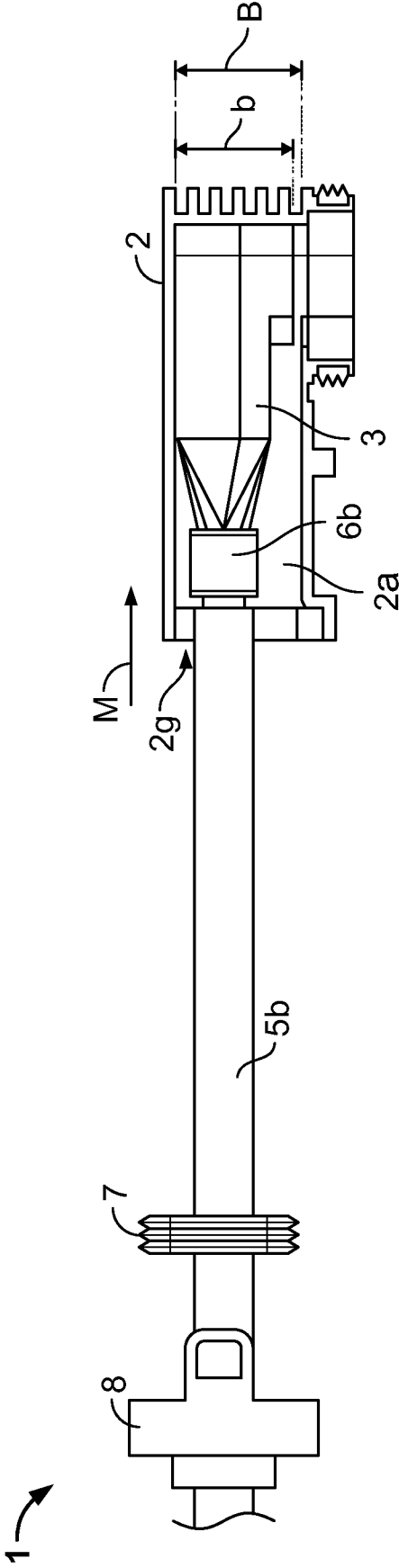


Fig. 3

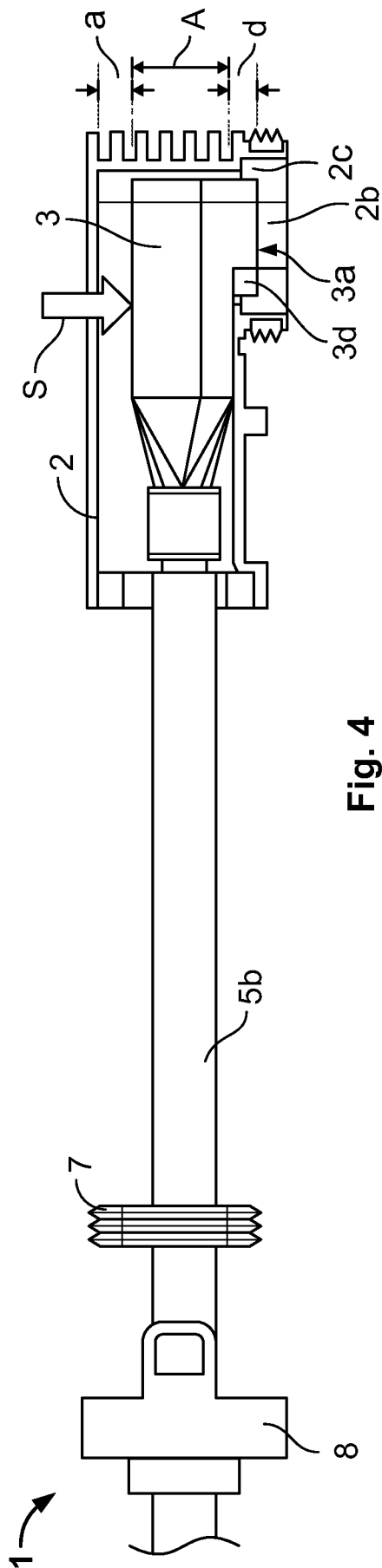


Fig. 4

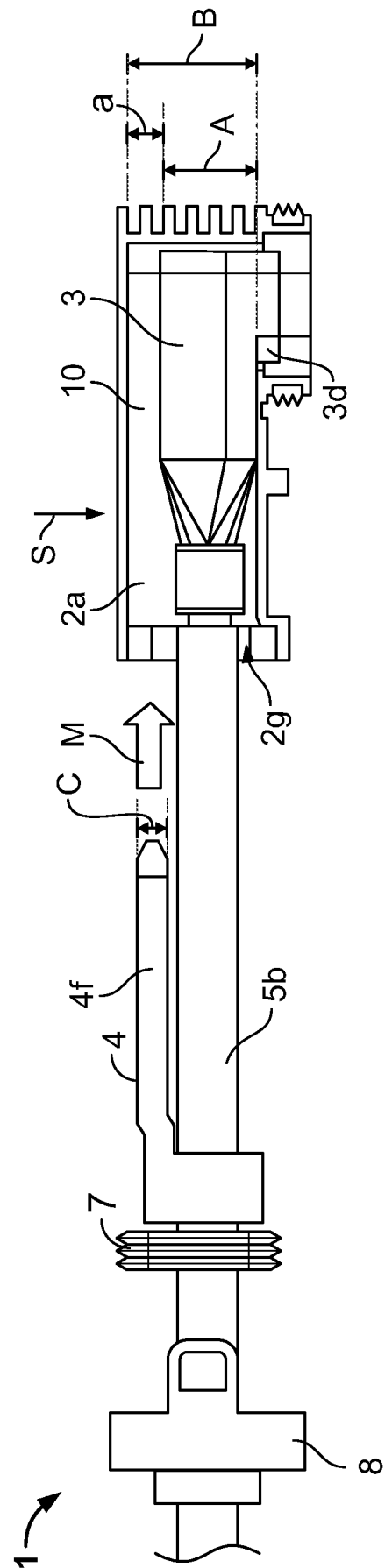
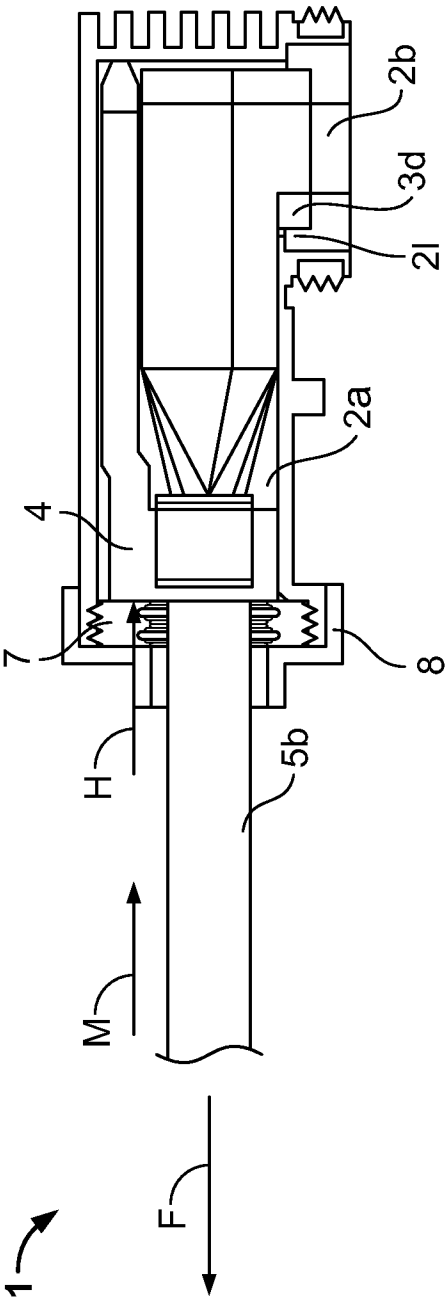
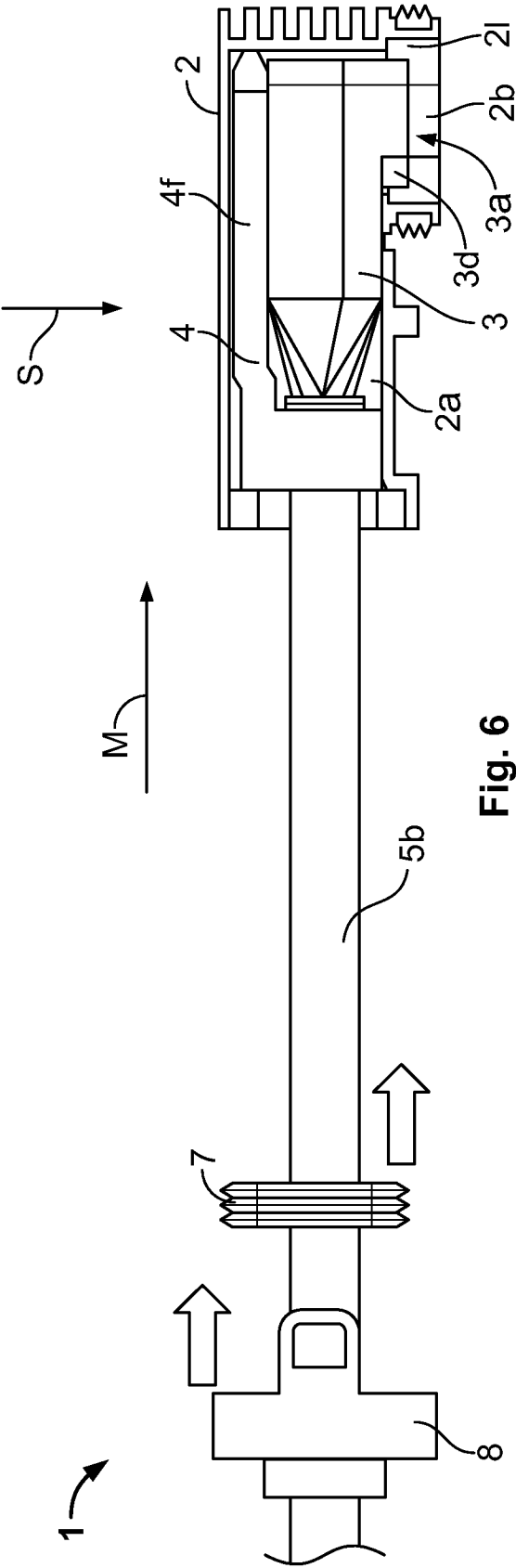


Fig. 5



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/059655

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R13/436 H01R13/502
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

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 practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 798 823 A1 (IRISO ELECTRONICS CO LTD [JP]) 20 June 2007 (2007-06-20)	1-3, 11, 12
Y	paragraph [0013] - paragraph [0025]	4-7
Y	US 2007/026736 A1 (ITANO MICHAEL [US] ET AL ITANO MICHAEL [US] ET AL) 1 February 2007 (2007-02-01) paragraph [0027]	4
Y	EP 1 128 488 A2 (TYCO ELECTRONICS AMP ESPANOLA [ES]) 29 August 2001 (2001-08-29) * abstract	5-7

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

10 September 2010

Date of mailing of the international search report

20/09/2010

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

Bertin, Michel

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2010/059655

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1798823	A1	20-06-2007	AT 454728 T 15-01-2010
			CN 1934755 A 21-03-2007
			WO 2006095456 A1 14-09-2006
			JP 4044937 B2 06-02-2008
			JP 2006252975 A 21-09-2006
			KR 20060122962 A 30-11-2006
			PT 1798823 E 08-04-2010
			TW 286863 B 11-09-2007
			US 2007207643 A1 06-09-2007
US 2007026736	A1	01-02-2007	NONE
EP 1128488	A2	29-08-2001	NONE