(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 706 249 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
09.09.2020 Bulletin 2020/37

(51) Int Cl.:
H01R 12/72 *(2011.01)* ***H01R 13/717*** *(2006.01)*

(21) Application number: **19160770.4**

(22) Date of filing: **05.03.2019**

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

(71) Applicant: **TTTech Computertechnik Aktiengesellschaft**
1040 Wien (AT)

(72) Inventors:
- **Buchta, Thomas**
  1230 Wien (AT)
- **Kröpfl, Sebastian**
  1050 Wien (AT)
- **Rabl, Markus**
  1210 Wien (AT)

(74) Representative: **Patentanwaltskanzlei Matschnig & Forsthuber OG**
Biberstraße 22
Postfach 36
1010 Wien (AT)

(54) ELECTRICAL CONNECTOR FOR MOTOR VEHICLES

(57) Electrical connector for a motor vehicle, comprising:
- a jack receptacle connector comprising an insulative housing with a mating face, wherein on the mating face of the insulative housing at least one cavity profiled to receive a complementary plug is arranged, and wherein the insulative housing comprises at least one light indicator area, which is at least partially translucent and has a light entry surface and a light exit surface opposite to the light entry surface for emitting light in the direction of the mating face of the insulative housing, and
- a circuit board on which the jack receptacle connector is electrically connected, wherein the circuit board comprises at least one light emitting device, which light emitting device is assigned to the at least one light indicator area and is configured to emit light towards the light entry surface of the at least one light indicator area, wherein the at least one light indicator area and the insulative housing are made of one material, wherein the at least one light indicator area is formed integrally with the insulative housing.

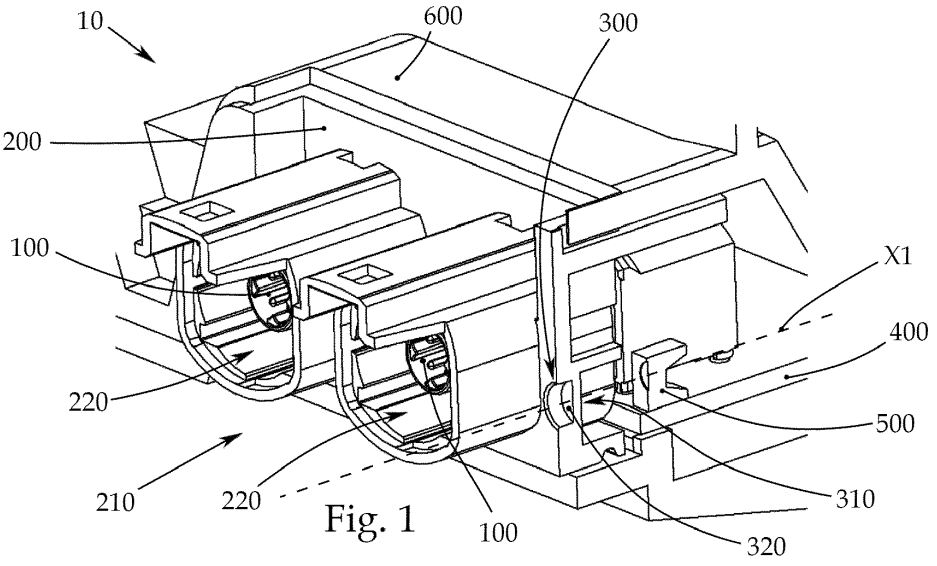

Fig. 1

EP 3 706 249 A1

Description

[0001] The invention relates to an electrical connector for a motor vehicle, comprising:

- a jack receptacle connector comprising an insulative housing with a mating face, wherein on the mating face of the insulative housing at least one cavity profiled to receive a complementary plug is arranged, and wherein the insulative housing comprises at least one light indicator area, which is at least partially translucent and has a light entry surface and a light exit surface opposite to the light entry surface for emitting light in the direction of the mating face of the insulative housing, and

- a circuit board on which the jack receptacle connector is electrically connected, wherein the circuit board comprises at least one light emitting device, which light emitting device is assigned to the at least one light indicator area and is configured to emit light towards the light entry surface of the at least one light indicator area.

[0002] These connectors are typically used for electrical connection between electrical communication devices. In order to ensure that a proper connection has been made and therefore a link is created between the electrical communication devices, indicators are often incorporated into circuits on the printed circuit board. These indicators are typically light emitting diodes which are turned on when a circuit is completed between the mating connectors and the communication devices. Additionally, LEDs can be mounted on the printed circuit board to indicate a number of other conditions including the passage of communication signals between the two communication devices, an indication of power supply status, indication that an error in transmitting the signals has occurred, or used for debugging purposes during development.

[0003] Such connectors can be used in vehicles for construction, agricultural forestry, municipal, industrial and/or railway applications.

[0004] Classical or standard electrical connectors in a motor vehicle face usually harsh environmental conditions and have therefore, in general, no visible status indicators. Typical harsh environmental conditions for motor vehicles are high temperature fluctuations from -40°C up to 85°C or even higher, vibrations, shock, bump or the like.

[0005] Electrical connectors of prior art, accomplish such indicators with LEDs, light guides, adhesives and/or coloured films, but thereby cause a higher risk of leaking in the assembly due to more and different sealing interfaces, which can come apart due to aforementioned conditions in a motor vehicle.

[0006] An example of such a connector is disclosed in US 4,978,317 which teaches a connector for receiving a plug having visual indicator positioned within the front wall of the electrical connector housing. Incorporation of the indicator into the electrical connector eliminates the need for a separate location on the printed circuit board for mounting of such an indicator. The LED indicator is inserted into a recess of the electrical connector such that its electrical leads pass through the recess and connect to the printed circuit board. The indicator is then cemented into the recess or attached using an appropriate adhesive. The LEDs may also be moulded into the electrical connector during the moulding process of the housing.

[0007] A problem arises with these connectors in that additional manufacturing steps are required for insertion and accurate positioning of the LEDs for mounting to corresponding openings in the printed circuit board. These additional manufacturing steps include first accurately positioning the LED in a recess of the connector and also securing the LED thereto by either cementing or otherwise adhering the LEDS to the housing. Also, for identification purposes, LEDs must be manufactured with the component being overmoulded by coloured translucent material and having leads attached thereto for connection to the circuit board.

[0008] Another example of such a connector is disclosed in US 5,876,239 which discloses a modular jack receptacle connector which has at least one light pipe for transmitting light signals from a light emitting device receiving area through an output face along the mating face of the modular jack receptacle, wherein the at least one light pipe or indicator is then attached onto the receptacle connector using an appropriate adhesive.

[0009] It is therefore an object of the invention to provide an enhanced electrical connector.

[0010] To achieve this object, the at least one light indicator area and the insulative housing are made of one material, wherein the at least one light indicator area is formed integrally with the insulative housing.

[0011] The at least one light indicator area acts as a status indicator for the electronic connector or the at least one jack receptacle connectors.

[0012] Advantageously, in the case of two or more light emitting devices (LED), each of which can emit light in a different colour, e.g. red, green, blue, orange, and yellow.

[0013] Advantageously, the light entry surface and the light exit surface are parallel to each other, wherein the light entry surface and the light exit surface have a distance to one another from 0,8 to 1,3 mm, preferably 0,8 mm.

[0014] Advantageously, the light entry surface and the light exit surface are parallel and opposite to each other, wherein the distance between the light entry surface and the light exit surface is smaller than the thickness of the direct surrounding section of the insulative housing.

[0015] Advantageously, the light emitting device has a main propagation direction and is disposed such that the main propagation direction is orthogonal to the light entry surface of the at least one light indicator area.

[0016] Advantageously, the electrical connector comprises at least two or more, preferably exactly two jack receptacle connectors, wherein the insulative housings of each jack receptacle connector are formed together in one piece.

[0017] Advantageously, the insulative housing together with the light indicator area is fabricated by injection moulding.

[0018] Advantageously, the insulative housing is made of polybutylene terephthalate with glass fibre content of 10 % to 50%, preferably 20% to 30%, particularly with 30% (PBT GF30).

[0019] Advantageously, the insulative housing, preferably made of polybutylene terephthalate, is not colored.

[0020] In other words, the material contains only the most necessary additives for environmental resistance and only those that do not greatly reduce the light transmission.

[0021] Advantageously, the material of the insulative housing comprises flame-retarding additives.

[0022] Advantageously, the circuit board, the light emitting devices and parts of the jack receptacle connectors for connecting the jack receptacle connectors electrically with the circuit board are housed in a housing, wherein the housing is connected with the insulative housing via at least one fixing means. The fixing means can be an adhesive.

[0023] In the following, in order to further demonstrate the present invention, illustrative and non-restrictive embodiments are discussed, as shown in the drawings, which show:

Fig. 1 a perspective view of an exemplary electrical connector with two jack receptacle connectors and an insulative housing, wherein the insulative housing comprises light indicator areas;

Fig. 2 a front view of the electrical connector of Fig. 1; and

Fig. 3 a horizontal section of the electrical connector of Fig. 1.

[0024] **Fig. 1** shows an electrical connector **10** for a motor vehicle, comprising two jack receptacle connectors **100,** which comprise an insulative housing **200** with a mating face **210,** wherein on the mating face **210** of the insulative housing **210** one cavity **220** profiled to receive a complementary plug for each jack receptacle connector **100** is arranged.

[0025] The insulative housing **200** further comprises three light indicator areas **300,** shown in **Fig. 2.** It should be noted, that more or less light indicator areas are possible.

[0026] The light indicator areas **300** are at least partially translucent and each has a light entry surface **310** and a light exit surface **320** opposite to the light entry surface **310** for emitting light in the direction of the mating face **210** of the insulative housing **200.**

[0027] The electrical connector further comprises a circuit board **400** (which can be seen in **Fig. 1** and **Fig. 3**) on which the jack receptacle connectors **100** are electrically connected, wherein the circuit board **400** comprises three light emitting devices **500,** each of which is assigned to a light indicator area **300** and is configured to emit light towards the light entry surface **310** of the at least one light indicator area **300.** In the shown example, the light emitting devices **500** have a main propagation direction **X1** and are disposed such that the main propagation direction **X1** is orthogonal to the light entry surface **310** of the assigned light indicator area **300.** Furthermore, the circuit board **400,** the light emitting devices **500** and parts of the jack receptacle connectors **100** for connecting the jack receptacle connectors **100** electrically with the circuit board **400** are housed in a housing **600,** wherein the housing **600** is connected with the insulative housing **200** via at least one fixing means. The fixing means in the shown example in the figures is an adhesive.

[0028] Further, the light entry surface **310** and the light exit surface **320** are parallel to each other, wherein the light entry surface **310** and the light exit surface **320** have a distance to one another from 0,8 to 1,3 mm, preferably 0,8 mm.

[0029] Moreover, all light indicator areas **300** and the insulative housing **200** are made of one material, wherein the light indicator areas **300** are formed integrally with the insulative housing **200,** e.g. by injection moulding. The insulative housing **200** and the indicator areas **300** could be made of polybutylene terephthalate with glass fibre content of 10 % to 50%, preferably 20% to 30%, particularly with 30% (PBT GF30).

LIST OF REFERENCE SIGNS

Electrical connector	10
Jack receptacle connector	100
Insulative housing	200
Mating face	210
Cavity	220
Light indicator area	300
Light entry surface	310
Light exit surface	320
Circuit board	400
Light emitting device	500
Housing	600
Main propagation direction	X1

Claims

1. Electrical connector (10) for vehicles, in particular motor vehicles, comprising:

- at least one jack receptacle connector (100)

comprising an insulative housing (200) with a mating face (210), wherein on the mating face (210) of the insulative housing (210) at least one cavity (220) profiled to receive a complementary plug is arranged, and wherein the insulative housing (200) comprises at least one light indicator area (300), which is at least partially translucent and has a light entry surface (310) and a light exit surface (320) opposite to the light entry surface (310) for emitting light in the direction of the mating face (210) of the insulative housing (200), and

- a circuit board (400) on which the at least one jack receptacle connector (100) is electrically connected, wherein the circuit board (400) comprises at least one light emitting device (500), which light emitting device (500) is assigned to the at least one light indicator area (300) and is configured to emit light towards the light entry surface (310) of the at least one light indicator area (300),

characterized in that
the at least one light indicator area (300) and the insulative housing (200) are made of one material, wherein the at least one light indicator area (300) is formed integrally with the insulative housing (200).

2. Electrical connector according to claim 1, **wherein** the light entry surface (310) and the light exit surface (320) are parallel to each other, wherein the light entry surface (310) and the light exit surface (320) have a distance to one another from 0,8 to 1,3 mm, preferably 0,8 mm.

3. Electrical connector according to claim 1 or 2, **wherein** the light emitting device (500) has a main propagation direction (X1) and is disposed such that the main propagation direction (X1) is orthogonal to the light entry surface (310) of the at least one light indicator area (300).

4. Electrical connector according to anyone of the claims 1 to 3, **wherein** the electrical connector (10) comprises at least two, preferably exactly two jack receptacle connectors (100), wherein the insulative housings (200) of each jack receptacle connector (200) are formed together in one piece.

5. Electrical connector according to anyone of the claims 1 to 4, **wherein** the insulative housing (200) together with the light indicator area (300) is fabricated by injection moulding.

6. Electrical connector according to anyone of claim 1 to 5, **wherein** the insulative housing (200) is made of polybutylene terephthalate with a glass fibre content of 10 % to 50%, preferably 20% to 30%, particularly with 30%.

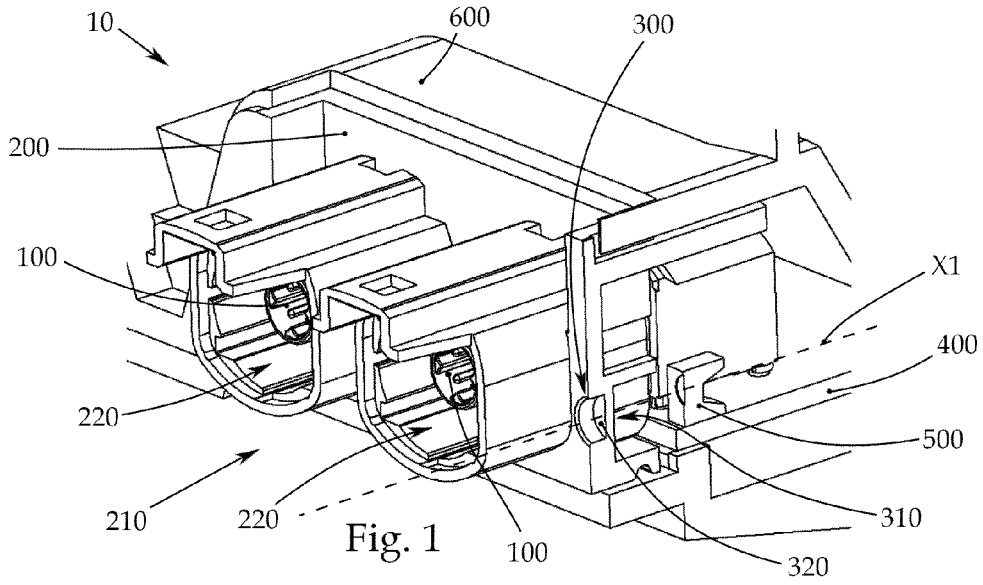

Fig. 1

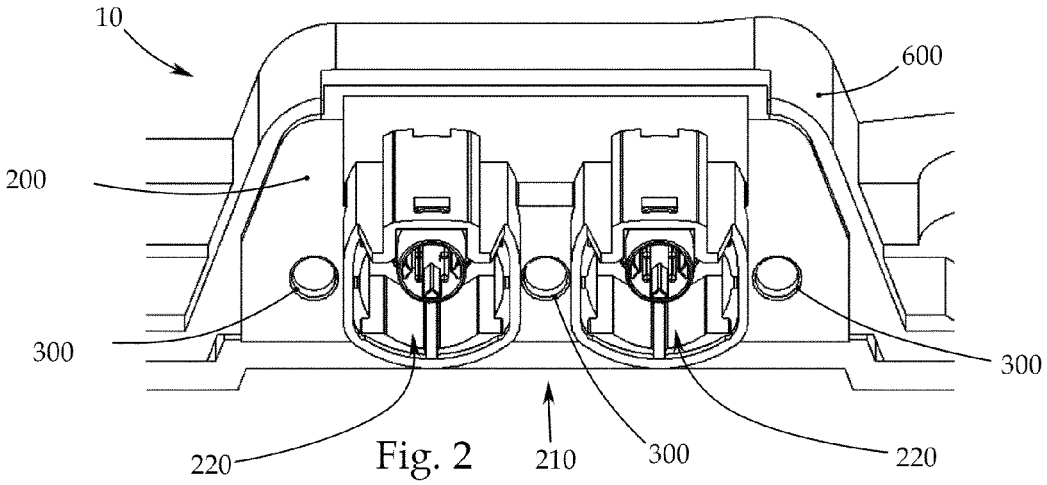

Fig. 2

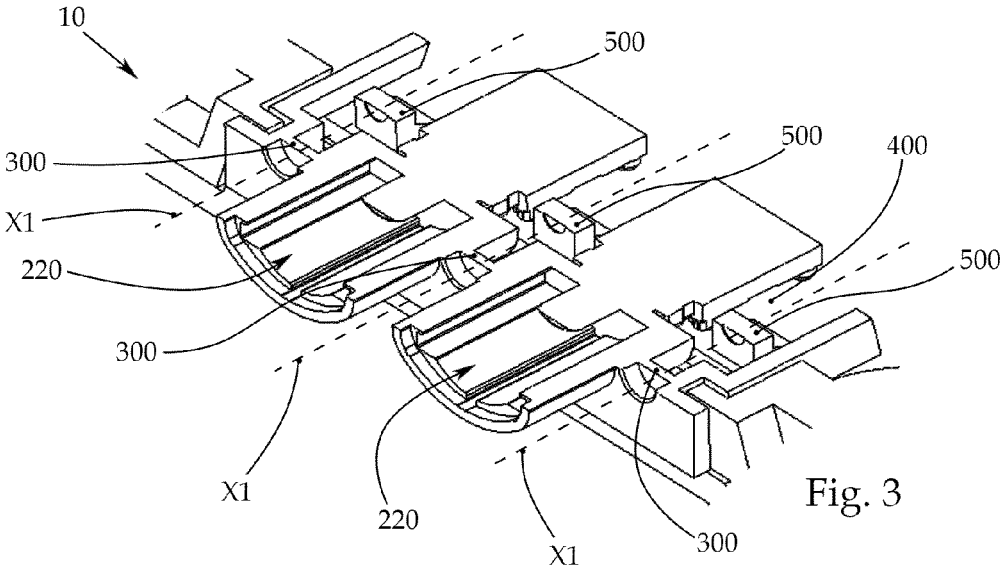

Fig. 3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 16 0770

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2016/149355 A1 (YEOM KYU HWA [KR]) 26 May 2016 (2016-05-26) * paragraph [0059]; figures 9,10 *	1,2,4,5	INV. H01R12/72 H01R13/717
X	US 5 613 873 A (BELL JR JOSEPH W [US]) 25 March 1997 (1997-03-25) * column 4, line 19 - line 35; figure 11 *	1,3,5	
X	WO 00/26997 A1 (3COM CORP [US]) 11 May 2000 (2000-05-11) * figure 3 *	1,5,6	
X	US 2007/059975 A1 (WALSH PETER J [US]) 15 March 2007 (2007-03-15) * figure 3 *	1,3	
A,D	US 4 978 317 A (POCRASS ALAN [US]) 18 December 1990 (1990-12-18) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (IPC)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 September 2019	Corrales, Daniel

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 19 16 0770

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

12-09-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2016149355 A1	26-05-2016	US 2016149355 A1	26-05-2016
		WO 2015005557 A1	15-01-2015
US 5613873 A	25-03-1997	NONE	
WO 0026997 A1	11-05-2000	AU 1608800 A	22-05-2000
		US 6159037 A	12-12-2000
		WO 0026997 A1	11-05-2000
US 2007059975 A1	15-03-2007	DE 102006029269 A1	05-04-2007
		JP 2007080813 A	29-03-2007
		US 2007059975 A1	15-03-2007
US 4978317 A	18-12-1990	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 4978317 A **[0006]**
- US 5876239 A **[0008]**