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(71) Applicants:
- **Gureak Lanean S.A.**
  20018 San Sebastián, Guipúzcoa (ES)
- **VALEO ILUMINACION, S.A.**
  23600 Martos Jaen (ES)

(72) Inventors:
- **Sanchez Idigoras, Ion**
  20400 Ibarra (Guipuzcoa) (ES)
- **Romera Moral, Juan Pablo**
  20400 Ibarra, (Guipuzcoa) (ES)
- **Martin Garrido, Juan Carlos**
  23600 Martos, Jaén (ES)
- **Rubia, Juan Antonio**
  23600 Martos, Jaén (ES)
- **Garcia Castilla, José**
  23600 Martos, Jaén (ES)
- **Sanchez Alguacil, Ramón**
  23600 Martos, Jaén (ES)
- **Valdivia Mateos, Gema**
  23600 Martos, Jaén (ES)
- **Perez Negrillo, Juan**
  23600 Martos, Jaén (ES)

(74) Representative: **Balder IP Law, S.L.**
Paseo de la Castellana 93
5ª planta
28046 Madrid (ES)

(54) **METHOD AND LIGHTING ASSEMBLY FOR CONNECTION OF CONNECTORS IN AN AUTOMOTIVE LAMP**

(57) A method for connecting a first connector with a second connector within an automotive lamp, the method comprising: providing an automotive lighting module in the automotive lamp, the automotive lighting module comprising both a housing and the first connector; attaching a connecting device to a supporting device for the connecting device, the connecting device comprising the second connector; attaching the supporting device to a lamp body of the automotive lamp; and moving in a first direction either the automotive lighting module towards the lamp body or the lamp body towards the automotive lighting module thereby connecting the first connector with the second connector in the first direction; the lamp body being adapted for attachment of the supporting device thereto and support movement of the supporting device along a first axis thereof while attached, the first axis of the supporting device being perpendicular to the first direction.

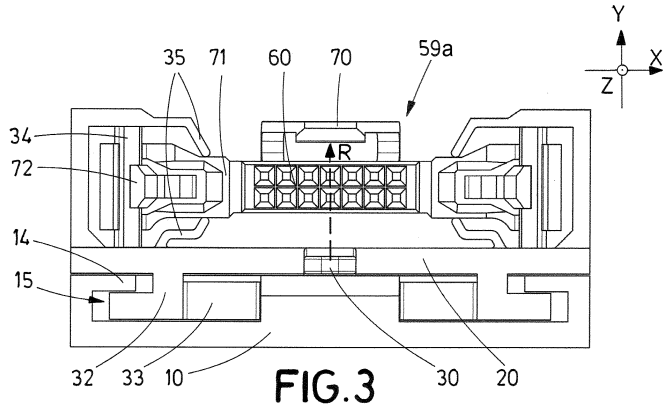

FIG.3

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Description

TECHNICAL FIELD

[0001] The present invention relates to connectors in an automotive lamp. More particularly, the present invention relates to connection establishment of connectors in an automotive lamp.

STATE OF THE ART

[0002] A number of lighting devices are generally provided within a same automotive lamp. The lighting devices may belong to a same lighting function or to different lighting functions. Each of these lighting devices is to be electrically powered and controlled and, to this end, the lighting devices or the lighting modules thereof are provided with at least a connector that is connectable to a connector of the motor vehicle, which in turn supplies electrical energy and controls signals.

[0003] The reduced amount of free space in the automotive lamps makes the connection of such connectors difficult as the access to the connectors is limited. In order to cope with this problem, oftentimes the length of the cables of at least one of the connectors (usually the cables of the connector supplying energy and signals to the lighting devices and/or modules) is extended so that an operator may make the connection despite the limited access. This, in turn, exacerbates another problem: the cables are more prone to entanglement or collision with moving parts within the automotive lamp, something that may affect the operation and/or reliability of the corresponding lighting functions and, ultimately, the automotive lamp.

[0004] There have been attempts in the prior art to ease the connection of such connectors in motor vehicles. Patent document EP-0967692-A2 discloses a connector and connector attachment structure that can facilitate an attachment of components in dash panels, instruments panels or door panels and which may absorb deviations in position of the components. The document discloses a first connector fixed to an attachment member and a second connector fixed to a holder, and this second connector advances towards the first connector when the attachment member and the holder are approached in a direction perpendicular to the direction of advancement of the second connector.

[0005] Other patent documents, such as EP-3431865-A1, provide solutions for easing the connection of connectors in automotive lamps. This patent document discloses an automotive lighting device with a housing, a lighting module, a main connector, first and second supports, and ball joints. The second support, which can move, pivot and/or rotate with respect to the first support, has a first secondary connector electrically connected to the main connector, and the lighting module has a second secondary connector for connection to the first secondary connector. The connection is made by means of the two secondary connectors, which is eased owing to positioning means of both the second support and the lighting module.

[0006] There is an interest in providing both a method and a lighting assembly for connecting connectors in an automotive lamp that solve the aforementioned problems, simplify the connection to be made and, preferably, also make possible to automatize the connection.

DESCRIPTION OF THE INVENTION

[0007] A first aspect of the invention relates to a method for connecting a first connector with a second connector within an automotive lamp, the method comprising: providing an automotive lighting module in the automotive lamp, the automotive lighting module comprising both a housing and the first connector; attaching a connecting device to a supporting device for the connecting device, the connecting device comprising the second connector; attaching the supporting device to a lamp body of the automotive lamp; and moving in a first direction either the automotive lighting module towards the lamp body or the lamp body towards the automotive lighting module thereby connecting the first connector with the second connector in the first direction; the lamp body being adapted for attachment of the supporting device thereto and support movement of the supporting device along a first axis thereof while attached, the first axis of the supporting device being perpendicular to the first direction.

[0008] The connector of the lighting module connects with the connector of the automotive lamp body in the mating direction, i.e. the first direction, without requiring the provision of additional cable length in the wire harness. The housing is preferably adapted to receive, in the first direction, the connecting device (with the second connector) while attached to the supporting device such that the first and second connectors are partially or completely in aligned relationship (in the first direction) in order to ease the connection thereof. When the lighting module and, thus, the housing thereof approach the supporting device (and, thus, the lamp body) with the connecting device arranged thereon in the first direction, the supporting device does not collide with the housing, something which would impede the connection of the connectors; and, in some cases, the housing is shaped such that a cavity is provided for receiving the supporting device in order to avoid collision between the two.

[0009] As handling the module in the automotive lamp is usually complex due to the reduced space therein, usually connecting the connectors is not straightforward either as misalignments between the first and second connectors preclude the connection from being effectively completed. In the prior art one or both connectors are provided with additional cable length or wire harness length for handling the connectors more flexibly so as to effect the connection. In order to alleviate this problem, the supporting device can be moved in the first axis thereof relative to the lamp body so that, even if the lamp body

is fixed, the position of the supporting device and, thus, the position of the connecting device is adjustable (the latter meaning that the position of the second connector is adjustable), thereby making possible to move the supporting device when the connectors are to be connected and, thus, partially or completely align the second connector with the first connector thereby easing the connection. Once connected, electric power and/or electric signals for operating the one or more light sources may be supplied between the connectors; each of the first and second connectors has a number of cables or a wire harness for respectively transferring the electric power and/or signals to/from the lighting module and to/from other parts of a motor vehicle (e.g. energy source, controller, etc.).

[0010] By way of example, if the connection direction is in the Z axis of a 3D coordinate system, the supporting device may be moved in the X axis or in the Y axis for attaining alignment of the first and second connectors in one of said axes, which makes possible the connection in the Z direction when the misalignment has been compensated for.

[0011] The connector of the lighting module is a (second) connecting device that only comprises the first connector adapted for attachment to the lighting module, or that comprises the first connector attached to a shell adapted for attachment to the lighting module.

[0012] In some embodiments, the method further comprises: detaching the supporting device from each of the lamp body and the connecting device such that the second connector remains connected with the first connector; and removing the supporting device from the automotive lamp.

[0013] The supporting device may be used during the process of connection of the connectors and then be removed from the automotive lamp without affecting the reliability of the connection made. To this end, the housing is adapted to allow removal of the supporting device in the first direction while the first connector is connected to the second connector, namely it is shaped in such a way that the supporting device does not collide with the housing during extraction thereof. The supporting device, upon detachment and removal from the automotive lamp, may even be used in a different automotive lamp for simplifying the same process in that lamp, thus the supporting device is reusable.

[0014] In some embodiments, the connecting device comprises the second connector thereof and a shell attached thereto. Said shell attached to the second connector is adapted to also be attachable to the supporting device so that the latter will move the connecting device when the position of the supporting device is adjusted. Said shell may, for instance, be provided with one or more of: body extensions (e.g. an enlarged body surface), gripping elements, and the like. In this sense, the geometry of the shell is such that it is attachable to the supporting device, e.g. by having one or more portions of the geometry that are complimentary with one or more portions of the supporting device for enabling attachment between the two. In some of these embodiments, the connecting device only comprises the second connector and said shell attached thereto.

[0015] In some embodiments, the connecting device only comprises the second connector, i.e. the connecting device is the second connector. In some of these embodiments, the second connector is adapted to be attachable to the supporting device, for instance by being provided with one or more of: body extensions (e.g. an enlarged body surface), gripping elements, and the like. In this sense, the geometry of the second connector is such that it extends beyond the connection part itself (i.e. the part with the connection terminals) so as to be attachable to the supporting device. Said geometry of the second connector has one or more portions that are complimentary with one or more portions of the supporting device for enabling attachment between the two.

[0016] In some embodiments, the method further comprises at least one of: moving the supporting device with respect to the lamp body along the first axis of the supporting device while the supporting device is attached to the lamp body; and rotating the supporting device with respect to the lamp body about a rotation axis perpendicular to the first axis of the supporting device; and the lamp body comprises one or more recesses and/or one or more protrusions for receiving the supporting device, the one or more recesses and/or the one or more protrusions being adapted to support movement of the supporting device along the first axis thereof and/or rotation of the supporting device about the rotation axis.

[0017] If the connectors are not aligned in the first direction when connection is to be effected, the supporting device is moved and/or rotated so as to align the connectors; then, the connection is effected in the first direction. To this end, the lamp body comprises the recess(es) and/or protrusion(s) that support such movement and/or rotation.

[0018] In some embodiments, the supporting device comprises one or more protrusions and/or one or more recesses that cooperate with the recess(es) and/or protrusion(s) of the lamp body in order to move and/or rotate.

[0019] By way of example, the supporting device is fitted in a recess of the lamp body in such a way that some free room is available between the supporting device and the recess of the lamp body so that the supporting device is movable along the first axis thereof.

[0020] In some embodiments, the method further comprises moving the connecting device with respect to the supporting device along a first axis of the connecting device while the connecting device is attached to the supporting device; and the supporting device is adapted to support movement of the connecting device along the first axis thereof.

[0021] The supporting device is movable along one axis thereof with respect to the lamp body, whereas the connecting device (and, thus, the second connector) is movable along one axis thereof with respect to the sup-

porting device. In this way, additional flexibility for aligning the housing with both the supporting device and the second connector is provided, thereby simplifying the mating and connection process. Preferably, the first axis of the supporting device and the first axis of the connecting device form an angle between 60° and 120° (the endpoints being included in the range), more preferably they form an angle between 80° and 100° (the endpoints being included in the range), and more preferably the first axis of the supporting device is perpendicular to the first axis of the connecting device; with such arrangement, a wider range of adjustments is made possible, e.g. adjustment movements in the X and Y axes when the first direction is along the Z axis.

[0022] In some embodiments, the first connector is chamfered in a connecting side thereof. In some embodiments, the second connector is chamfered in a connecting side thereof. In some embodiments, the connecting device is chamfered in a region thereof where the second connector is introduced. In the context of the present disclosure, "connecting side" refers to the side of the connector that is to mate the other connector, in particular the connecting side of the other connector.

[0023] The chamfers provided in the connector(s) and/or the connecting device force/s alignment between the connectors when the misalignments in one direction perpendicular to the first direction are small, usually less than 2,0 cm, e.g. 1 mm, 2 mm, 5 mm, etc., but in any case if the size of the connectors is made larger, the chamfers can be dimensioned so as to compensate for larger misalignments. In this sense, the chamfers of the first connector cooperate with the chamfers of the second connector or the connecting device for forcing alignment between the connectors. Even though the chamfers are provided in the connecting side of the connectors, or in the region of the connecting device where the second connector is comprised (in the connecting side thereof), the same do not impede the connection between the connecting side of the first connector and the connecting side of the second connector.

[0024] In some embodiments, the first connector is attached to a shell adapted for attachment to the lighting module, both the first connector and the shell forming a (second) connecting device. In some of these embodiments, the shell is chamfered in one region thereof for easing the connection of the first connector with the second connector.

[0025] The shell adapts a connector, e.g. a standard and/or a commercially available connector, for arrangement thereof in the lighting module. In some examples, the shell comprises one or more elements for any one or both of easing alignment of connectors (e.g. chamfers on a surface of the shell) and securing the connection between the two connectors (e.g. one or more projecting elements such as hooks).

[0026] The chamfers of the shell cooperate with the chamfers of the second connector or the connecting device for forcing alignment between the connectors.

[0027] In some embodiments, the supporting device comprises at least one spring element attached to a first side thereof, the first side being opposite to a second side of the supporting device facing in the first direction towards the first connector.

[0028] The spring element(s) is attached to the back of the supporting device in the first direction.

[0029] It may occur that the supporting element limits the movement of the lighting module in the first direction, in particular when the lighting module is moved for being coupled to the ball joints that will adjust the orientation of the module. In that event, as the supporting device blocks the movement, the lighting module may break the supporting device or not reach the position of the ball joints at all. The spring element(s) makes possible to move the supporting device in the first direction towards the ball joints when the lighting module is moved in the first direction. The spring element(s) allows moving the supporting element a distance such as, for example, 0,5 mm, 1,0 mm, 1,5 mm, etc., thereby allowing the movement of the lighting module by a same distance so that it may reach the ball joints without breaking the supporting device.

[0030] The spring element(s) may be any mechanical device that provides a spring-like function, that is to say, the at least one spring element is not only limited to springs.

[0031] In the context of the present disclosure, when the connecting device comprises a connector and a shell attached thereto for attachment to the supporting device, the axes of the connecting device described herein are the axes of the connector provided in the connecting device, since the axes of the connector are the ones that influence the connection between the connectors in the automotive lamp.

[0032] A second aspect of the invention relates to a lighting assembly for an automotive lamp comprising: an automotive lighting module comprising both a housing and a first connector for receiving electric power and/or electric signals for operating one or more light sources; a lamp body; and a connecting device comprising a second connector for supplying electric power and/or electric signals for operating the one or more light sources; the housing being moveable towards a supporting device for the connecting device in a first direction so that the first connector is connectable to the second connector in the first direction; and the lamp body being adapted for attachment of the supporting device for the connecting device thereto and support movement of the supporting device along a first axis thereof while attached, the first axis of the supporting device being perpendicular to the first direction.

[0033] The lighting assembly has an arrangement that simplifies and eases the connection of the connector of the lighting module with the connector of the lamp body in a connection direction, namely the first direction.

[0034] The first and second connectors are aligned by means of the supporting device and, thus, connection of

the first and second connectors in the first direction is simplified. The lamp body is adapted for receiving the supporting device in such a manner that the latter is movable in a direction perpendicular to the first direction. In this way, misalignments between the connectors may be compensated for by adjusting the relative position between the lamp body and the supporting device when the same is attached thereto.

[0035] In some embodiments, the connecting device comprises the second connector thereof and a shell attached thereto. Said shell attached to the second connector is adapted to also be attachable to the supporting device so that the latter will move the connecting device when the position of the supporting device is adjusted. Said shell may, for instance, be provided with one or more of: body extensions (e.g. an enlarged body surface), gripping elements, and the like. In this sense, the geometry of the shell is such that it is attachable to the supporting device, e.g. by having one or more portions of the geometry that are complimentary with one or more portions of the supporting device for enabling attachment between the two. In some of these embodiments, the connecting device only comprises the second connector and the shell attached thereto.

[0036] In some embodiments, the connecting device only comprises the second connector, i.e. the connecting device is the second connector. In some of these embodiments, the second connector is adapted to be attachable to the supporting device, for instance by being provided with one or more of: body extensions (e.g. an enlarged body surface), gripping elements, and the like. In this sense, the geometry of the second connector is such that it extends beyond the connection part itself (i.e. the part with the connection terminals) so as to be attachable to the supporting device. Said geometry of the second connector has one or more portions that are complimentary with one or more portions of the supporting device for enabling attachment between the two.

[0037] In some embodiments, the connecting device is adapted for attachment to the supporting device such that: the connecting device is movable with the supporting device and the second connector thereof is connectable to the first connector in the first direction. In some of these embodiments, the connecting device is adapted to detachably attach to the supporting device.

[0038] The connecting device can be detached from the supporting device, which is useful after the connection between the first and second connectors is made since the supporting device can be withdrawn from the lighting module (i.e. the lighting module does not block the extraction of the supporting device when the second connector is connected to the first connector arranged in the lighting module) and, thus, from the automotive lamp. The lighting module then comprises one fewer component that it does not need for operation thereof, or for operation of the automotive lamp, thereby freeing space therein.

[0039] Preferably, the housing is adapted to allow removal of the supporting device in the first direction while the first connector is connected to the second connector.

[0040] In some embodiments, the housing comprises one or more protrusions and/or one or more recesses for receiving the supporting device in the first direction.

[0041] The protrusion(s) and/or the recess(es) assist in receiving the supporting device in the first direction in order to ease alignment of the first and second connectors.

[0042] In some embodiments, the first connector is chamfered in a connecting side thereof. In some embodiments, the second connector is chamfered in a connecting side thereof. In some embodiments, the connecting device is chamfered in a region thereof where the second connector is introduced.

[0043] In some embodiments, the first connector is attached to a shell adapted for attachment to the lighting module, both the first connector and the shell forming a (second) connecting device. In some of these embodiments, the shell is chamfered in one region thereof for easing the connection of the first connector with the second connector.

[0044] In some embodiments, the lamp body comprises one or more recesses and/or one or more protrusions for receiving the supporting device in the first direction, the one or more recesses and/or the one or more protrusions being adapted to support at least one of: movement of the supporting device along the first axis thereof, and rotation of the supporting device with respect to the lamp body about a rotation axis perpendicular to the first axis of the supporting device.

[0045] In some embodiments, the lighting assembly further comprises the supporting device.

[0046] In some embodiments, the supporting device is adapted to detachably attach to the connecting device. In some embodiments, the supporting device is adapted to support movement of the connecting device along a first axis thereof.

[0047] In some of these embodiments, the first axis of the supporting device and the first axis of the connecting device form an angle between 60° and 120° (the endpoints being included in the range). In some of these embodiments, the angle is between 80° and 100° (the endpoints being included in the range). In some of these embodiments, the first axis of the supporting device is perpendicular to the first axis of the connecting device.

[0048] In some embodiments, the supporting device comprises at least one spring element attached to a first side thereof, the first side being opposite to a second side of the supporting device facing in the first direction towards the first connector.

[0049] Similar advantages as those described for the first aspect of the invention also apply to this aspect of the invention.

[0050] A third aspect of the invention relates to a method for connecting a first connector with a second connector within an automotive lamp, the method comprising: providing an automotive lighting module in the auto-

motive lamp, the automotive lighting module comprising both a housing, and a connecting device comprising the first connector; attaching a supporting device for the first connecting device to the housing; attaching the connecting device to the supporting device; attaching the second connector to a lamp body of the automotive lamp; moving in a first direction either the automotive lighting module towards the lamp body or the lamp body towards the automotive lighting module while the connecting device is attached to the supporting device so as to connect the first connector with the second connector in the first direction; the housing being adapted for attachment of the supporting device thereto and support movement of the supporting device along a first axis thereof while attached, the first axis of the supporting device being perpendicular to the first direction.

[0051] The connector (in the connecting device) of the lighting module connects with the connector of the automotive lamp body in the first direction by moving the housing in the same direction towards the lamp body. In contrast to the first aspect of the invention, the supporting device is arranged on the housing of the lighting module rather than on the lamp body, and allows the movement of the connecting device (and, thus, the first connector) in the direction of the first axis of the supporting device so as to compensate for any misalignment between the two connectors in that direction.

[0052] The supporting device can be moved in the first axis thereof relative to the housing and, consequently, the connecting device moves a same amount as it is attached to the supporting device.

[0053] By way of example, if the connection direction is in the Z axis of a 3D coordinate system, the supporting device may be moved in the X axis or in the Y axis for attaining alignment of the first connector and the second connector in one of said axes, which makes possible the connection in the Z direction when the misalignment has been compensated for.

[0054] The second connector may be attached to the lamp body of the automotive lamp either in a detachable manner or in a non-detachable manner.

[0055] In some embodiments, the connecting device comprises the first connector thereof and a shell attached thereto. Said shell attached to the first connector is adapted to also be attachable to the supporting device so that the latter will move the connecting device when the position of the supporting device is adjusted. Said shell may, for instance, be provided with one or more of: body extensions (e.g. an enlarged body surface), gripping elements, and the like. In this sense, the geometry of the shell is such that it is attachable to the supporting device, e.g. by having one or more portions of the geometry that are complimentary with one or more portions of the supporting device for enabling attachment between the two. In some of these embodiments, the connecting device only comprises the first connector and the shell attached thereto.

[0056] In some embodiments, the connecting device only comprises the first connector, i.e. the connecting device is the first connector. In some of these embodiments, the first connector is adapted to be attachable to the supporting device, for instance by being provided with one or more of: body extensions (e.g. an enlarged body surface), gripping elements, and the like. In this sense, the geometry of the first connector is such that it extends beyond the connection part itself (i.e. the part with the connection terminals) so as to be attachable to the supporting device. Said geometry of the first connector has one or more portions that are complimentary with one or more portions of the supporting device for enabling attachment between the two.

[0057] In some embodiments, the method further comprises: detaching the supporting device from each of the housing and the connecting device such that the first connector remains connected with the second connector; and removing the supporting device from the automotive lamp.

[0058] The supporting device can be reused in a different automotive lamp by detaching it from both the housing and the connecting device and removing it from the lamp. To this end, the housing is adapted to allow removal of the supporting device in the first direction while the first connector is connected to the second connector, namely it is shaped in such a way that the supporting device does not collide with the housing during extraction thereof.

[0059] In some embodiments, the method further comprises at least one of: moving the supporting device with respect to the housing along the first axis of the supporting device while the supporting device is attached to the housing; and rotating the supporting device with respect to the housing about a rotation axis perpendicular to the first axis of the supporting device; and the housing comprises one or more recesses and/or one or more protrusions for receiving the supporting device, the one or more recesses and/or the one or more protrusions being adapted to support movement of the supporting device along the first axis thereof and/or rotation of the supporting device about the rotation axis.

[0060] In some embodiments, the method further comprises moving the connecting device with respect to the supporting device along a first axis of the connecting device (namely along a first axis of the first connector) while the connecting device is attached to the supporting device; and the supporting device is adapted to support movement of the connecting device along the first axis thereof (namely along the first axis of the first connector).

[0061] In some embodiments, the first axis of the supporting device and the first axis of the connecting device form an angle between 60° and 120° (the endpoints being included in the range). In some of these embodiments, the angle is between 80° and 100° (the endpoints being included in the range). In some of these embodiments, the first axis of the supporting device is perpendicular to the first axis of the connecting device.

[0062] In some embodiments, the first connector is

chamfered in a connecting side thereof. In some embodiments, the second connector is chamfered in a connecting side thereof. In some embodiments, the connecting device is chamfered in a region thereof where the first connector is introduced.

[0063] In some embodiments, the second connector is attached to a shell adapted for attachment to the lamp body, both the second connector and the shell forming a (second) connecting device. In some of these embodiments, the shell is chamfered in one region thereof, for easing the connection of the second connector with the first connector.

[0064] The shell adapts a connector, e.g. a standard and/or a commercially available connector, for arrangement thereof in the lamp body. In some examples, the shell comprises one or more elements for any one or both of easing alignment of connectors and securing the connection between the two connectors.

[0065] Similar advantages as described for the first and second aspects of the inventions may also be applicable to the third aspect of the invention.

[0066] A fourth aspect of the invention relates to a lighting assembly for an automotive lamp comprising: an automotive lighting module comprising both a housing, and connecting device comprising a first connector for receiving electric power and/or electric signals for operating one or more light sources; a lamp body; and a second connector for supplying electric power and/or electric signals for operating the one or more light sources, the second connector being attached to the lamp body; the housing being adapted for attachment of a supporting device for the connecting device thereto and support movement of the supporting device along a first axis thereof while attached, the first axis of the supporting device being perpendicular to the first direction; and the connecting device being adapted for attachment to the supporting device such that: the connecting device is movable with the supporting device and the first connector thereof is connectable to the second connector in the first direction.

[0067] The lighting assembly has an arrangement that simplifies and eases the connection of the connector of the lighting module with the connector of the lamp body in the first direction when the housing is advanced towards the connector of the lamp body in said first direction.

[0068] The connecting device is attachable to the supporting device so that the connector thereof moves together with the supporting device. The supporting device is adjustable in position along the first axis thereof, in turn adjusting the position of the connecting device (and, thus, the first connector) in the same direction. When there is a misalignment between the first and second connectors in that direction, the adjustments of the supporting device can compensate for said misalignment and, thus, enable the connection between the connectors.

[0069] In some embodiments, the connecting device comprises the first connector thereof and a shell attached thereto. Said shell attached to the first connector is adapted to be also attachable to the supporting device so that the latter will move the connecting device when the position of the supporting device is adjusted. Said shell may, for instance, be provided with one or more of: body extensions (e.g. an enlarged body surface), gripping elements, and the like. In this sense, the geometry of the shell is such that it is attachable to the supporting device, e.g. by having one or more portions of the geometry that are complimentary with one or more portions of the supporting device for enabling attachment between the two. In some of these embodiments, the connecting device only comprises the first connector and the shell attached thereto.

[0070] In some embodiments, the connecting device only comprises the first connector, i.e. the connecting device is the first connector. In some of these embodiments, the first connector is adapted to be attachable to the supporting device, for instance by being provided with one or more of: body extensions (e.g. an enlarged body surface), gripping elements, and the like. In this sense, the geometry of the first connector is such that it extends beyond the connection part itself (i.e. the part with the connection terminals) so as to be attachable to the supporting device. Said geometry of the first connector has one or more portions that are complimentary with one or more portions of the supporting device for enabling attachment between the two.

[0071] In some embodiments, the connecting device is adapted to detachably attach to the supporting device.

[0072] In some embodiments, the housing comprises one or more recesses and/or one or more protrusions for receiving the supporting device (preferably in the first direction), the one or more recesses and/or the one or more protrusions being adapted to support at least one of: movement of the supporting device along the first axis thereof, and rotation of the supporting device with respect to the housing about a rotation axis perpendicular to the first axis of the supporting device.

[0073] In some embodiments, the lighting assembly further comprises the supporting device.

[0074] In some embodiments, the supporting device is adapted to detachably attach to the connecting device.

[0075] In some embodiments, the supporting device is adapted to support movement of the connecting device along a first axis thereof (namely along a first axis of the first connector).

[0076] In some of these embodiments, the first axis of the supporting device and the first axis of the connecting device form an angle between 60° and 120° (the endpoints being included in the range). In some of these embodiments, the angle is between 80° and 100° (the endpoints being included in the range). In some of these embodiments, the first axis of the supporting device is perpendicular to the first axis of the connecting device.

[0077] In some embodiments, the first connector is chamfered in a connecting side thereof. In some embodiments, the second connector is chamfered in a connecting side thereof. In some embodiments, the connecting

device is chamfered in a region thereof where the first connector is introduced.

[0078] In some embodiments, the second connector is attached to a shell adapted for attachment to the lamp body, both the second connector and the shell forming a (second) connecting device. In some of these embodiments, the shell is chamfered in one region thereof, for easing the connection of the second connector with the first connector.

[0079] Similar advantages as described for the first, second and third aspects of the inventions may also be applicable to the fourth aspect of the invention.

[0080] A fifth aspect of the invention relates to an automotive lamp comprising one or more lighting assemblies according to the second and/or fourth aspects of the invention.

[0081] A sixth aspect of the invention relates to a motor vehicle comprising one or more automotive lamps according to the fifth aspect of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0082] To complete the description and in order to provide for a better understanding of the invention, a set of drawings is provided. Said drawings form an integral part of the description and illustrate embodiments of the invention, which should not be interpreted as restricting the scope of the invention, but just as examples of how the invention can be carried out. The drawings comprise the following figures:

Figure 1 shows a lighting assembly in accordance with an embodiment.

Figures 2 and 3 show the connector with the supporting device of Figure 1.

Figures 4, 5A and 5B show connectors with supporting devices of lighting assemblies in accordance with embodiments.

Figure 6 shows the connector of Figures 5A and 5B connected to a connector of a lighting module.

Figure 7 shows a lighting assembly in accordance with another embodiment.

Figure 8 shows a connecting device in accordance with an embodiment.

Figures 9A and 9B show the parts forming the connecting device of Figure 8.

Figures 10A and 10B show a connecting device in accordance with an embodiment.

Figure 11 shows a shell for a connector of a lighting module, or a part forming the connecting device of Figure 10.

DESCRIPTION OF WAYS OF CARRYING OUT THE INVENTION

[0083] Figure 1 shows a lighting assembly in accordance with an embodiment.

[0084] The lighting assembly comprises a lighting module 40 for an automotive lamp and a lamp body 10, and also comprises a first connector 50 and a connecting device 59a consisting of a second connector 60 for electrical connection with the first connector 50.

[0085] The lighting module 40 comprises both a housing 41 and the first connector 50 attached to the housing 41. The lamp body 10 has a supporting device 20 for the connecting device 59a (that is, the second connector 60) attached thereto, and the connecting device 59a is attached to the supporting device 20. In this embodiment, the supporting device 20 is introduced in the lamp body 10 in the direction of the Z axis represented, for example by sliding the supporting device 20 over the surface of the lamp body 10. In order to support the second connector 60, the supporting device 20 comprises two beams 34 (illustrated in Figure 3) extending along the Y axis represented to which the second connector 60 may attach by means of gripping elements 72 thereof. The connecting device 59a (i.e. the second connector 60) is movable owing to the supporting device 20.

[0086] The supporting device 20 is attached to the lamp body 10 in a movable manner by being inserted in a recess 15 of the lamp body 10. To this end, the supporting device 20 is adapted to fit in said recess 15 for example by being provided with protruding elements 32, 33 as illustrated in Figure 3. The recess 15 and the protruding elements 32, 33 are shaped and dimensioned so as to allow movement of the supporting device 20 along a first axis thereof; in this particular example, the first axis has the direction of the X axis represented. As the supporting device 20 can move along the X axis with respect to the lamp body 10, misalignments between the connector 60 on the supporting device 20 and the connector 50 on the housing 41 in that direction can be compensated for by moving the supporting device 20.

[0087] When the housing 41 (and, thus, the entire lighting module 40) is moved towards the supporting device 20 (and, thus, the lamp body 10) in a first direction (along the Z axis represented) or the lamp body 10 is moved towards the housing 41 in the first direction, the first connector 50 is connected to the second connector 60 in the first direction. In order to ease alignment between the first and second connectors 50, 60, the housing 41 is preferably provided with one or more protrusions 44 and/or one or more recesses that assist in aligning both the housing 41 and the supporting device 20 in the directions perpendicular to the first direction, in this case the directions along the X and Y axes represented, so that connection can be effected. Also, the supporting device 20 is preferably provided with one or more protrusions and/or one or more recesses for such alignment purposes.

[0088] Preferably, the first connector 50 has attached thereto a shell (e.g. for example a shell similar to the shell 67b of Figure 11) that may be adapted for attachment to the lighting module 40 (thus, attaching holding the first connector 50 attached to the lighting module 40), and/or for easing alignment of the first and second connectors

50, 60 when the shell is provided with chamfers, as explained later on. The shell may, therefore, adapt a connector to be arranged in the lighting module 40 and, also, provide elements for any one or both of easing alignment of connectors and securing the connection between the two connectors.

[0089] The second connector 60 is provided with a further gripping element 70 that secures the connection with the first connector 50 when it grips a corresponding element thereof that is accessible thanks to a cavity 45 in the housing 41; in some other embodiments, the gripping element 70 is provided on the opposite side and, hence, no cavity is necessary in the housing 41 because the gripping element 70 is on the bottom part rather than on the top part (the bottom and top parts being referred to the representation of Figure 1). The gripping element 70 thus precludes the connection from being accidentally released. When the first connector 50 has a shell attached thereto, the same shell may be provided with the element for securing the connection in cooperation with the gripping element 70, for example a projecting element or a hook, which is accessible thanks to the aforesaid cavity 45.

[0090] In some other embodiments, the first connector is attached to a shell adapted for attachment to the lighting module 40.

[0091] Figures 2 and 3 show the connector 60 (i.e. the connecting device 59a) with the supporting device 20 of Figure 1; Figure 2 shows a cross-section in the Y-Z plane, whereas Figure 3 is a representation from the front (as if seen from the first connector 50 when the housing 41 is to be moved towards the supporting device 20 in the first direction, or when the housing 41 is to receive the lamp body 10 in the first direction).

[0092] The recess 15 of the lamp body 10 includes a recess 16 extending along the X axis represented where the protruding element 31 of the protrusion 30 engages. This engagement prevents the supporting device 20 from accidentally moving in the first direction (Z axis represented) relative to the lamp body 10 or even falling off from the lamp body 10 when the connector 60 arranged on the supporting device 20 is being mated to the connector 50 on the housing 41.

[0093] By adjusting the shapes and dimensions of the recess 15, 16 and the protruding elements 32, 33 that make possible the movement of the supporting device 20 relative to the lamp body 10, the supporting device 20 can be subjected to rotation as well if there is enough free room between these elements. The rotation is possible about a rotation axis R that is parallel to the Y axis represented. The rotation axis R moves together with the supporting device 20 when the latter is displaced along the first axis thereof (X axis represented), and it is more in the front or in the back (in this example, the front and back being along the Z axis represented) of the supporting device 20 depending on said shapes and dimensions. The second connector 60 rotates together with the supporting device 20 owing to its attachment thereto.

[0094] In order to avoid the supporting device 20 from moving along the Y axis represented, protrusions 14 may be formed on the lamp body 10 that limit such motion.

[0095] As better seen in Figure 3, the second connector 60 is adapted to attach to the supporting device 20 by means of body extensions 71 on which the gripping elements 72 are formed.

[0096] As aforementioned, the gripping elements 72 attach to the beams 34 of the supporting device 20. Thanks to both, the second connector 60 is movable along a first axis thereof (in this example, the first axis being in the direction of the Y axis represented), thereby making possible position adjustments in this direction. Accordingly, the second connector 60 is movable in each of the X and Y axes represented owing to both the movement capabilities of the supporting device 20 relative to the lamp body 10 along the X axis represented, and the movement capabilities of the second connector 60 relative to the supporting device 20 along the Y axis represented. Furthermore, the second connector 60 may also be rotated owing to the rotation of the supporting device 20 about the rotation axis R relative to the lamp body 10. All these movements ease the connection between the first and second connectors 50, 60 as misalignments in these directions can be compensated for.

[0097] The supporting device 20 has formed thereon arms 35 that vertically center (that is to say, in the direction of the Y axis represented) the second connector 60, namely the arms 35 maintain the second connector 60 vertically in a middle position that initially simplifies the alignment in that direction. Additionally, the arms 35 provide a resistance against the movement of the second connector 60 along the first axis thereof (Y axis represented). These arms 35 preferably have an elastic behavior whereby they get elastically deformed so as to allow the movement of the second connector 60 in a limited manner.

[0098] Figure 4 shows a connecting device 59a only comprising a connector 60 with a supporting device 21 of a lighting assembly in accordance with an embodiment.

[0099] The supporting device 21 is receiving in a lamp body 11 in the first direction (i.e. the connection direction, which in this case is along the Z axis represented) and attached thereto; to this end, the lamp body 11 includes the recess 15 for insertion of the protruding element 32. The lighting assembly also includes a holding device 19 insertable in a cavity 18 of the lamp body 11. The holding device 19 maintains the supporting device 21 in place so that the same cannot move in the first direction due to the blocking of the holding device 19, whereas on the opposite side the lamp body is provided with a wall that prevents the supporting device 21 from moving along the Z axis represented. Upon insertion of the supporting device 21 into the lamp body 11 in the first direction, the holding device 19 is introduced in the cavity 18 and kept therein at least until connection of the connectors is effected, at which point the holding device 19 and the sup-

porting device 21 may both be removed from the automotive lamp if so desired.

[0100] In addition, the supporting device 21 includes arms 36 that operate in a fashion similar to that of arms 35.

[0101] The connector 60 includes the gripping element 70 for securing the connection, and gripping elements 72 for attaching to the supporting device 21 and enabling movement along a first axis thereof (in the Y axis represented).

[0102] Figures 5A and 5B show, from two different perspectives, a connecting device 59b comprising a (second) connector 60 in a lamp body 12 with a supporting device 22 of a lighting assembly in accordance with another embodiment, whereas Figure 6 shows said (second) connector 60 already connected to a (first) connector 50 of a lighting module.

[0103] The second connector 60 is inserted in the supporting device 22 in the first direction by way of teeth 76 that cooperate with grooves 38 of the supporting device 22, thereby attaching the connector 60 to the supporting device 22. The supporting device 22 includes indentations 39 at one or both sides for receiving the second connector 60; the indentations 39 ease the insertion of the connector 60 as the teeth 76 collide with the walls of the supporting device 22 until they are introduced in the grooves 38. The second connector 60 is provided with arms 75 for limiting or even precluding the pitching of the connector 60 such that it eases the movement of the connector 60 in the Y axis represented with no pitching of the connector 60.

[0104] The arms 37 of the supporting device 22, and the teeth 76 and the grooves 38 make possible the movement of the second connector 60 in the direction corresponding to the Y axis represented so as to allow the compensation for misalignments (between the first connector 50 and the second connector 60) in this direction. The supporting device 22 is provided with arms 37 that operate in a fashion similar to that of arms 35 and 36 of the supporting devices 20 and 21.

[0105] The supporting device 22 comprises the protruding element 32 for insertion in the recess 15 of the lamp body 12, and the protruding element 31 for insertion in the further recess 16 of the lamp body 12; while the device 22 is inserted, it can be moved along a first axis thereof (along the X axis represented). In this example, due to the shapes and dimensions of these elements, the supporting device 22 supports rotation about a rotation axis. The recess 15 may also be provided with a poka-yoke recess in order to only allow insertion of the supporting device 22 when the latter is correctly oriented.

[0106] The first connector 50 comprises a hook 55 for mating a projecting element 74 of the second connector 60. Upon connection of the two connectors 50, 60, the hook 55 prevents an accidental connection release between the connectors 50, 60. The first connector 50 also comprises chamfers (not seen due to the perspective of Figure 6) that cooperate with chamfers 77 of the second connector 60 for alignment of the two connectors 50, 60.

[0107] In some non-illustrated embodiments, at least one spring element is arranged on a back side 29 of a supporting device (e.g. the supporting device 20 of Figures 1-3, the supporting device 21 of Figure 4, the supporting device 22 of Figures 5A-5B and 6), i.e. the side opposite to the side facing towards the first connector when the two connectors are to be connected. With reference to Figure 5A, if the lighting module is to be moved in the Z direction represented but towards the negative Z (where the ball joints are normally arranged prior to the coupling thereof to the lighting module), the spring element(s) allows the movement of the supporting device in that direction, thereby allowing the movement of the lighting module in the same manner as the supporting device is moved as the spring element(s) compresses.

[0108] The at least one spring element preferably requires that, for compression thereof, the force that has to be provided is greater than the force necessary for connecting together the first and second connectors. In this way, the supporting element does not move when effecting the connection of the connectors; when the connectors are connected, if the lighting module is still not coupled to the ball joint(s), by providing the force necessary for compressing the spring element(s) the lighting module may reach the ball joint(s).

[0109] Figure 7 shows a lighting assembly in accordance with another embodiment.

[0110] The lighting assembly comprises a lighting module 40 for an automotive lamp and a lamp body 13, and also comprises a connecting device 49a, which only comprises a first connector 51 (i.e. the connecting device 49a is the first connector 51), and a second connector 61 that are to be electrically connected.

[0111] The lighting module 40 comprises both a housing 42 and the connecting device 49a, and also a supporting device 23 for supporting the connecting device 49a attached to the housing 42 in a movable manner (e.g. by means of non-illustrated projecting arms on two opposite sides of the connector 51). The housing 42 is adapted to support the movements of the supporting device 23, for example by means of one or more protrusions and/or one or more recesses that cooperate with the supporting device 23. To this end, the supporting device 23 either has a shape and dimensions adequate for such movable attachment, or comprises one or more protrusions and/or one or more recesses that cooperate with corresponding elements of the housing 42 (as described with reference to the embodiments of Figures 1-6 in which the lamp body has a recess and the supporting device is adapted to cooperate with said recess) so that movement along an axis of the supporting device 23 is possible, the axis being perpendicular to the connection direction, i.e. first direction, which in this example coincides with the Z axis represented. For instance, the supporting device 23 may move along the X axis represented or the Y axis represented, thereby making possible to compensate for misalignments between the first and second con-

nectors 51, 61 in said direction that would prevent the connectors from being connected until the same are aligned.

[0112] The connecting device 49a is preferably attached to the supporting device 23 such that movement of the connecting device 49a is possible along an axis thereof (with an attachment like, for example, that described with reference to the embodiments of Figures 1-6 in which the supporting device comprises beams or grooves and the connector is adapted to cooperate with said beams or grooves). Preferably, the axis of the connecting device 49a (namely, the axis of the first connector 51) is perpendicular to both said axis of the supporting device 23 (X axis represented) and the first direction (Z axis represented) as this allows the compensation of misalignments in a further direction (Y axis represented). Hence, the connecting device 49a (and, thus, the first connector 51) may be moved in two directions (along the X and Y axes represented) that are perpendicular to the first direction.

[0113] The lamp body 13 has the second connector 61 attached to protruding elements 17 of the lamp body 13. The provision of the protruding elements 17 is convenient for avoiding collision between the lamp body 13 and one of the housing 42 and the supporting device 23 before the first and second connectors 51, 61 are fully mated in order to effect the connection. In some other embodiments, the second connector is not adapted for attachment to the lamp body 13 but is attached to a shell (e.g. a shell similar to the shell 67b of Figure 11) adapted for attachment to the lamp body 13, the shell thus effectively attaching the second connector to the lamp body 13. The shell may also be provided with chamfers for easing alignment of the connectors and/or elements for securing the connection between the connectors.

[0114] It is readily apparent that different mechanical elements in the form of recesses and/or protruding elements may be arranged on the components of the lighting assemblies described that attain the same movement capabilities and/or limitations without departing from the scope of the present disclosure.

[0115] Figure 8 shows a connecting device 59c in accordance with an embodiment.

[0116] The connecting device 59c comprises a connector 63 that is also illustrated in Figure 9B, and a shell 67a attached thereto that is adapted to be attachable to a supporting device (such as supporting device 22 as described with reference to the embodiments of Figures 5A, 5B and 6) and which is also illustrated in Figure 9A.

[0117] The shell 67a may be attached to the connector 63 by means of friction between surfaces thereof, gripping elements or matching geometries between the connector 63 and the surfaces of the shell 67a in an inner region 68 of the latter, where the connector 63 is introduced. By way of example, the shell 67a comprises gripping elements 72 for movement of the shell 67a (together with the connector 63) along an axis thereof by cooperating with a supporting device. The shell 67a is preferably provided with a projecting element 74 for mating with a hook of the other connector. Further, the shell 67a is provided with chamfers 77 that assist in the alignment of the connectors when the connection is to be effected.

[0118] The connector 63 may be, for instance but without limitation, a standard and/or a commercially available connector that is introduced in the inner region 68 of the shell 67a so as to make possible the alignment thereof by means of the supporting devices and/or the shell 67a itself as previously described. In some examples, the shell 67a comprises one or more stops for retaining the movement of the connector 63 within the inner region 68.

[0119] In other embodiments, such as in those described with reference to Figures 1-6, the connecting device 59a only comprises a connector (i.e. the connecting device 59a is the connector), which is preferably adapted to attach to the supporting device and allow the movement thereof owing to mechanical elements such as body extensions, gripping elements, etc.

[0120] Figures 10A and 10B show a connecting device 49b in accordance with another embodiment. The connecting device 49b may replace, for instance, the connector 50 of the embodiment of Figure 6.

[0121] The shell 67b for forming the connecting device of this example is based on a same concept as the one described with reference to Figures 8, 9A-9B. The shell 67b is adapted to be attachable to both the connector 53 and a lighting module so as to make possible the alignment of a connector 53 (that may be standard or commercially available) introduced in an inner region 68 of said shell 67b relative to another connector.

[0122] Any one or both the connector 53 and the shell 67b may be provided with chamfers 77 for connector alignment when the connection between the two connectors is to be effected.

[0123] The device 67b is preferably chamfered 77 in one side corresponding to the connecting side of the connector 53 so as to ease alignment of the connector that is to mate the connector 53 within the inner region of the shell 67b.

[0124] In some other embodiments, a similar shell has a geometry adapted for attachment to a lamp body; for example, in the embodiment of Figure 7, the second connector 61 may be attached to the lamp body by means of such a shell.

[0125] Figure 11 shows the shell 67b for forming the connecting device 49b of Figures 10A and 10B.

[0126] As it can be appreciated in the figure, the shell 67b comprises a hook 55 mateable, for instance, with a projecting element such as the projecting element 74 of Figures 5B, 6 and 9A, and the inner region 68 where the connector 63 is to be introduced.

[0127] In this text, the terms first, second, third, etc. have been used herein to describe several devices, elements or parameters, it will be understood that the devices, elements or parameters should not be limited by these terms since the terms are only used to distinguish one device, element or parameter from another. For ex-

ample, the first connector could as well be named second connector, and the second connector could be named first connector without departing from the scope of this disclosure.

[0128] In this text, the term "comprises" and its derivations (such as "comprising", etc.) should not be understood in an excluding sense, that is, these terms should not be interpreted as excluding the possibility that what is described and defined may include further elements, steps, etc.

[0129] On the other hand, the invention is obviously not limited to the specific embodiment(s) described herein, but also encompasses any variations that may be considered by any person skilled in the art (for example, as regards the choice of materials, dimensions, components, configuration, etc.), within the general scope of the invention as defined in the claims.

Claims

1. A method for connecting a first connector (50, 51, 53) with a second connector (60, 61, 63) within an automotive lamp, the method comprising:

   providing an automotive lighting module (40) in the automotive lamp, the automotive lighting module (40) comprising:

   a housing (41); and
   the first connector (50, 53);

   attaching a connecting device (59a-59c) to a supporting device (20-22) for the connecting device (59a-59c), the connecting device (59a-59c) comprising the second connector (60, 63); and attaching the supporting device (20-22) to a lamp body (10-12) of the automotive lamp;
   characterized by:

   moving in a first direction (Z) either the automotive lighting module (40) towards the lamp body (10-12) or the lamp body (10-12) towards the automotive lighting module (40) thereby connecting the first connector (50, 53) with the second connector (60, 63) in the first direction (Z);
   the lamp body (10-12) being adapted for attachment of the supporting device (20-22) thereto and support movement of the supporting device (20-22) along a first axis (X) thereof while attached, the first axis (X) of the supporting device (20-22) being perpendicular to the first direction (Z).

2. The method of claim 1, further comprising:

   detaching the supporting device (20-22) from each of the lamp body (10-12) and the connecting device (59a-59c) such that the second connector (60, 63) remains connected with the first connector (50, 53); and
   removing the supporting device (20-22) from the automotive lamp.

3. The method of any one of the preceding claims, further comprising at least one of:

   moving the supporting device (20-22) with respect to the lamp body (10-12) along the first axis (X) of the supporting device (20-22) while the supporting device (20-22) is attached to the lamp body (10-12); and
   rotating the supporting device (20-22) with respect to the lamp body (10-12) about a rotation axis (R) perpendicular to the first axis (X) of the supporting device (20-22); and
   wherein the lamp body (10-12) comprises one or more recesses (15, 16) and/or one or more protrusions (14) for receiving the supporting device (20-22), the one or more recesses (15, 16) and/or the one or more protrusions (14) being adapted to support movement of the supporting device (20-22) along the first axis (X) thereof and/or rotation of the supporting device (20-22) about the rotation axis (R).

4. The method of any one of the preceding claims, further comprising moving the connecting device (59a-59c) with respect to the supporting device (20-22) along a first axis (Y) of the connecting device (59a-59c) while the connecting device (59a-59c) is attached to the supporting device (20-22); and wherein the supporting device (20-22) is adapted to support movement of the connecting device (59a-59c) along the first axis (Y) thereof.

5. A lighting assembly for an automotive lamp comprising:

   an automotive lighting module (40) comprising:

   a housing (41); and
   a first connector (50, 53) for receiving electric power and/or electric signals for operating one or more light sources;

   a lamp body (10-12); and
   a connecting device (59a-59c) comprising a second connector (60, 63) for supplying electric power and/or electric signals for operating the one or more light sources;
   characterized in that:

   the housing (41) is moveable towards a supporting device (20-22) for the connecting

device (59a-59c) in a first direction (Z) so that the first connector (50, 53) is connectable to the second connector (60, 63) in the first direction (Z); and
the lamp body (10-12) is adapted for attachment of the supporting device (20-22) for the connecting device (59a-59c) thereto and support movement of the supporting device (20-22) along a first axis (X) thereof while attached, the first axis (X) of the supporting device (20-22) being perpendicular to the first direction (Z).

6. The lighting assembly of claim 5, wherein the connecting device (59a-59c) is adapted for attachment to the supporting device (20-22) such that: the connecting device (59a-59c) is movable with the supporting device (20-22) and the second connector (60, 63) thereof is connectable to the first connector (50, 53) in the first direction (Z).

7. The lighting assembly of any one of claims 5-6, wherein the housing (41) is adapted to allow removal of the supporting device (20-22) in the first direction (Z) while the first connector (50, 53) is connected to the second connector (60, 63).

8. The lighting assembly of any one of claims 5-7, wherein the lamp body (10-12) comprises one or more recesses (15, 16) and/or one or more protrusions (14) for receiving the supporting device (20-22) in the first direction (Z), the one or more recesses (15, 16) and/or the one or more protrusions (14) being adapted to support at least one of: movement of the supporting device (20-22) along the first axis (X) thereof, and rotation of the supporting device (20-22) with respect to the lamp body (10-12) about a rotation axis (R) perpendicular to the first axis (X) of the supporting device (20-22).

9. A lighting assembly for an automotive lamp comprising:

an automotive lighting module (40) comprising:

a housing (42); and
a connecting device (49a) comprising a first connector (51, 53) for receiving electric power and/or electric signals for operating one or more light sources;

a lamp body (13); and
a second connector (61) for supplying electric power and/or electric signals for operating the one or more light sources, the second connector (61) being attached to the lamp body (13);
characterized in that:

the housing (42) is adapted for attachment of a supporting device (23) for the connecting device (49a) thereto and support movement of the supporting device (23) along a first axis (X) thereof while attached, the first axis (X) of the supporting device (23) being perpendicular to the first direction (Z); and
the connecting device (49a) is adapted for attachment to the supporting device (23) such that: the connecting device (49a) is movable with the supporting device (23) and the first connector thereof (51, 53) is connectable to the second connector (61) in the first direction (Z).

10. The lighting assembly of any one of claims 6-9, further comprising the supporting device (20-23).

11. The lighting assembly of claim 10 when depending upon any one of claims 6-8, wherein the supporting device (20-22) is adapted to detachably attach to the connecting device (59a-59c).

12. The lighting assembly of claim 11, or claim 10 when depending upon any one of claims 6-8, wherein the supporting device (20-22) is adapted to support movement of the connecting device (59a-59c) along a first axis (Y) thereof.

13. The lighting assembly of any one of claims 6-8, or any one of claims 10-12 when depending upon any one of claims 6-8, or the method of any one of claims 1-4, wherein:

the connecting device (59a-59c) is a first connecting device (59a-59c); and
the first connector (50, 53) is attached to a shell (67b) adapted for attachment to the lighting module (40), both the first connector (50, 53) and the shell (67b) forming a second connecting device (49b).

14. The lighting assembly of claim 9, or claim 10 when depending upon claim 9, wherein:

the connecting device (49a) is a first connecting device (49a); and
the second connector (61, 63) is attached to a shell adapted for attachment to the lamp body (13), both the second connector (61, 63) and the shell forming a second connecting device.

15. The lighting assembly of any one of claims 5-14, or the method of any one of claims 1-4, wherein:

the connecting device (49a, 59a, 59b) is the connector (51, 60) thereof, the connector (51, 60) being adapted for attachment to the supporting

device (20-23); or
the connecting device (49b, 59c) comprises the connector (53, 63) thereof and a shell (67a, 67b) attached thereto, the shell (67a, 67b) being attachable to the supporting device (20-23).

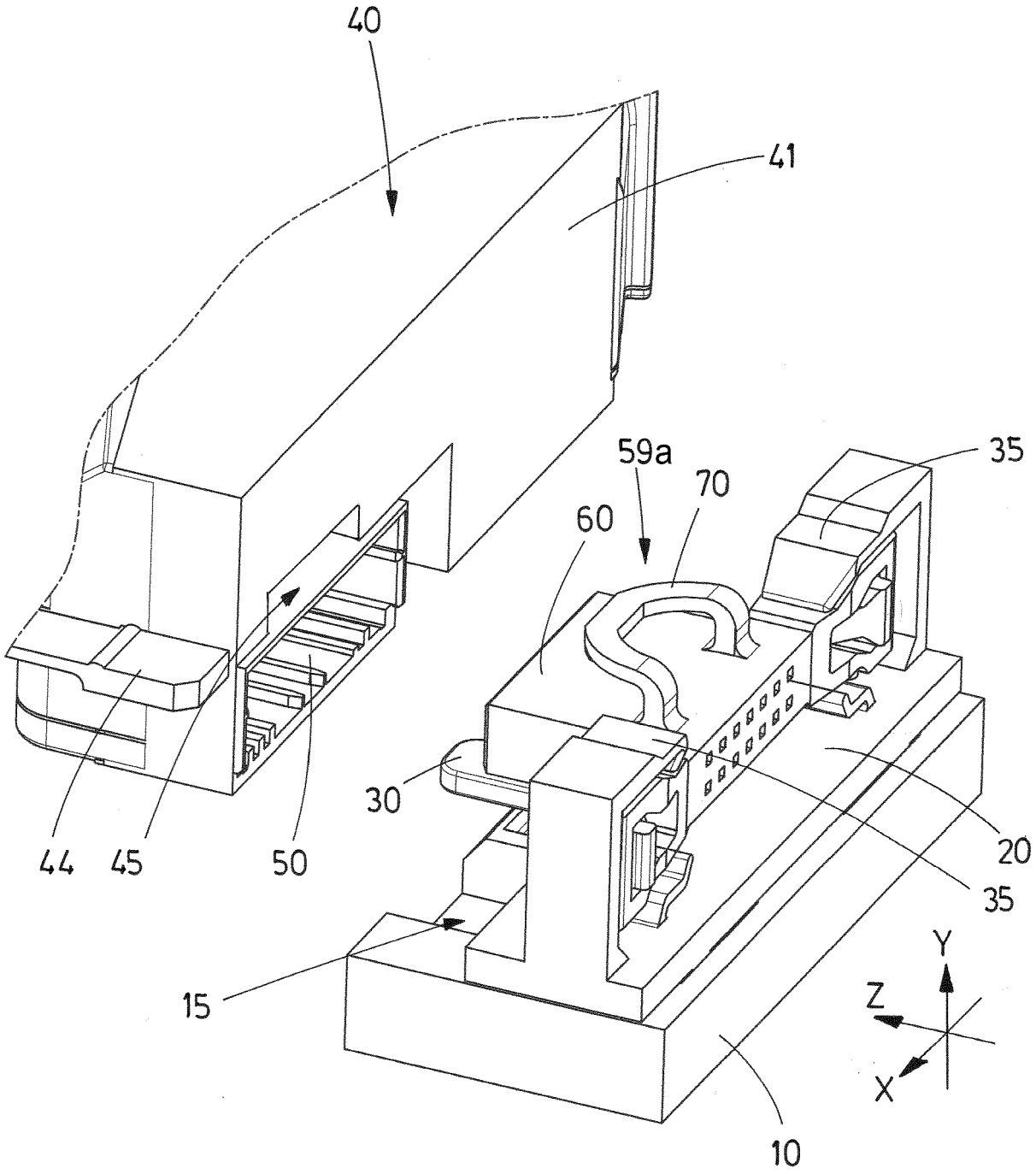

FIG.1

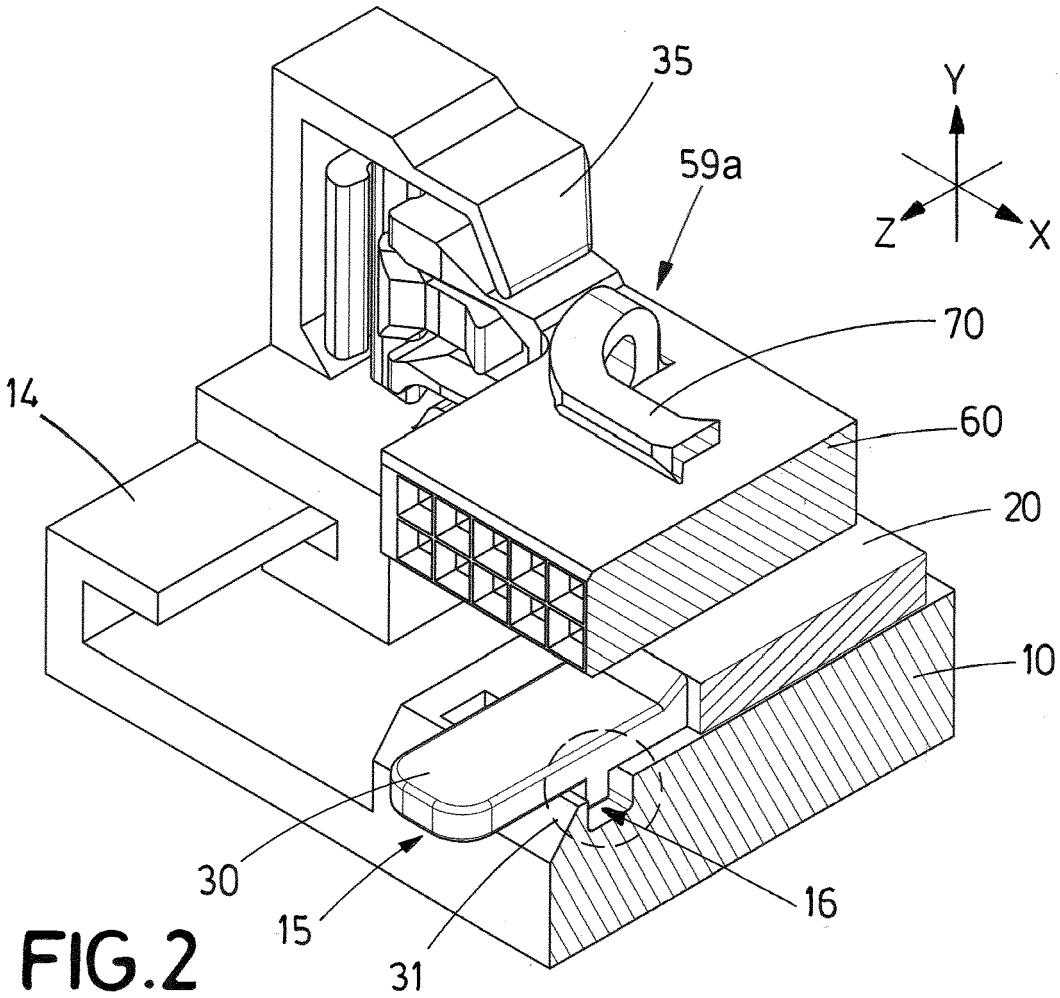
35
59a
Y
Z
X
70
14
60
20
10
30
15
31
16

FIG.2

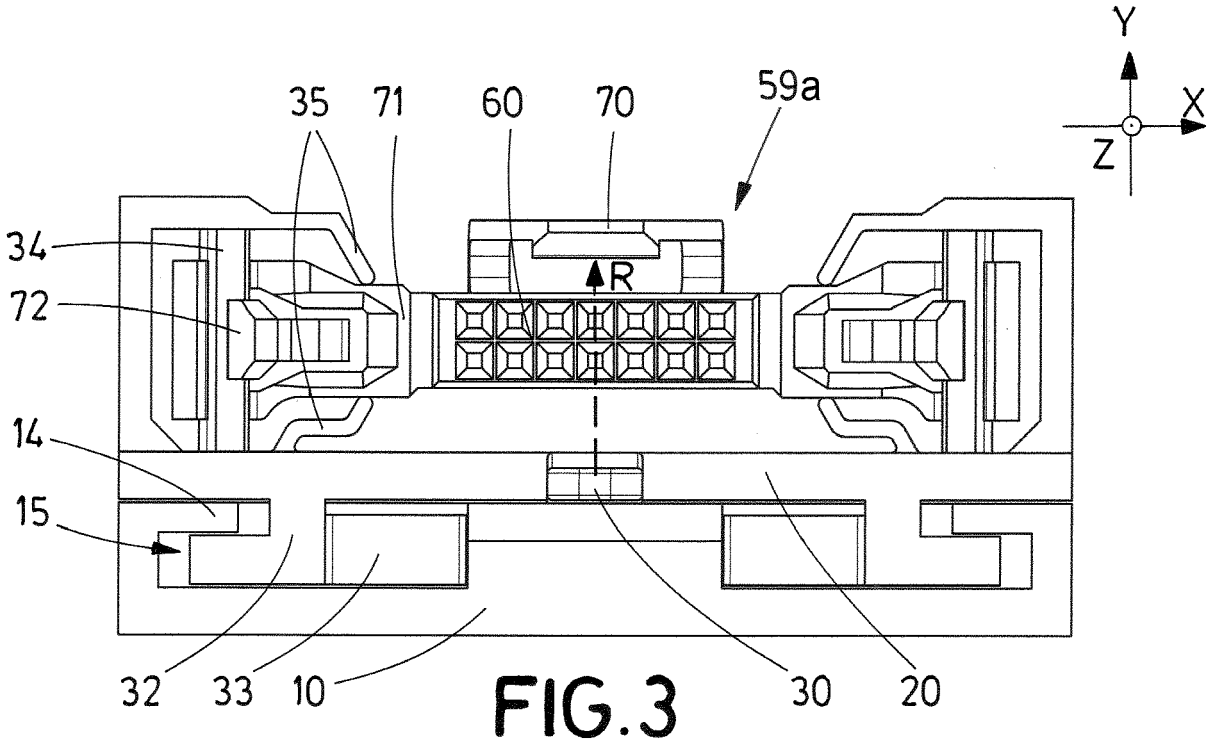
Y
X
Z
35
71
60
70
59a
34
72
R
14
15
32
33
10
30
20

FIG.3

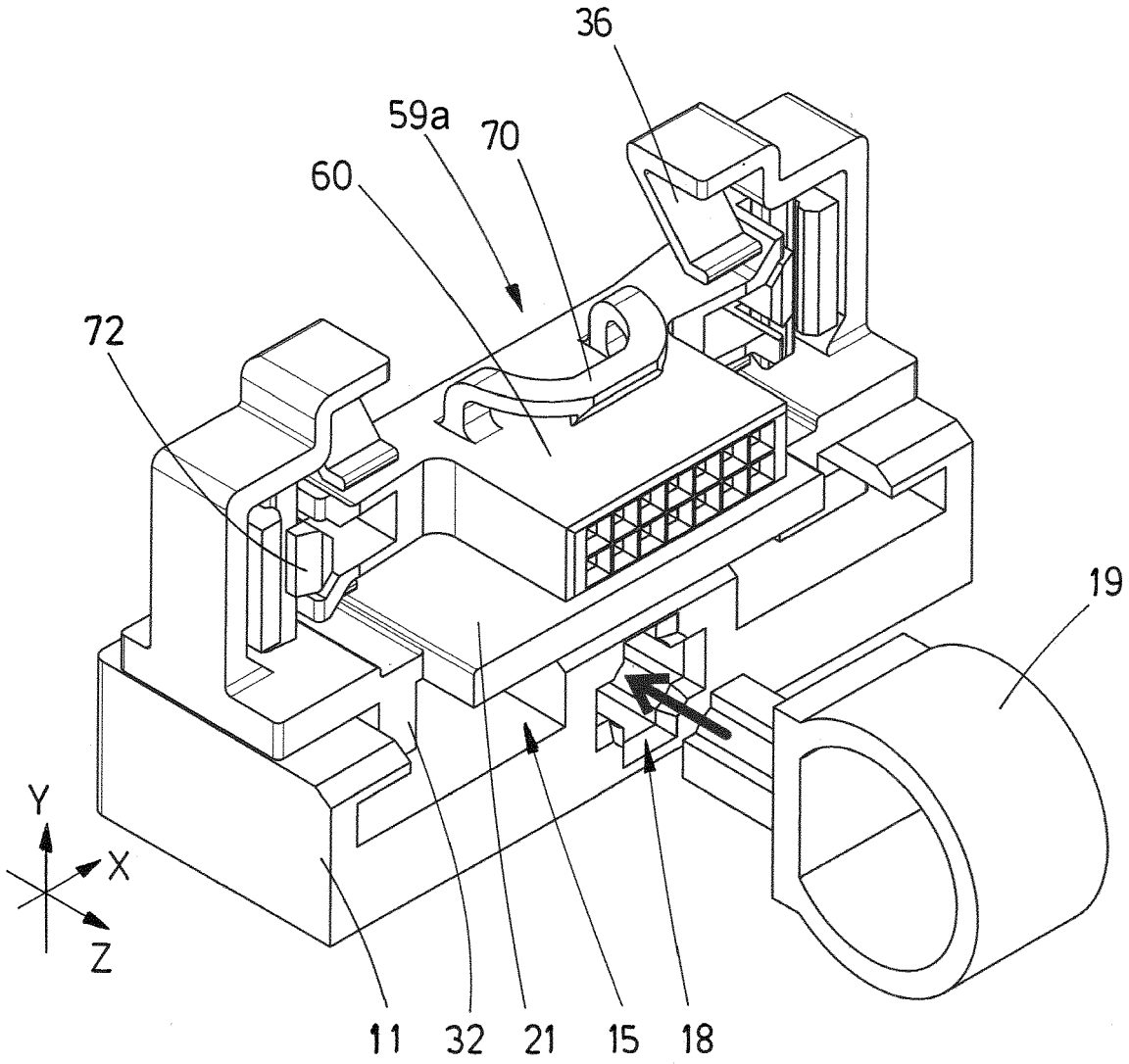

FIG.4

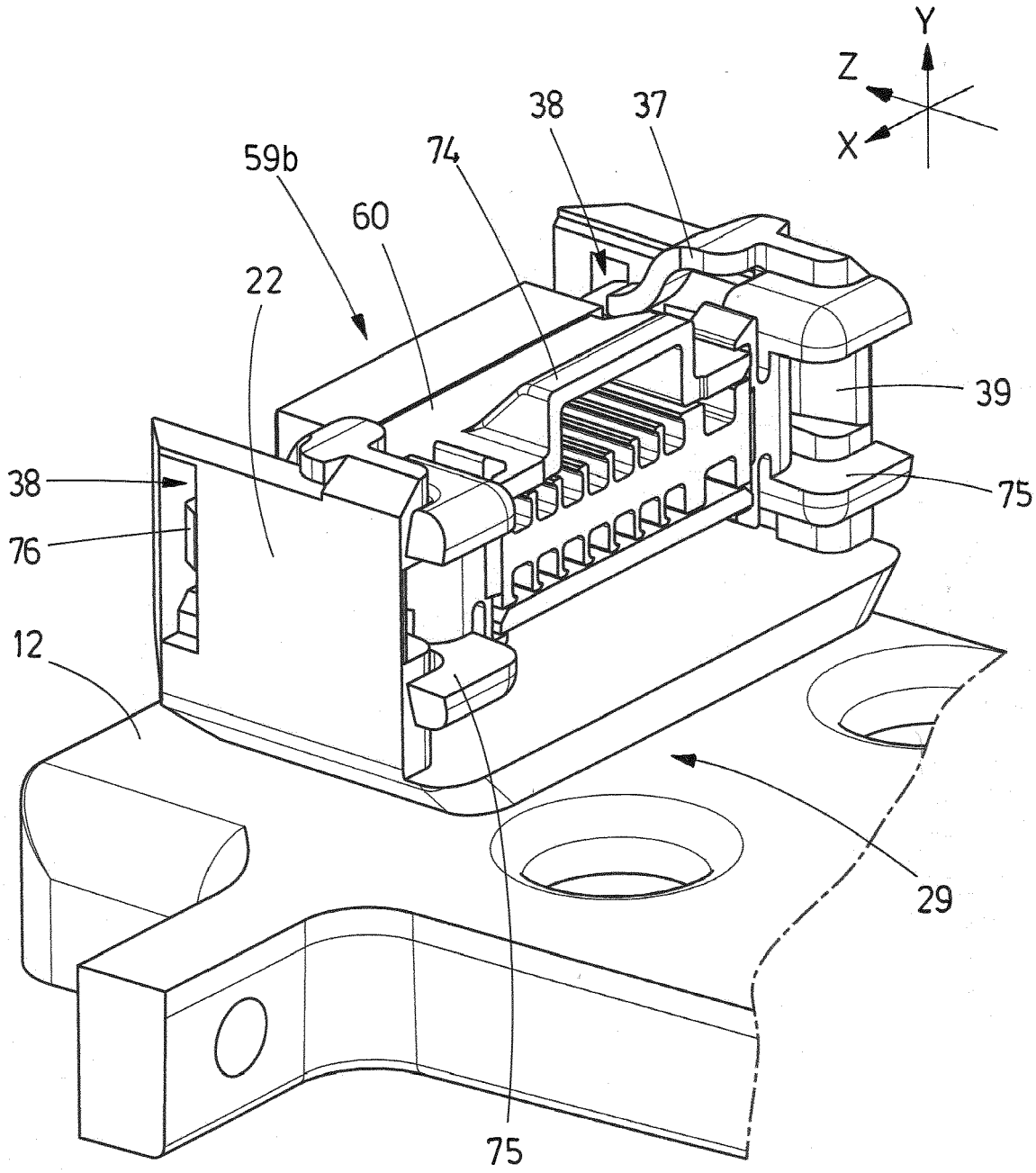

FIG.5A

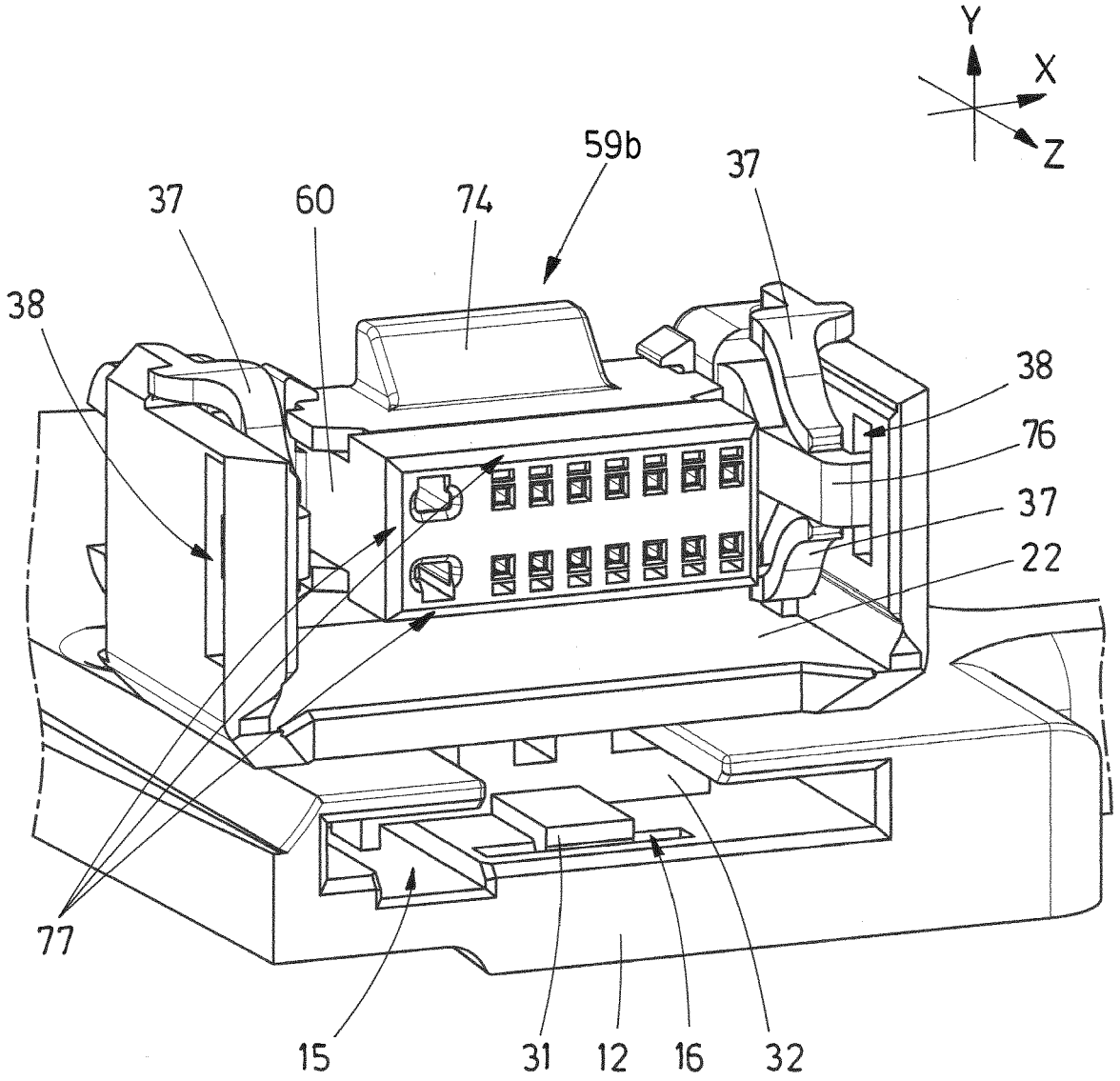

FIG.5B

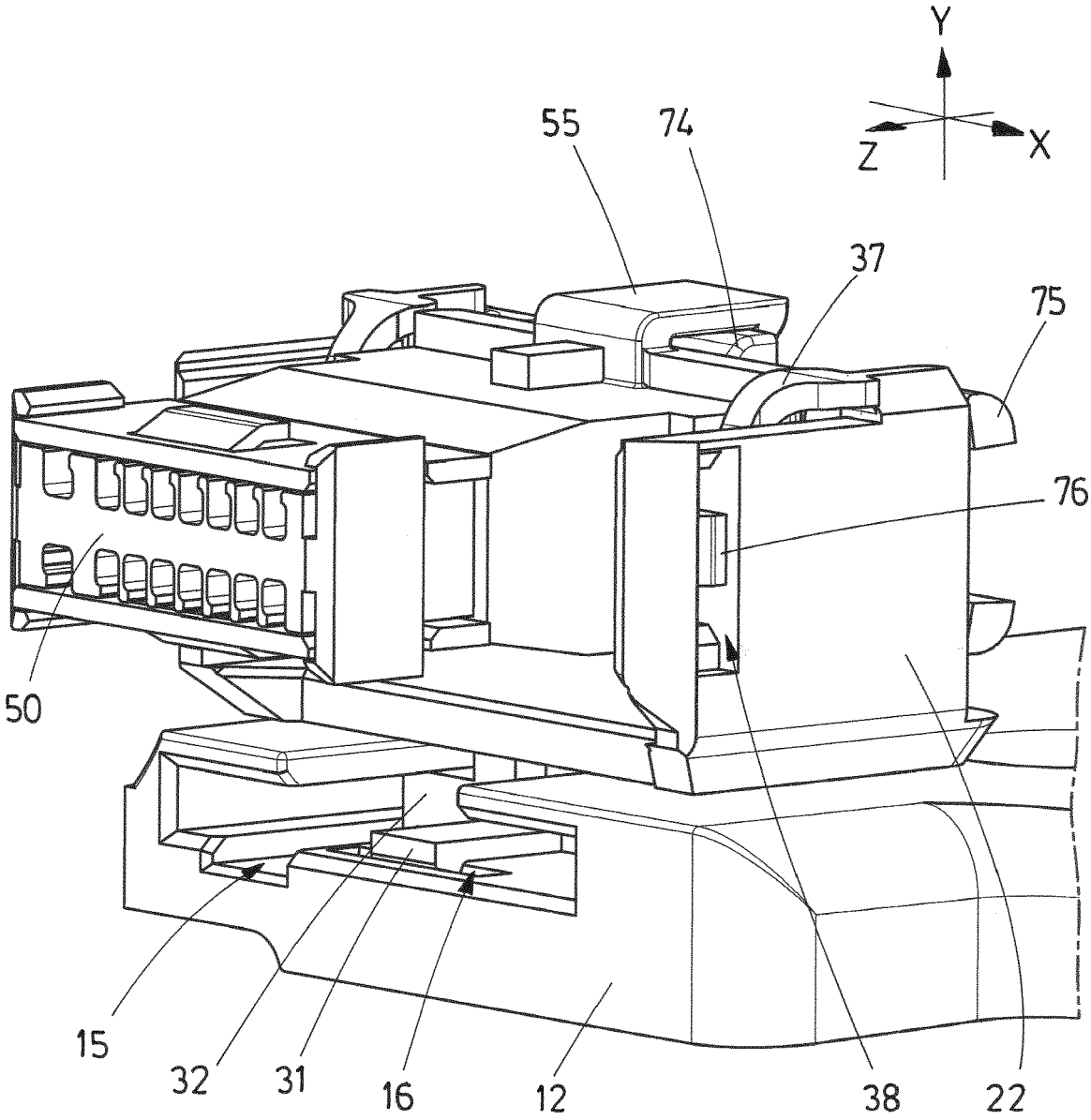

FIG.6

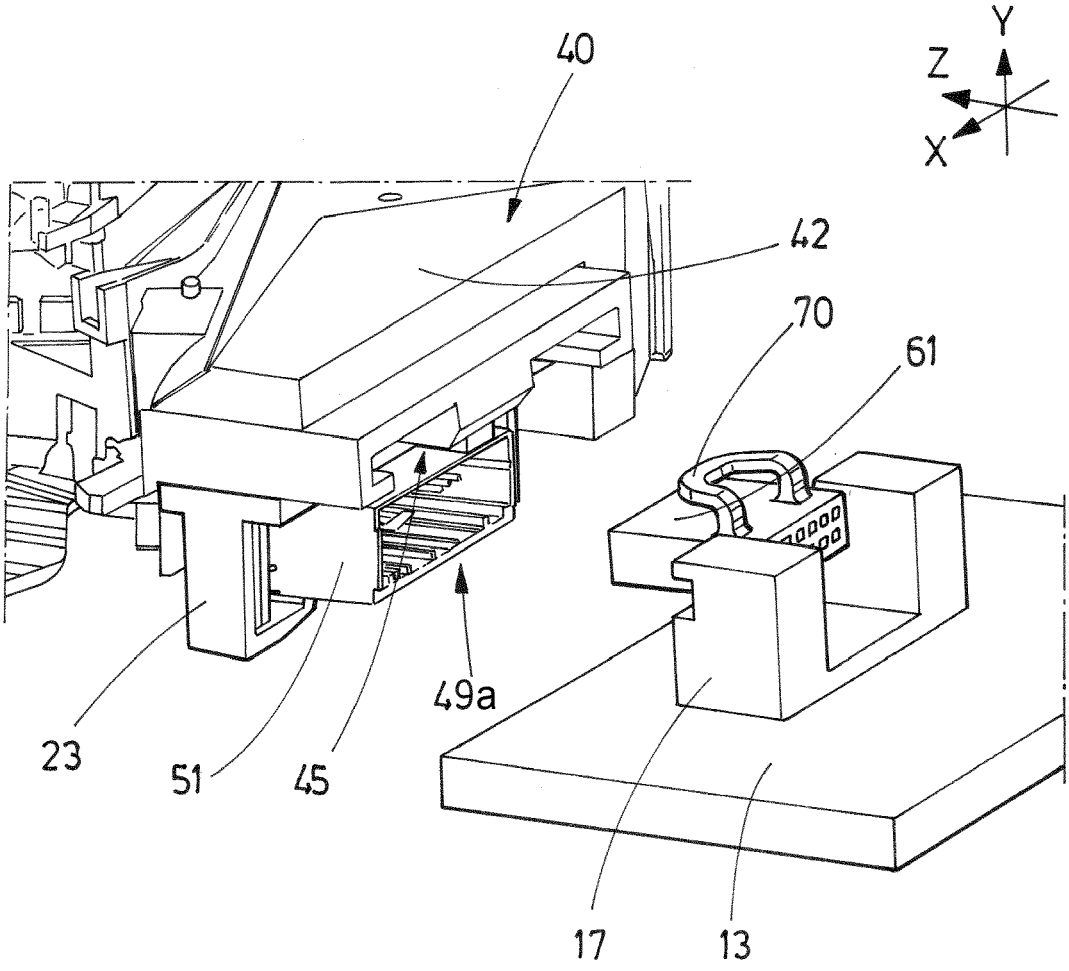

FIG.7

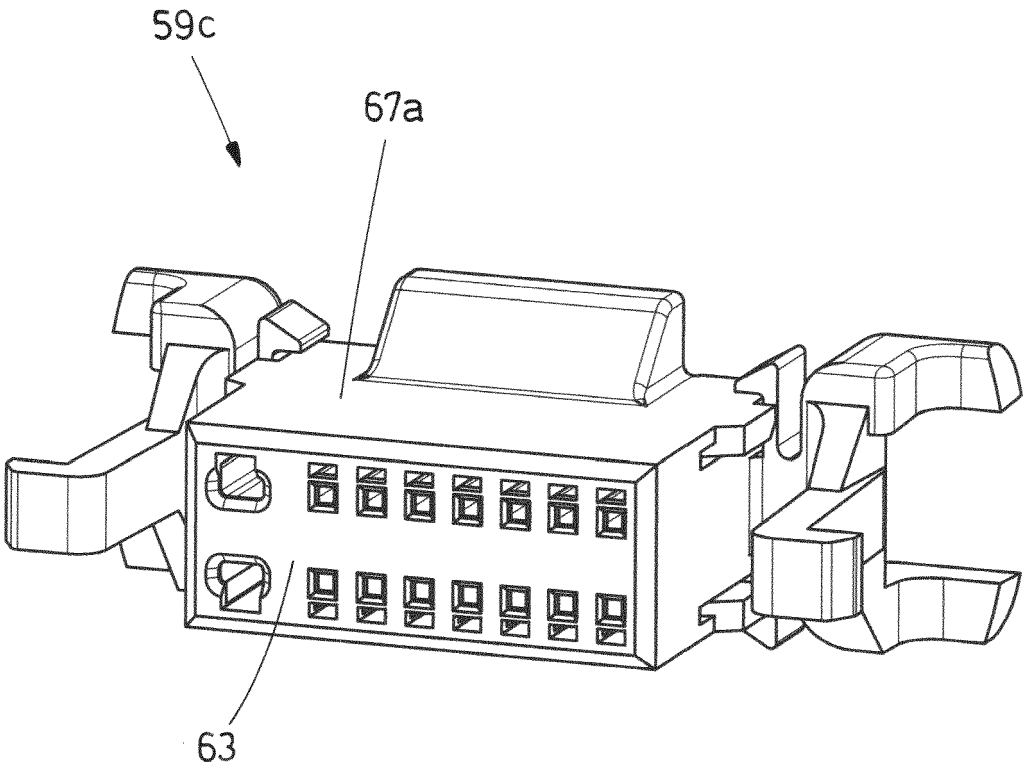

FIG.8

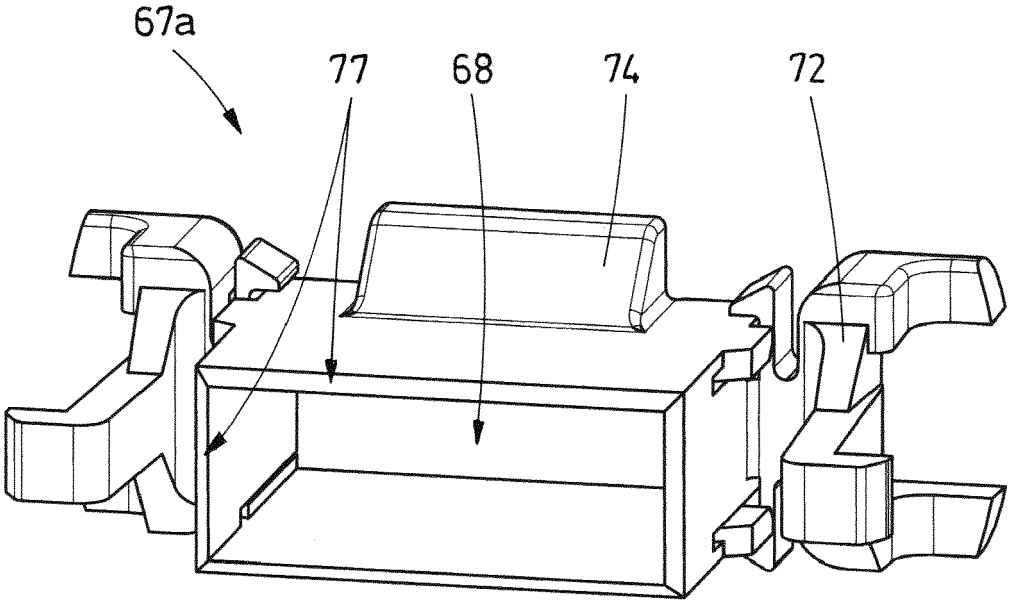

FIG.9A

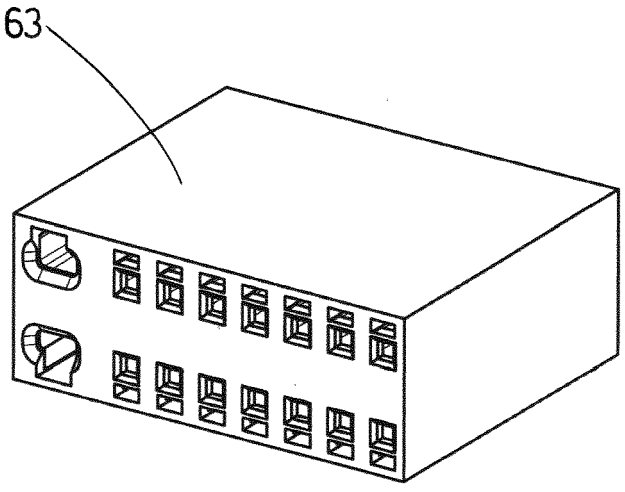

FIG.9B

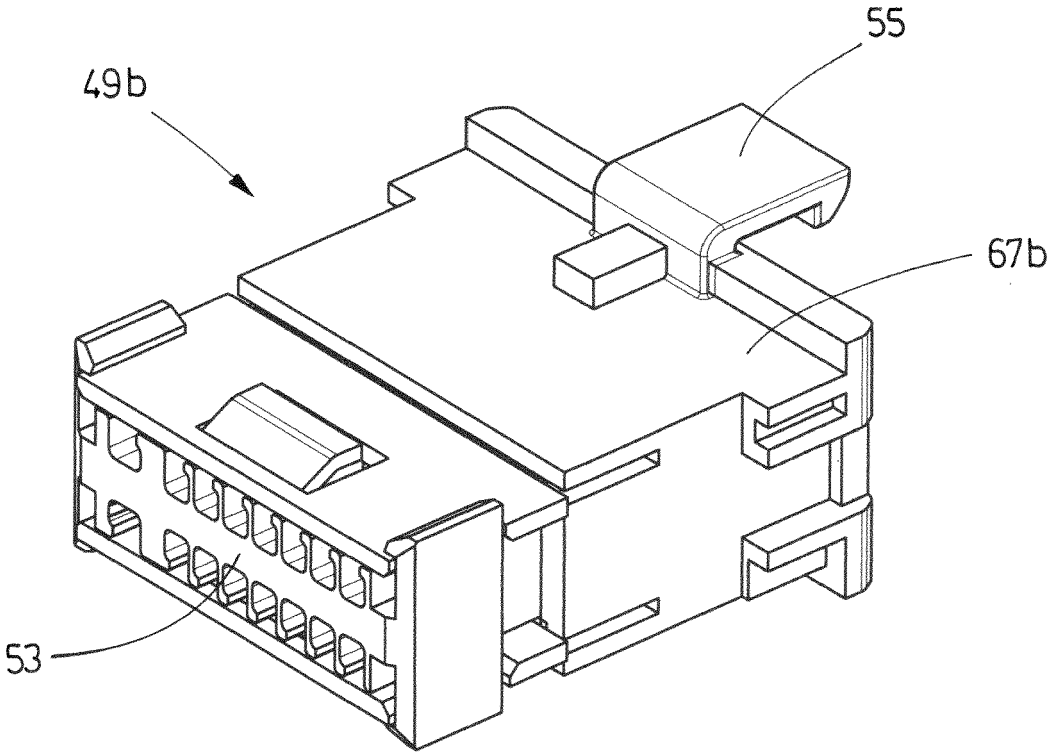

FIG.10A

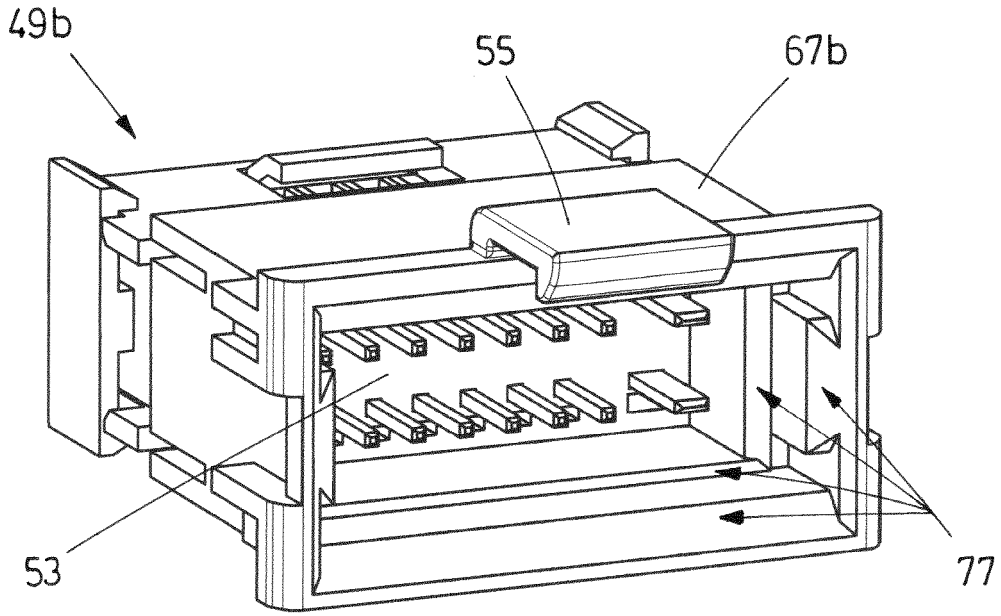

FIG.10B

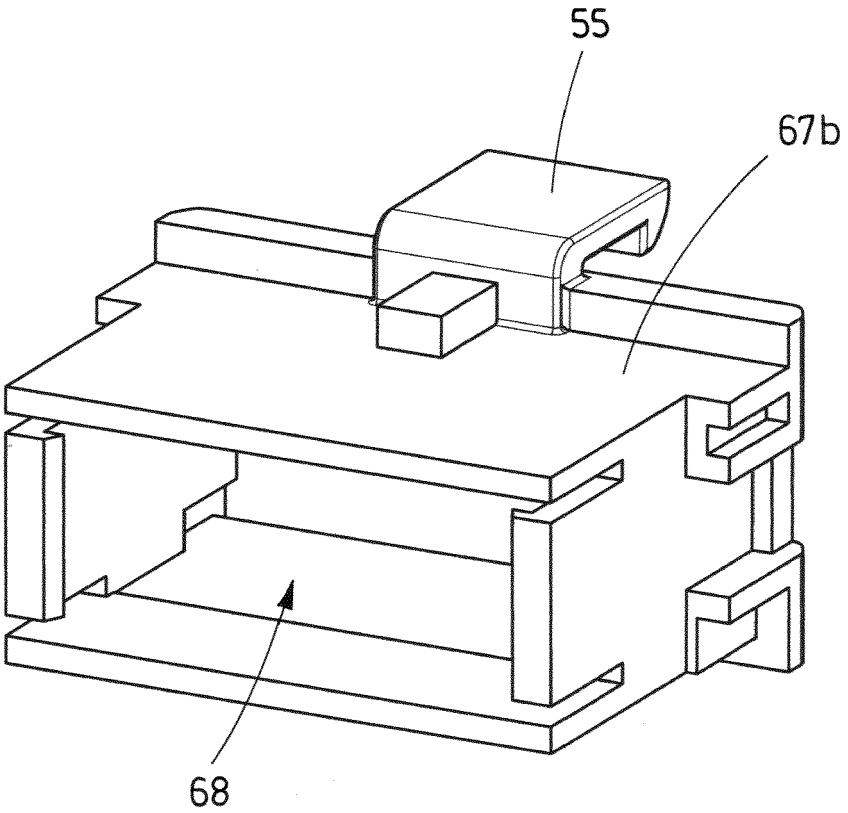

FIG.11

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EUROPEAN SEARCH REPORT

Application Number
EP 19 38 2739

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F21S H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 March 2020	Corrales, Daniel

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