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(54) Electrical connector

(57) The invention relates to a plug-in connector. Plug-in connectors of this type are used, for example, for attaching cables to devices in electrical appliances, machines, motors, vehicles or the like. As a plug-in connector which can be used for different plug-in contacts and simplifies the connection process and the attachment of a cable to a device, the invention provides the plug-in connector according to claim 1 including a plug housing pair with two connectable plug housings and a contact housing pair with two connectable contact housings, each plug housing comprising at least one socket for a contact housing.

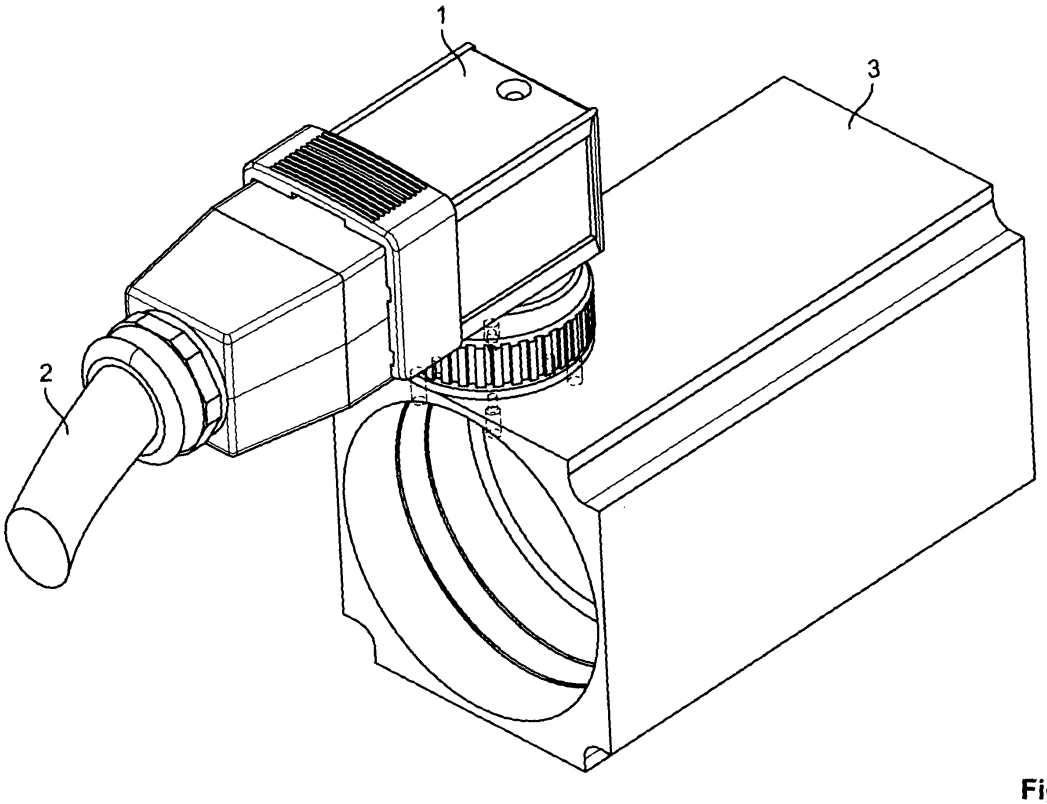

Fig. 1

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Description

[0001] The invention relates to a plug-in connector.

[0002] Plug-in connectors of this type are used, for example, for attaching cables to devices in electrical appliances, machines, motors, vehicles or the like.

[0003] A plug-in connector of this type is known, for example, from DE 20 2005 000 883 U1.

[0004] With this plug-in connector, different plug-in connectors are required for different plug-in contacts. In addition, the connection and attachment of a cable to a device is problematic owing to the complex structure of the plug-in connector.

[0005] The object of the invention is to provide a plug-in connector which can be used for different plug-in contacts and simplifies the process of connection and attachment of a cable to a device.

[0006] To achieve this object, the invention provides the plug-in connector according to claim 1, including: a pair of plugs housings with two connectable plug housings and a pair of contact housings with two connectable contact housings, each plug housing comprising at least one socket for a contact housing. With this arrangement, each contact housing can have a size which is adapted to the plug housing socket and/or standardised so contact housings equipped with different plug-in contacts can be inserted into the same plug housing. The same plug-in connector can therefore be used for different plug-in contacts. Owing to the modular construction of the plug-in connector, the contact housings can be connected to cable-side and device-side terminals outside the plug housing to simplify the connection process and the attachment of a cable to a device.

[0007] It may prove helpful if the plug-in connector is configured in such a way that the contact housings are brought into contact on connection of the plug housings. The connection process and the attachment of the cable which is to be attached via the plug connector to the device can be further simplified in this way.

[0008] It may prove advantageous if the plug housing is lockable with a locking device. The locking device can prevent the plug housings from coming apart even under the influence of forces of abrasions.

[0009] However, it may also prove practical if at least one of the plug housings is divisible, so that a contact housing can be arranged in the socket. A contact housing can therefore be arranged in the socket in a particularly simple and secure manner, thus simplifying assembly of the contact housings in the plug housing.

[0010] It may also advantageous if each plug housing comprises at least one socket which is shielded from electromagnetic radiation. The influence of electromagnetic radiation from the environment can cause interference, in particular during signal transmission, and this represents a considerable safety risk, especially in automotive applications or in the aerospace sector. Preferably, the entire plug housing is shielded from electromagnetic radiation. However, if power and signals can be transmitted, for example, simultaneously via a plug-in connection, the power transmission can adversely affect the signal transmission. It is therefore advantageous if a socket of a plug housing is also shielded from electromagnetic radiation of which the origin is located in a different socket. For this purpose, a socket of a plug housing and/or the plug housing itself is lined and/or clad with a material, preferably metal, which acts as a shield against electromagnetic radiation, or is constructed completely from this material.

[0011] It may however also prove desirable if each plug housing comprises at least one further socket for a further contact housing. Power and signals can therefore be transmitted, for example, simultaneously via the plug-in connection.

[0012] It may also be useful if the sockets of a plug housing are adjacent transversely to a connection direction of the plug housings. The plug in connection can therefore have any number of sockets for contact housings.

[0013] It may also be useful if a plug housing and/or a contact housing has a polygonal, preferably substantially rectangular, more preferably substantially square cross-section. A plurality of plug housings and/or contact housings can therefore be arranged particularly densely next to one another.

[0014] It may also be helpful if a cross-section of a contact housing is adapted substantially to a cross-section of a socket. The contact housing therefore has little play in the socket for movement within the socket, for example during vibrations. The reliability of the plug-in connection can thus be improved.

[0015] It may be useful if a contact housing can be fixed non-positively and/or positively in a socket. The contact housing can therefore be held securely and rigidly in the socket and has no play for movement within the socket, for example during vibrations. The reliability of the plug-in connection can therefore be further improved.

[0016] It may prove advantageous if the plug-in connector can be fixed rotatably on a flange. The direction in which a cable which is to be attached to a device can be guided away from the device, can therefore be adjusted as desired.

[0017] It may also prove advantageous if the plug-in connector can be fixed or locked in a rotational position relative to the flange. The plug-in connection can thus be prevented from rotating unintentionally.

[0018] It may also prove advantageous if the plug-in connector is configured as an angle plug-in connector. A cable which is to be attached to a device can thus be led away from the device with slight spacing, and this has proven to be particularly practical, in particular in a restricted space.

[0019] However, it may also be advantageous if a connection direction of the plug housing is oriented along, parallel to or transversely to an axis of rotation of the plug-in connector. These embodiments may also prove

practical, in particular in a restricted space. The term "transverse" as used in this description also includes the meanings of the terms "oblique", "angled" and, in particular, "perpendicular".

[0020] It may also prove beneficial if one contact housing is configured as a plug pin and one contact housing as a plug socket. The contact housings can therefore engage in one another and be permanently connected.

[0021] A further preferred embodiment of the invention relates to plug-in connector including a pair of plug housings with two connectable plug housings and a pair of plug-in contacts with two connectable plug-in contacts, the plug-in connector comprising a locking device for locking the plug housing and the plug-in contacts being brought into contact when the plug housings are locked. The plug housings can therefore be connected with a hand grip and at the same time locked.

[0022] It may be practical if the locking device is mounted movably on a plug housing. A movement of the locking device relative to the plug housing can therefore be coupled to prevent faulty assembly of the plug-in connector.

[0023] It may be beneficial if the locking device is held captive on a plug housing. The risk of losing the locking device, for example during transportation, can also be reduced in this way.

[0024] However, it may also be practical if the locking device is movable transversely to a connection direction of the plug housings, for locking the plug housings.

[0025] This can prevent the locking device from being inadvertently released when a force acts in the connection direction of the plug housings.

[0026] It may be advantageous if the locking device is movable in a plane of a housing division for locking the plug housings. This can prevent the locking device from being inadvertently released when a force acts transversely to the plane of the housing division.

[0027] It may prove helpful if the locking device is configured as a substantially U-shaped hoop, surrounding the plug housing at least in some regions when locked. The plug housings can therefore be held together in an interlocking secure manner.

[0028] It may also be beneficial if a movement of the locking device relative to at least one of the plug housings is guided by a guide device. This enables the locking device to be operated easily, even by inexperienced personnel.

[0029] However, it may also be advantageous if a movement of the locking device relative to the first plug housing can be guided via a first link guide and a movement of the locking device relative to the second plug housing by a second link guide. The plug housings are thus guided particularly reliably and precisely relative to one another, and the risk of a defective connection or the risk of damage to plug contacts by defective connection is reduced.

[0030] It may also be practical if at least one guide link is constructed on the side of the locking device. The guide link can be constructed particularly easily in the locking device.

[0031] A further preferred embodiment of the invention relates to a plug-in connector system including a plug-in connector according to any one of the preceding claims and at least two pairs of contact housings with two respective connectable contact housings, the pairs of contact housings being equipped with different pairs of plug-in contacts. The same plug-in connector can therefore be combined with different pairs of contact housings or pairs of plug-in contacts and is thus substantially more versatile than a conventional plug-in connector.

[0032] Fig. 1 is a perspective view of a first embodiment of the plug-in connector according to the invention for attaching a multi-wire cable for transmitting power and signals to a motor, in the connected state.

[0033] Fig. 2 is an exploded view of the plug-in connector according to the invention from Fig. 1.

[0034] Fig. 3 is a perspective view of a second embodiment of the plug-in connector according to the invention for attaching a multi-wire cable for transmitting power and signals to a motor, in the connected state.

[0035] Fig. 4 is an exploded view of the plug-in connector according to the invention from Fig. 3.

[0036] Fig. 5 is a perspective view of a third embodiment of the plug-in connector according to the invention for attaching a multi-wire cable for the transmitting of power and signals to a motor, in the connected state.

[0037] The various features of the plug-in connector 1 according to the invention will first be described with reference to the accompanying drawings. The features of the various features of the plug-in connector 1 according to the invention can be combined in any way.

[0038] A first feature of the invention relates to a plug-in connector 1 including a pair of plug housings 5, 8 with two connectable plug housings 5, 8 and a pair of contact housings 7, 10, with two connectable contact housings 7, 10, each plug housing 5, 8 comprising at least one socket 6, 9 for a contact housing 7, 10. The plug-in connector 1 is constructed in such a way that the contact housings 7, 10 are brought into contact when the plug housings 5, 8 are connected.

[0039] Each plug housing 5,8 is produced with a polygonal, in particular substantially rectangular, cross-section, preferably from metal and/or plastics material, and comprises two sockets 6, 9 each with a polygonal, in particular substantially rectangular, cross-section. Each socket 6, 9 is adapted to receive a respective contact housing 7, 10. One socket 6, 9 of each plug housing 5, 8 is shielded from electromagnetic radiation. The sockets 6, 9 of a plug housing 5, 8 are arranged adjacent to one another transversely to a connection direction of the plug housings 5, 8. The socket 6, 9 which is shielded from electromagnetic radiation is intended for a contact housing 7, 10 for signal transmission and the other socket 6, 9 is intended for a contact housing 7, 10 for power transmission. Each plug housing 5, 8 is divisible so that the contact housings 7, 10 can be arranged in the sockets 6, 9.

[0040] One contact housing 7 of a contact housing pair 7, 10 is configured as a plug pin and the other contact housing 10 of a contact housing pair 7, 10 as a plug socket. Each contact housing 7, 10 is preferably configured as an injection-moulded plastics component with a polygonal, in particular substantially rectangular cross-section, the cross-section of the contact housing 7, 10 being adapted substantially to the cross-section of an associated socket 6, 9 so the contact housing 7, 10 can be fixed non-positively in the associated socket 6, 9. In addition, the contact housing 7, 10 can be fixed positively in the socket intended for it, and can also be, for example, latched or screwed. Each contact housing 7, 10 is equipped with a plug-in contact, an associated pair of contact housings 7, 10 receiving an associated pair of plug-in contacts which is connected when the contact housing pair 7, 10 is connected. The contact housing pairs 7, 10 are selected, for example, from the applicant's HVS (high variable system) modular system.

[0041] The plug-in connector 1 can be attached to a cable 2 via a cable-side terminal 16 with a cable grip and can be fixed rotatably on a flange 4 via a device-side terminal 17. The plug-in connector 1 can be fixed relative to the flange 4 via a union nut in a desired rotational position.

[0042] A connection direction of the plug housings 5, 8 can be oriented along, parallel to or transversely to an axis of rotation of the plug-in connector 1, the most favourable configuration being selected according to the preferred application. The embodiments described hereinafter basically differ by the orientation of the connection direction of the plug housings 5, 8 relative to the axis of rotation of the plug-in connector 1.

[0043] The plug-in connector 1 can be configured as an angle plug-in connector or as a linear plug-in connector.

[0044] The plug housings 5, 8 can be brought together in a connection direction and be connected and locked by a locking device 11. The locking device 11 represents part of the second feature of the invention which will be described in more detail hereinafter.

[0045] A second feature of the present invention relates to a plug-in connector 1 including a plug housing pair 5, 8 with two connectable plug housings 5, 8 and a plug-in contact pair 7, 10 with two connectable plug-in contacts 7, 10, the plug-in connector 1 comprising a locking device 11 for locking the plug housings 5, 8 and the plug-in contacts 7, 10 being brought into contact when the plug housings 5, 8 are locked.

[0046] According to the second feature of the invention, the plug housings 5, 8 can be equipped directly with plug-in contacts 7, 10 (without contact housings), or the plug-in contacts 7, 10 can be integrated directly into the respective plug housings 5, 8. As in the first feature of the invention, however, the plug-in contacts 7, 10 can be constructed in contact housings 7, 10 which can in turn be received in plug housing sockets 6, 9. The last-mentioned variant is preferred, and only this variant will be described for the sake of simplicity.

[0047] The locking device 11 is configured as a substantially U-shaped hoop surrounding the plug housings 5, 8 at least in some regions when locked.

[0048] A movement of the locking device 11 relative to the plug housings 5, 8 is guided by guide devices 12, 13. A movement of the locking device 11 relative to the cable-side plug housing 5 is guided via a first link guide 12 and a movement of the locking device 11 relative to the motor-side plug housing 8 is guided via a second link guide 13. The guide links of the link guides 12, 13 are constructed on the interior of the locking device 11. Two guide projections 14 are constructed on the cable-side plug housing 5 and can be brought into engagement with the guide links 12. Two guide projections 15 are formed on the motor-side plug housing 8 and engage with the guide links 13 so as to hold the locking device 11 in a movable, captive manner on the motor-side plug housing 8. For locking the plug housing 5, 8 transversely to a connection direction of the plug housing 5, 8, the locking device 11 is movable in the plane of the housing division, the plane of the hosing division being a dividing plane of the plug housings 5, 8.

[0049] The preferred embodiments of the plug-in connector 1 according to the invention will be described hereinafter with reference to the accompanying drawings.

[0050] Fig. 1 is a perspective view of a first embodiment of the plug-in connector 1 according to the invention for attaching a multi-wire cable 2 for transmitting power and signals to an electric motor 3 in the connected state. Fig. 2 is an exploded view of the plug-in connector 1 according to the invention from Fig. 1. The plug-in connector 1 of the first embodiment of the invention shown in Figs. 1 and 2 is constructed as an angle plug-in connector and includes the first and second features of the invention. The connection direction of the plug housings 5, 8 is oriented perpendicularly to an axis of rotation about which the plug-in connector 1 can be rotatably mounted on the motor 3 (arrow in Fig. 2).

[0051] Fig. 3 is a perspective view of a second embodiment of the plug-in connector 1 according to the invention for attaching a multi-wire cable 2 for transmitting power and signals to an electric motor 3, in the connected state. Fig. 4 is an exploded view of the plug-in connector 1 according to the invention from Fig. 3. The plug-in connector 1 of the second embodiment of the invention according to Figs. 3 and 4 is constructed as an angle plug-in connector and includes the first and second features of the invention. The connection direction of the plug housings 5, 8 is orientated along or parallel to the axis of rotation about which the plug-in connector 1 can be rotatably mounted on the motor 3.

[0052] Fig. 5 is a perspective view of a third embodiment of the plug-in connector 1 according to the invention for attaching a multi-wire cable 2 for transmitting power and signals to an electric motor 3, in the connected state. The plug-in connector 1 of the third embodiment of the invention is constructed as a linear plug-in connector and

includes the first and second features of the invention. The connection direction of the plug housings 5, 8 is oriented along or parallel to the axis of rotation about which the plug-in connector 1 can be rotatably mounted on the motor 3.

[0053] Assembly of the plug-in connector 1 according to the invention is described hereinafter.

[0054] For attaching the cable-side plug housing 5 and the cable-side contact housing 7, the cable 2 (Fig. 1) is guided via the terminal 16 into the plug housing 5. The individual strands of the cable 2 are connected to the contact housings 7, still arranged outside the plug housing sockets 6, for transmitting power and signals via a cable grip (not shown). The contact housing 7 for signal transmission is then arranged in the socket 6 of the plug housing 5, which is shielded from electromagnetic radiation, and the contact housing 7 for power transmission is arranged in the adjacent socket 9 of the plug housing 5.

[0055] A multi-wire motor feed cable (not shown) is guided via the terminal 17 into the plug housing 5 for attaching the motor-side plug housing 8 and the motor-side contact housing 10. The individual strands of the motor feed cable (not shown) are connected to the contact housings 10, still arranged outside the plug housing sockets 9, for transmitting power and signals via a cable grip (not shown). The contact housing 10 for signal transmission is then arranged in the socket 9 of the plug housing 8 which is shielded from electromagnetic radiation and the contact housing 10 for power transmission is arranged in the adjacent socket 9 of the plug housing 5.

[0056] The plug housings 5, 8 can be divided to simplify the arrangement of the contact housings 7, 10 in the sockets 6, 9 of the plug housings 5, 8. The plug housing parts are preferably brought together prior to connection of the plug housings 5, 8.

[0057] The terminal 17 of the motor-side plug housing 8 is then fastened rotatably on the flange 4 which is fastened on the housing of the motor 3.

[0058] To connect the plug housings 5, 8, the guide projections 14 of the cable-side plug housing 5 are introduced into the guide links 12 of the locking device 11 in the connection direction of the plug housings 5, 8 (arrow in Fig. 2), and the locking device 11 is actuated in the locking direction (arrow in Fig. 2) oriented perpendicularly or transversely to the connection direction, in order to connect and lock the plug housings 5, 8 and the contact housings 7, 10.

[0059] In the rotational position shown, the plug-in connector 1 is fixed relative to the flange 4 by a union nut.

[0060] The sequence of assembly steps is not predetermined and can be varied as desired.

[0061] A plug-in connector system according to the invention includes a plug-in connector 1 according to the invention corresponding to one of the aforementioned embodiments and at least two different contact housing pairs 7, 10 each with two connectable contact housings 7, 10, the contact housing pairs 7, 10 being equipped with different plug-in contact pairs. The same plug-in connector 1 can therefore be used in combination with different contact housing pairs 7, 10 or plug-in contact pairs selected, for example, from the applicant's HVS modular system.

LIST OF REFERENCE NUMERALS

[0062]

1	plug-in connector
2	cable
3	motor
4	flange
5	housing (cable-side)
6	socket in housing (cable-side)
7	contact housing/ plug-in contact (cable-side)
8	housing (motor-side)
9	socket in housing (motor-side)
10	contact housing/ plug-in contact (motor-side)
11	locking device
12	guide link for housing (cable-side)
13	guide link for housing (motor-side)
14	guide projection on housing (cable-side)
15	guide projection on housing (motor-side)
16	terminal (cable-side)
17	terminal (motor-side)

Claims

1. Plug-in connector (1) including a plug housing pair (5, 8) with two connectable plug housings (5, 8) and a contact housing pair (7, 10) with two connectable contact housings (7, 10), each plug housing (5, 8) comprising at least one socket (6, 9) for a contact housing (7, 10).

2. Plug-in connector (1) according to claim 1, wherein the plug-in connector (1) is constructed in such a way that the contact housings (7, 10) can be brought into contact on connection of the plug housings (5, 8).

3. Plug-in connector (1) according to any one of the preceding claims, wherein the plug housings (5, 8) can be locked by a locking device (11).

4. Plug-in connector (1) according to any one of the preceding claims, wherein at least one of the plug housings (5, 8) is divisible so that a contact housing (7, 10) can be arranged in the socket (6, 9).

5. Plug-in connector (1) according to any one of the preceding claims, wherein each plug housing (5, 8) comprises at least one socket (6, 9) which is shielded from electromagnetic radiation.

6. Plug-in connector (1) according to any one of the preceding claims, wherein each plug housing (5, 8)

comprises at least one further socket (6, 9) for a further contact housing (7, 10).

7. Plug-in connector (1) according to any one of the preceding claims, wherein the sockets (6, 9) of a plug housing (5, 8) are adjacent transversely to a connection direction of the plug housings (5, 8).

8. Plug-in connector (1) according to any one of the preceding claims, wherein a plug housing (5, 8) and/or a contact housing (7, 10) has a polygonal, preferably substantially rectangular, particularly substantially square cross-section.

9. Plug-in connector (1) according to any one of the preceding claims, wherein a cross-section of a contact housing (7, 10) is adapted substantially to a cross-section of a socket (6, 9).

10. Plug-in connector (1) according to any one of the preceding claims, wherein a contact housing (7, 10) can be fixed non-positively and/or positively in a socket (6, 9).

11. Plug-in connector (1) according to any one of the preceding claims, wherein the plug-in connector (1) can be fixed rotatably on a flange.

12. Plug-in connector (1) according to any one of the preceding claims, wherein the plug-in connector (1) can be fixed or locked in a rotational position relative to the flange.

13. Plug-in connector (1) according to any one of the preceding claims, wherein the plug-in connector (1) is constructed as an angle plug-in connector.

14. Plug-in connector (1) according to any one of the preceding claims, wherein a connection direction of the plug housings (5, 8) is oriented along, parallel to or transversely to an axis of rotation of the plug-in connector (1).

15. Plug-in connector (1) according to any one of the preceding claims, wherein a contact housing (7) is constructed as a plug pin and a contact housing (10) as a plug socket.

16. Plug-in connector (1) including a plug housing pair (5, 8) with two connectable plug housings (5, 8) and a plug-in contact pair (7, 10) with two connectable plug-in contacts (7, 10), the plug-in connector (1) comprising a locking device (11) for locking the plug housings (5, 8), the plug-in contacts (7, 10) being brought into contact when the plug housings (5, 8) are locked.

17. Plug-in connector (1) according to any one of the preceding claims, wherein the locking device (11) is mounted movably on a plug housing (8).

18. Plug-in connector (1) according to any one of the preceding claims, wherein the locking device (11) is held in a captive manner on a plug housing (8).

19. Plug-in connector (1) according to any one of the preceding claims, wherein the locking device (11) is movable transversely to a connection direction of the plug housings (5, 8) for locking the plug housings (5, 8).

20. Plug-in connector (1) according to any one of the preceding claims, wherein the locking device (11) is movable in a plane of a housing division for locking the plug housings (5, 8).

21. Plug-in connector (1) according to any one of the preceding claims, wherein the locking device (11) is constructed as a substantially U-shaped hoop surrounding the plug housings (5, 8) at least in some regions when locked.

22. Plug-in connector (1) according to any one of the preceding claims, wherein a movement of the locking device (11) relative to at least one of the plug housings (5, 8) is guided by a guide device (12).

23. Plug-in connector (1) according to any one of the preceding claims, wherein a movement of the locking device (11) relative to the first plug housing (5) can be guided via a first link guide (12) and a movement of the locking device (11) relative to the second plug housing (8) can be guided via a second link guide (13).

24. Plug-in connector (1) according to any one of the preceding claims, wherein at least one guide link (12) is constructed on the side of the locking device (11).

25. Plug-in connector system including a plug-in connector (1) according to any one of the preceding claims and at least two different contact housing pairs (7, 10) each with two connectable contact housings (7, 10), wherein the different contact housing pairs (7, 10) are equipped with different plug-in contact pairs.

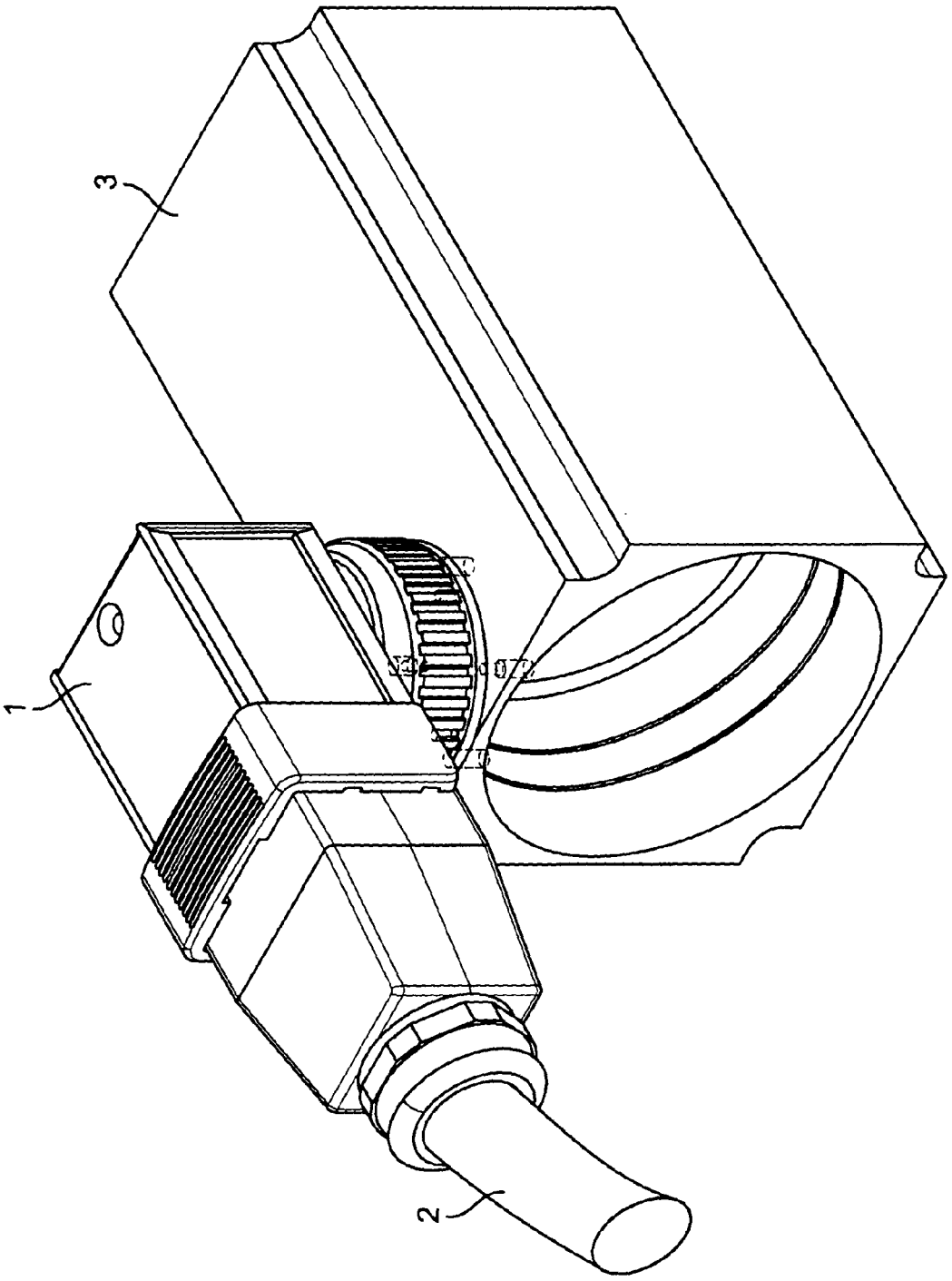

Fig. 1

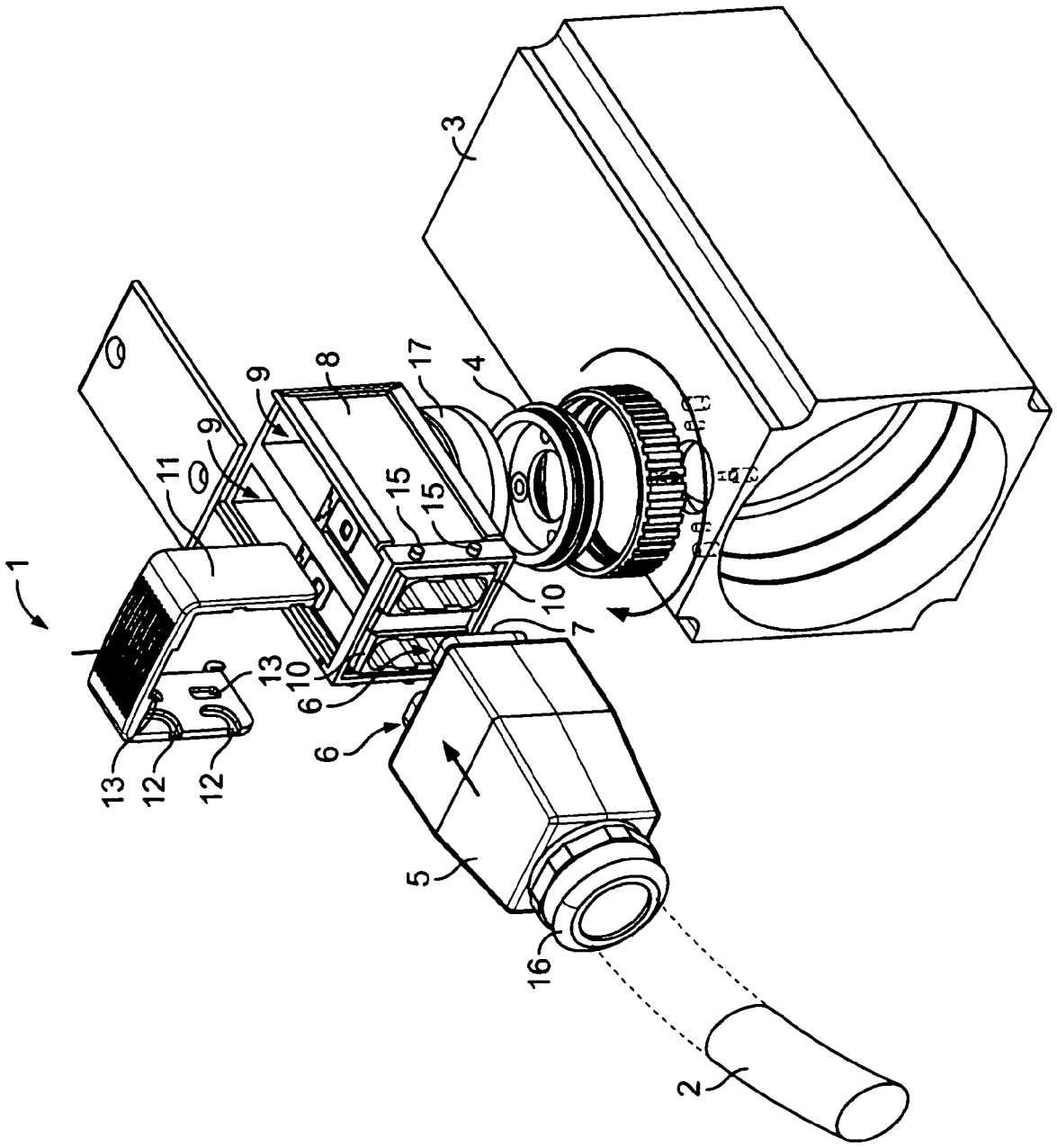

Fig. 2

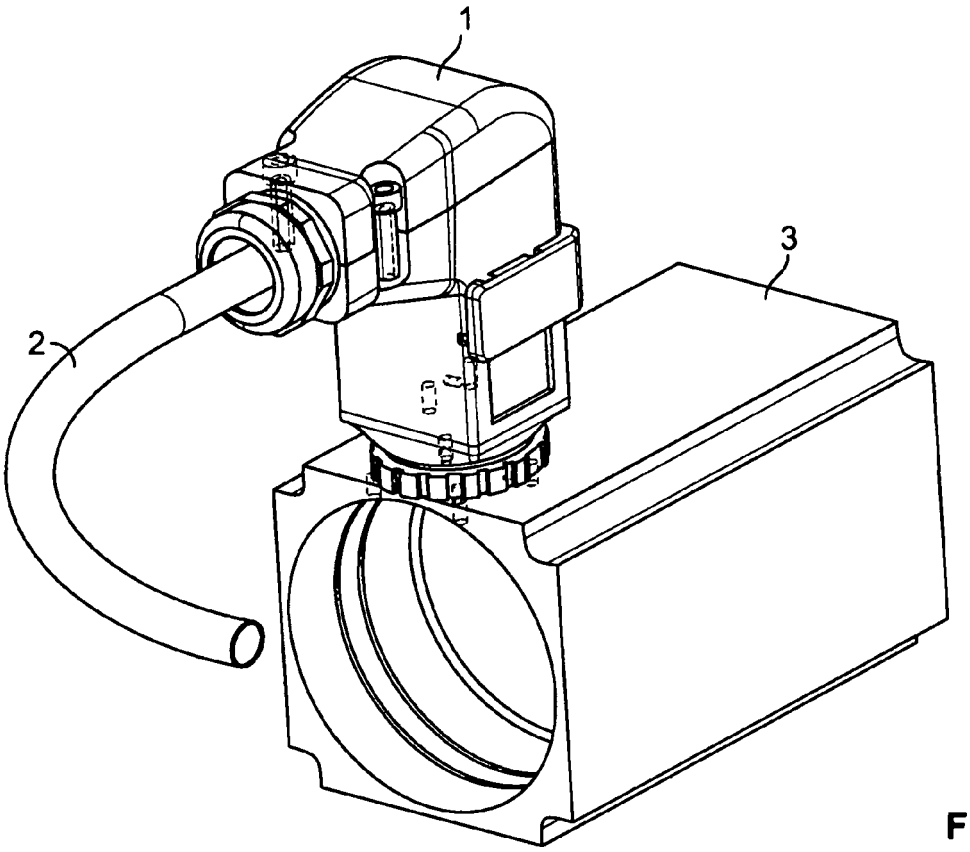

Fig. 3

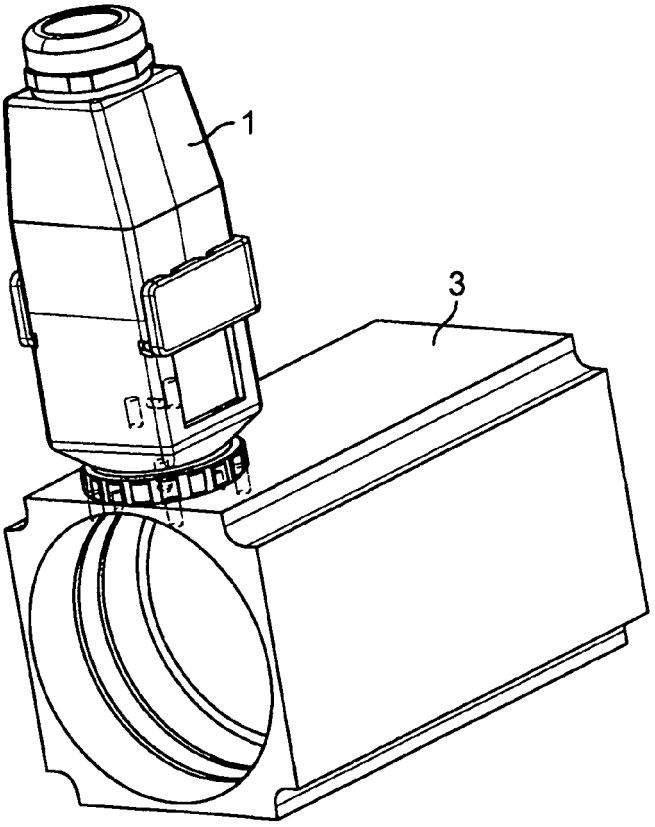

Fig. 5

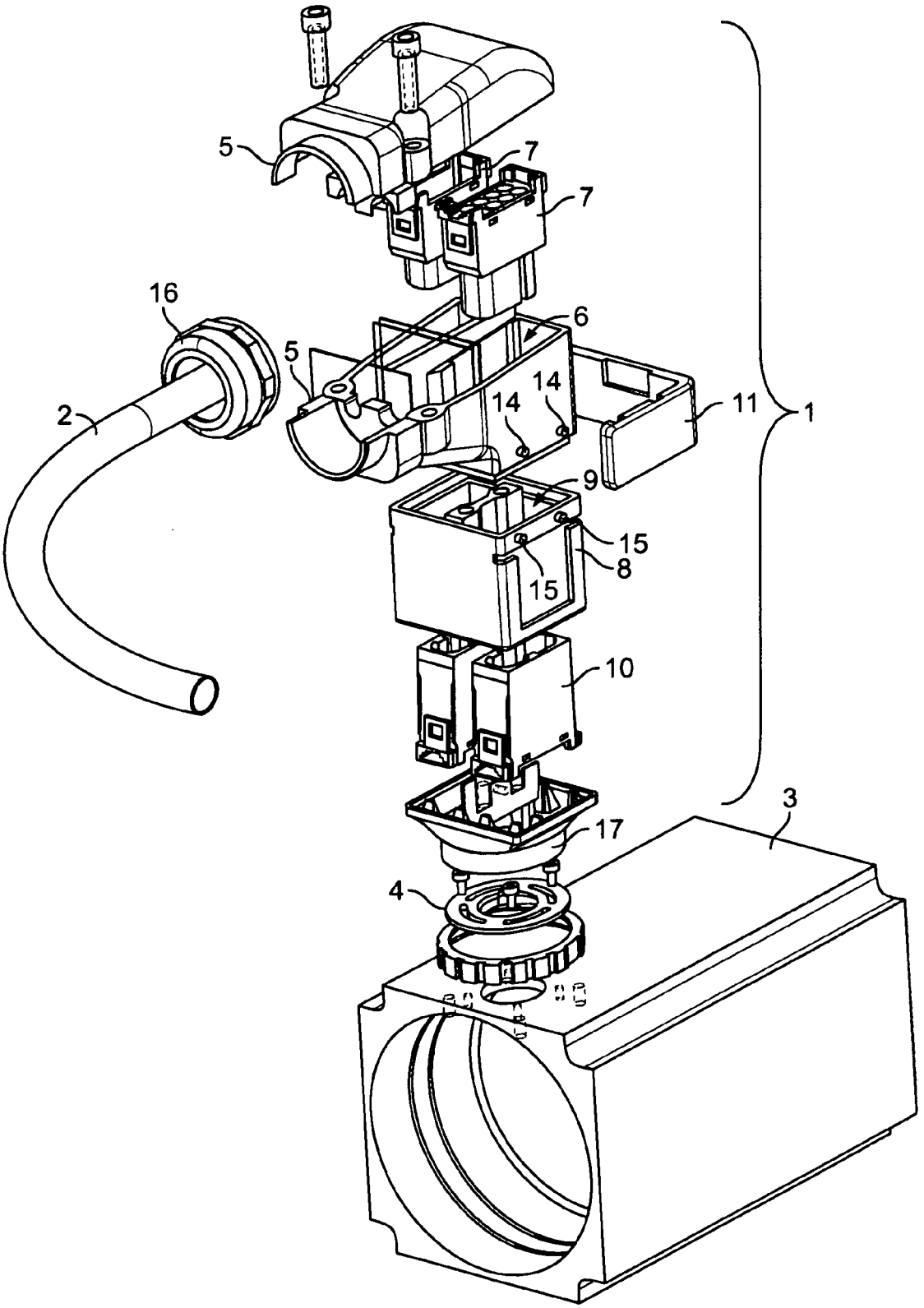

Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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