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

(11) **EP 3 136 511 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
01.03.2017 Bulletin 2017/09

(51) Int Cl.:
H01R 4/30 *(2006.01)* ***H01R 13/44*** *(2006.01)*

(21) Application number: **16185804.8**

(22) Date of filing: **26.08.2016**

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

(30) Priority: **28.08.2015 DE 102015216543**

(71) Applicant: **TE Connectivity Germany GmbH**
64625 Bensheim (DE)

(72) Inventors:
- **ECKEL, Markus**
  68642 Bürstadt (DE)
- **STOKOWSKI, Alexander**
  75443 Ötisheim (DE)
- **KOSMALSKI, Christoph**
  64291 Darmstadt (DE)
- **SPATARU, Florin**
  67547 Worms (DE)

(74) Representative: **Grünecker Patent- und Rechtsanwälte**
PartG mbB
Leopoldstraße 4
80802 München (DE)

(54) **CONTACT ARRANGEMENT, PLUG AND PLUG CONNECTION**

(57) A contact arrangement (1) is shown for a plug (35) for contacting a bus bar (2) with anti-touch protection (3), with an affixing element (22) for securing the contact arrangement (1) at the bus bar (2), and with a contact element (5), having a hole (21) through which the affixing element (22) extends, further comprising a bar-contacting sleeve (29) made of electrically conducting material for directly contacting the bus bar (2), wherein the affixing element (22) extends through the bar-contacting sleeve (29). Between the affixing element (22) and the contact element (5) there is arranged an insulation element (6) which insulates the affixing element (22) from the contact element (5) in order to make the contact arrangement (1) safer. A plug connection (600) according to the invention comprises a plug (35) and a mating plug (500).

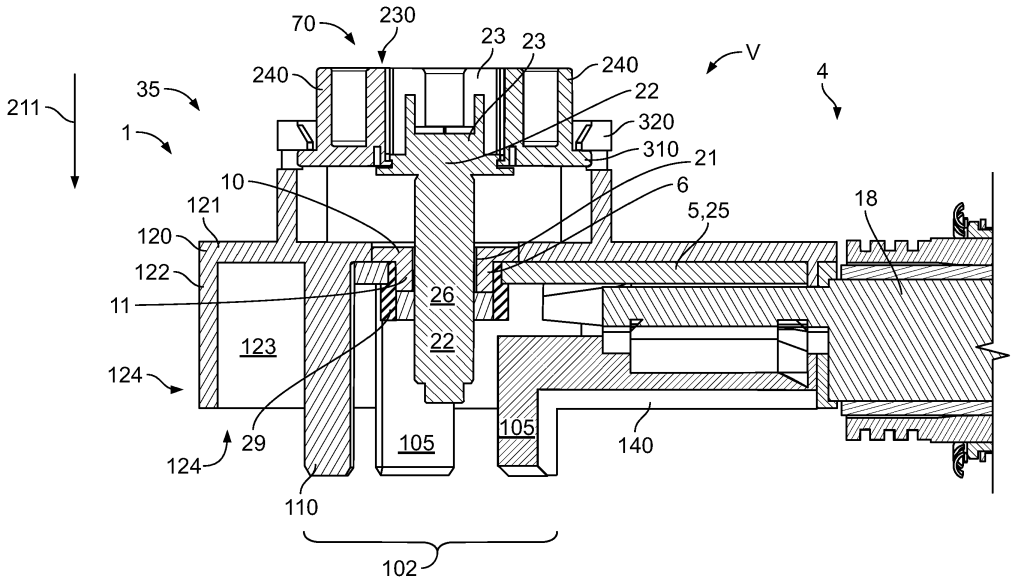

Fig. 2

EP 3 136 511 A2

Description

[0001] The invention relates to a contact arrangement for a plug for contacting a bus bar with anti-touch protection. The invention further relates to a plug with a contact arrangement for a plug connection with a contact arrangement.

[0002] Such contact arrangements usually have an affixing element for securing the contact arrangement to the bus bar, a contact element which has a hole through which the affixing element extends, and a bar-contacting sleeve made of an electrically conductive material for directly contacting the bus bar, wherein the affixing element extends through the bar-contacting sleeve. The bar-contacting sleeve allows the bus bar to be contacted despite the anti-touch protection.

[0003] A disadvantage in the stated contact arrangements is that there is a risk of electric shock for the user in the event of faulty operation

[0004] The problem of the invention is to provide a solution which is safer.

[0005] According to the invention, this is solved in that an insulation element which insulates the affixing element from the contact element is arranged between the affixing element and the contact element.

[0006] In this solution, the affixing element is electrically insulated from the contact element which conducts voltage and current, such that there is no risk of electric shock even if a user touches the affixing element. The solution according to the invention is therefore safe. It offers an anti-touch protection not only at the bus bar, but also on the side of the contact element, such that, in the case of a plug connection according to the invention, there is, overall, a two-sided anti-touch protection.

[0007] A plug according to the invention comprises a contact arrangement according to the invention. A plug connection according to the invention comprises a plug according to the invention and a bus bar which has anti-touch protection.

[0008] The solution according to the invention can be further improved with the following configurations and further developments which are advantageous per se.

[0009] In order to enable safe attachment which is in particular long-term stable and which has a low transition resistance, the bar-contacting sleeve can be pressed into the contact element.

[0010] Furthermore, in one advantageous configuration, the insulation element can be pressed into the bar-contacting sleeve, in order to enable a permanently stable attachment which in particular minimises the risk of loss. Handling can be simplified as a result.

[0011] In order to further improve safety, an actuation section of the affixing element can be electrically insulated. A user or a machine can actuate the affixing element at such an actuation section. The affixing element can be surrounded by insulation material in the actuation section, at least in the regions accessible by the user or a machine. In this case, the insulation material can be configured such that a simple actuation is possible, for example the insulation material can have a tool interface. The insulation material can be configured as a screw head, for instance.

[0012] In one advantageous configuration, the insulation element can form a retainer for the affixing element. Such a retainer can prevent the affixing element from being lost. This simplifies mounting. The retainer can retain the affixing element at least in a friction-locking manner, for example in a premounting position.

[0013] In a further advantageous configuration, the insulation element forms a guide for the affixing element. As a result, it is possible to dispense with further elements such as an additional guide element. A guide can restrict the movability of the affixing element substantially to one dimension. As a result, it is possible to restrict unintentional movement of the affixing element which leads to a possible contact with a current-carrying element. If a guide is also a retainer, the greatest possible safety is obtained as a result, through an extensive restriction of the movement of the affixing element.

[0014] To obtain a good distribution of force, the insulation element can have a support collar for the affixing element. This can distribute the force coming from the affixing element onto a wide surface. This can lead to smaller deformations by the affixing element, in particular in elements with little mechanical stability.

[0015] In a solution which is simple to implement, the affixing element can be a screw with a head and a bolt and the insulation element can have a support for the head and a channel for the bolt. In a simple configuration, such an insulation element can have a double-L-shaped cross-section. A cylindrical section which forms the channel for the bolt can be integral with a disc-shaped section which forms the support for the head.

[0016] In order to enable touching of current-carrying parts, even from one side at which contacting with a plug takes place, the contact arrangement can have a housing part which in a premounting state is open at at least one side, wherein an anti-touch protection finger projects from a housing wall in the direction of the open side. The anti-touch protection finger can prevent the penetration of a test finger which is based on the human finger. Such an anti-touch protection finger, together with other housing parts, in particular housing walls, can form regions in which such a test finger can penetrate only to such a small extent that touching of current-conducting parts is prohibited. For this purpose, the anti-touch protection finger can be kept a certain maximum value away from other housing parts, such as housing walls.

[0017] A plug according to the invention can in particular be an angle plug, i.e. a plug which enables contacting at an angle. A plug according to the invention can furthermore have a housing which receives the contact arrangement, and the housing can permit a further anti-touch protection, for example by apertures present therein permitting protection for a test finger. This can be achieved, for instance, through a maximum allowed size

of apertures.

[0018] In a plug connection according to the invention, the insulation element can be part of a pressing arrangement which presses the bar-contacting sleeve onto the bus bar. It is possible to dispense with further elements which optimise transmission of the pressing force.

[0019] Hereafter, the application will be explained in greater detail using advantageous configurations with reference to the drawings. The features thus shown are each independent of one another and can be combined with one another as desired, as required depending on the application.

[0020] In the drawings:

Fig. 1 shows a schematic perspective view of a plug according to the invention;

Fig. 2 shows a longitudinal section through the plug from Fig. 1;

Fig. 3 shows a schematic perspective view of the plug from Figs. 1 and 2;

Fig. 4 shows a further schematic perspective view of the plug from Figs. 1 to 3;

Fig. 5 shows a further schematic perspective view of the plug from Figs. 1 to 4;

Fig. 6 shows a further schematic perspective view of the plug from Figs. 1 to 5;

Fig. 7 shows a schematic perspective view of a plug connection with the plug from Figs. 1 to 6;

Fig. 8 shows a longitudinal section through the plug connection from Fig. 7;

Fig. 9 shows a further schematic perspective view of the plug connection from Figs. 7 and 8.

[0021] Figs. 1 to 6 show a plug 35 with a contact arrangement 1 in a premounting position V. Figs. 7 to 9 show the plug 35 together with a mating plug 500. These together form a plug connection 600.

[0022] The plug 35 serves to contact a bus bar 2 arranged in the mating plug 500. A conductor 18 of a cable 4 is attached to a contact element 5 of the contact arrangement 1. The contact element 5 is configured in the form of a cable lug 25.

[0023] A bar-contacting sleeve 29 is attached in a hole 21 in the contact element 5. The bar-contacting sleeve 29 is pressed into the contact element 5, such that a good electrical and mechanical connection is produced. With the bar-contacting sleeve 29, an anti-touch protection 3 at the mating plug 500 can be overcome and the bus bar 2 can be contacted. The anti-touch protection 3 comprises an inner anti-touch protection collar 510 and an outer anti-touch protection collar 520, between which a passage 205 is formed into which a test finger cannot advance up to the bus bar 2. The anti-touch protection collars 510, 520 are each configured to be cylindrical.

[0024] An affixing element 22 is present in order to affix the plug 35 to the mating plug 500. The affixing element 22 extends through the hole 21 in the contact element 5. In the mounting position M shown in Figs. 7 to 9, the affixing element 22, which is configured as a screw 220 by way of example, cooperates with a nut 540 which serves as a mating affixing element 550.

[0025] The bar-contacting sleeve 29 is made of electrically conductive material and contacts the bus bar 2 directly. The affixing element 22 extends through the bar-contacting sleeve 29. In the mounting position M, the affixing element 22 also extends through the inner anti-touch protection collar 510 of the anti-touch protection 3 at the mating plug 500.

[0026] An insulation element 6 which insulates the affixing element 22 from the contact element 5 is arranged between the affixing element 22 and the contact element 5. If a user mistakenly touches the affixing element 22 in the premounting position V, then he does not get an electric shock, because the affixing element 22 is insulated from the contact element 5. The insulation element 6 also insulates the affixing element 22 from the bar-contacting sleeve 29.

[0027] The insulation element 6 is pressed into the bar-contacting sleeve 29 such that if cannot be lost.

[0028] The insulation element 6 forms a retainer 10 for the affixing element 22. At the same time it forms a guide 11 for the affixing element 22. The affixing element 22 is guided along a guide direction 211. Within the retainer 10 and the guide 11, the affixing element 22 has little clearance and cannot touch the interior of the bar-contacting sleeve 29, for example, by tilting.

[0029] The insulation element 6 has a support collar 61 for the affixing element 22. This extends laterally away from a channel 66 which acts as a guide 11 and retainer 10 for the bolt 26 of the screw 220, and has the form of a disc with a hole. The support collar 61 forms a support 65 for the head 23 of the screw 220.

[0030] The insulation element 6 is part of a pressing arrangement 560 which in the mounting position M presses the contact element 5 via the bar-contacting sleeve 29 onto the bus bar 2 and as a result produces a good mechanical and electrical contact. The support 65 in the form of the support collar 61 distributes the forces, which arise here, uniformly over a wide surface.

[0031] In the embodiment shown, the screw 220 is also, in the mounting position M, electrically insulated from the conductor 18, since the insulation element 6 and the inner anti-touch protection collar 510, which insulate the screw 220 from the contact element 5, the bar-contacting sleeve 29 and the bus bar 2, are arranged around the screw 220.

[0032] In order to permit even safer operation, for example if the insulation element 6 is not present or should

be defective, an actuation section 70 of the affixing element 22 is electrically insulated at least in the regions accessible by a user. This is achieved by the insulation material 71 being arranged around the head 23 of the screw 220. The insulation material 21 itself again forms a head 23 which has a tool interface 230 for an actuating tool. In the case shown, the tool interface 230 is configured for actuation with a hexagonal socket. A protective ring 240 arranged around the tool interface in particular prevents an actuation with an open-ended wrench.

[0033] The affixing element 22 is undetachably attached to a housing part 120. For this purpose, a protrusion 310 of that part of the head 23 which is made of insulation material 71 projects to the side and cooperates with several engagement hooks 320 at the housing part 121.

[0034] In the premounting position V, the housing part 120 has an open side 124, at which the contacting to the mating plug 500 takes place. In order to prevent contacting with a finger here, an anti-touch protection arrangement 102 is present.

[0035] The anti-touch protection arrangement 102 has anti-touch protection elements 105 in the form of protruding collar elements. Such an anti-touch protection element 105 is also arranged at an additional housing part 140 which can be connected to the housing part 120. Since, in particular, a contacting of the contact element 5 between the affixing element 22 and a front wall 122 spaced apart therefrom would be possible if only the anti-touch protection elements 105 were present, the anti-touch protection 102 further possesses an anti-touch protection finger 110. The anti-touch protection finger 110 projects from a cover wall 121 toward the open side 124. There is not sufficient space between the anti-touch protection finger 110 and the front wall 122, as well as side walls 123, to introduce a test finger up to the contact element 5.

[0036] The shown plug connection 600 has a two-sided anti-touch protection, i.e. on the one hand anti-touch protection at the plug 35, and an anti-touch protection at the mating plug 500 on the other hand.

Reference Signs

[0037]

1	contact arrangement
2	bus bar
3	anti-touch protection
4	cable
5	contact element
6	insulation element
10	retainer
11	guide
18	electrical conductor
21	hole in the contact element
22	affixing element
23	head
24	head support surface
25	cable lug
26	bolt
29	bar-contacting sleeve
35	plug
61	support collar
65	support
66	channel
70	actuation section
71	insulation material
102	anti-touch protection arrangement
105	anti-touch protection element
110	anti-touch protection finger
120	housing part
121	cover wall
122	front wall
123	side wall
124	open side
140	housing part
205	passage
211	guide direction
220	screw
230	tool interface
240	protective ring
310	protrusion
320	engagement hook
500	mating plug
510	inner anti-touch protection collar
520	outer anti-touch protection collar
540	nut
550	mating affixing element
600	plug connection
M	mounting position
V	premounting position

Claims

1. A contact arrangement (1) for a plug (35) for contacting a bus bar (2) with anti-touch protection (3), with an affixing element (22) for securing the contact arrangement (1) at the bus bar (2), and with a contact element (5), having a hole (21) through which the affixing element (22) extends, further comprising a bar-contacting sleeve (29) made of electrically conducting material for directly contacting the bus bar (2), wherein the affixing element (22) extends through the bar-contacting sleeve (29), **characterised in that** between the affixing element (22) and the contact element (5) there is arranged an insulation element (6) which insulates the affixing element (22) from the contact element (5).

2. A contact arrangement (1) according to Claim 1, **characterised in that** the bar-contacting sleeve (29) is pressed into the contact element (5).

3. The contact arrangement (1) according to any one

of Claims 1 or 2, **characterised in that** the insulation element (6) is pressed into the bar-contacting sleeve (29).

4. The contact arrangement (1) according to any one of Claims 1 to 3, **characterised in that** an actuation section (70) of the affixing element (22) is electrically insulated.

5. The contact arrangement (1) according to any one of Claims 1 to 4, **characterised in that** the insulation element (6) forms a retainer (10) for the affixing element (22).

6. The contact arrangement (1) according to any one of Claims 1 to 5, **characterised in that** the insulation element (6) forms a guide (11) for the affixing element (22).

7. The contact arrangement (1) according to any one of Claims 1 to 6, **characterised in that** the insulation element (6) has a support collar (61) for the affixing element (22).

8. The contact arrangement (1) according to any one of Claims 1 to 7, **characterised in that** the affixing element (22) is a screw (220) with a head (23) and a bolt (26) and the insulation element (6) has a support (65) for the head (23) and a channel (66) for the bolt (26).

9. The contact arrangement (1) according to any one of Claims 1 to 8, **characterised in that** the contact arrangement (1) has a housing part (120) which, in a premounting state (V), is open at at least one side (124), wherein an anti-touch protection finger (110) protrudes from a housing wall (121) in the direction of the open side (124).

10. A plug (35), in particular an angle plug, with a contact element (5), which can be affixed to an electrical line (18), and with a housing (120,140) which receives a contact arrangement (1), **characterised in that** the contact arrangement (1) is configured according to any one of Claims 1 to 9.

11. A plug connection (600) with a bus bar (2) which has anti-touch protection, and with a plug (35), **characterised in that** the plug (35) has a contact arrangement (1) according to any one of Claims 1 to 9.

12. The plug connection (600) according to Claim 11, **characterised in that** the insulation element (6) is part of a pressing arrangement which presses the bar-contacting sleeve (29) onto the bus bar (2).

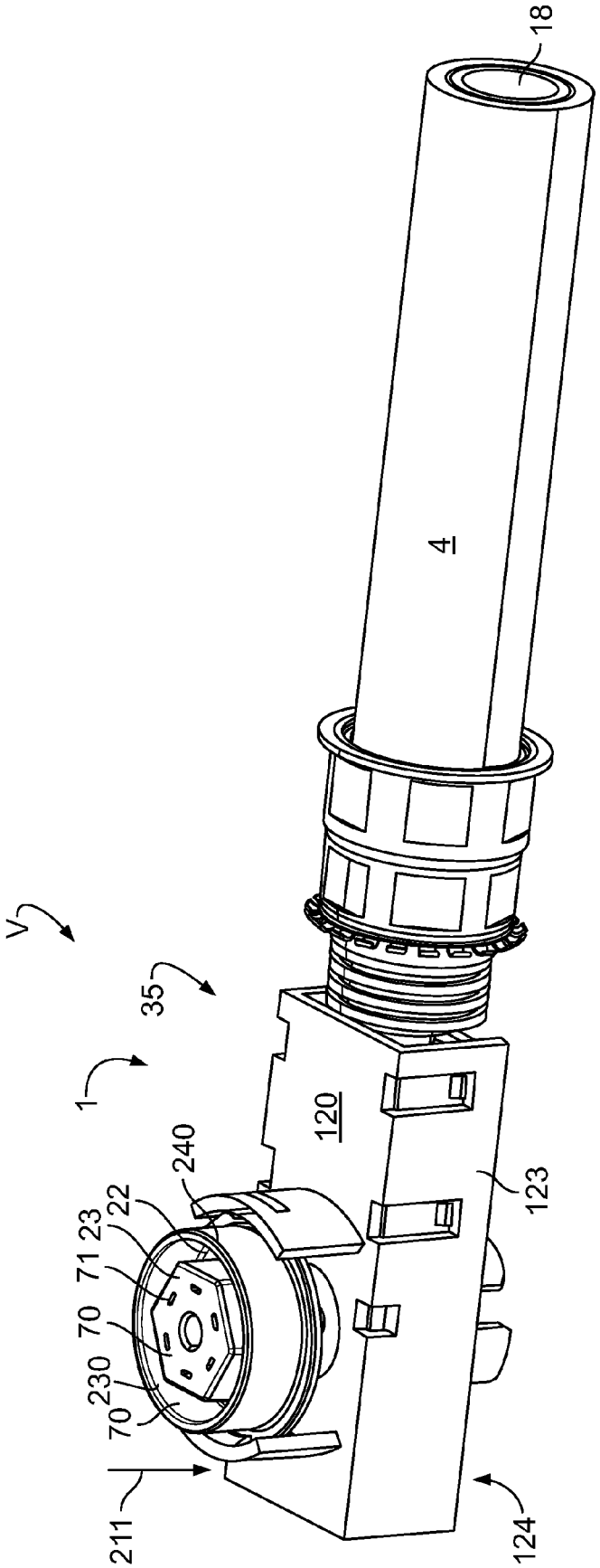

Fig. 1

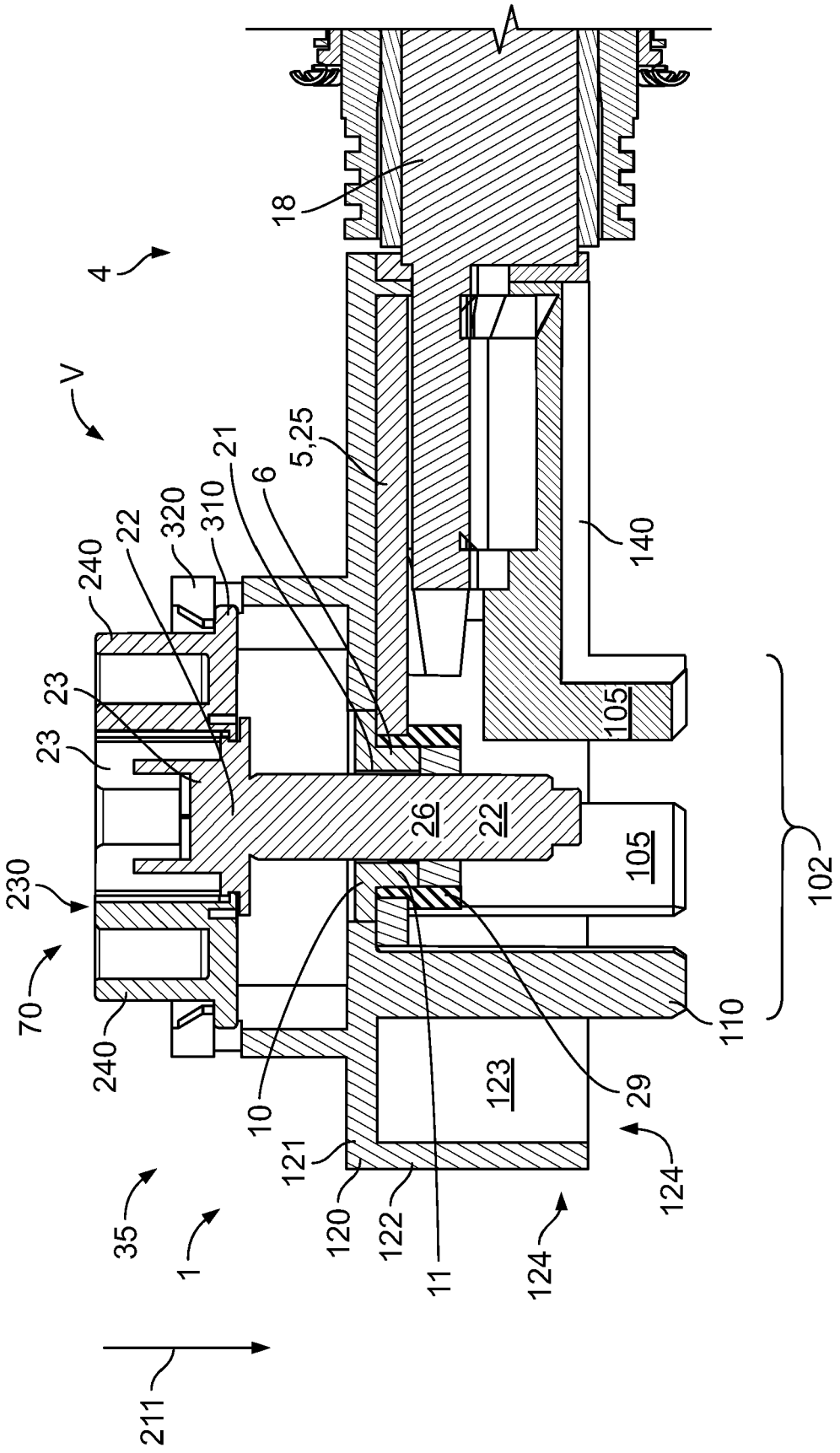
18
4
V
5,25
21
6
310
320
22
240
140
23
23
105
26
22
105
230
102
70
240
110
10
123
29
121
124
120
122
35
1
11
124
211

Fig. 2

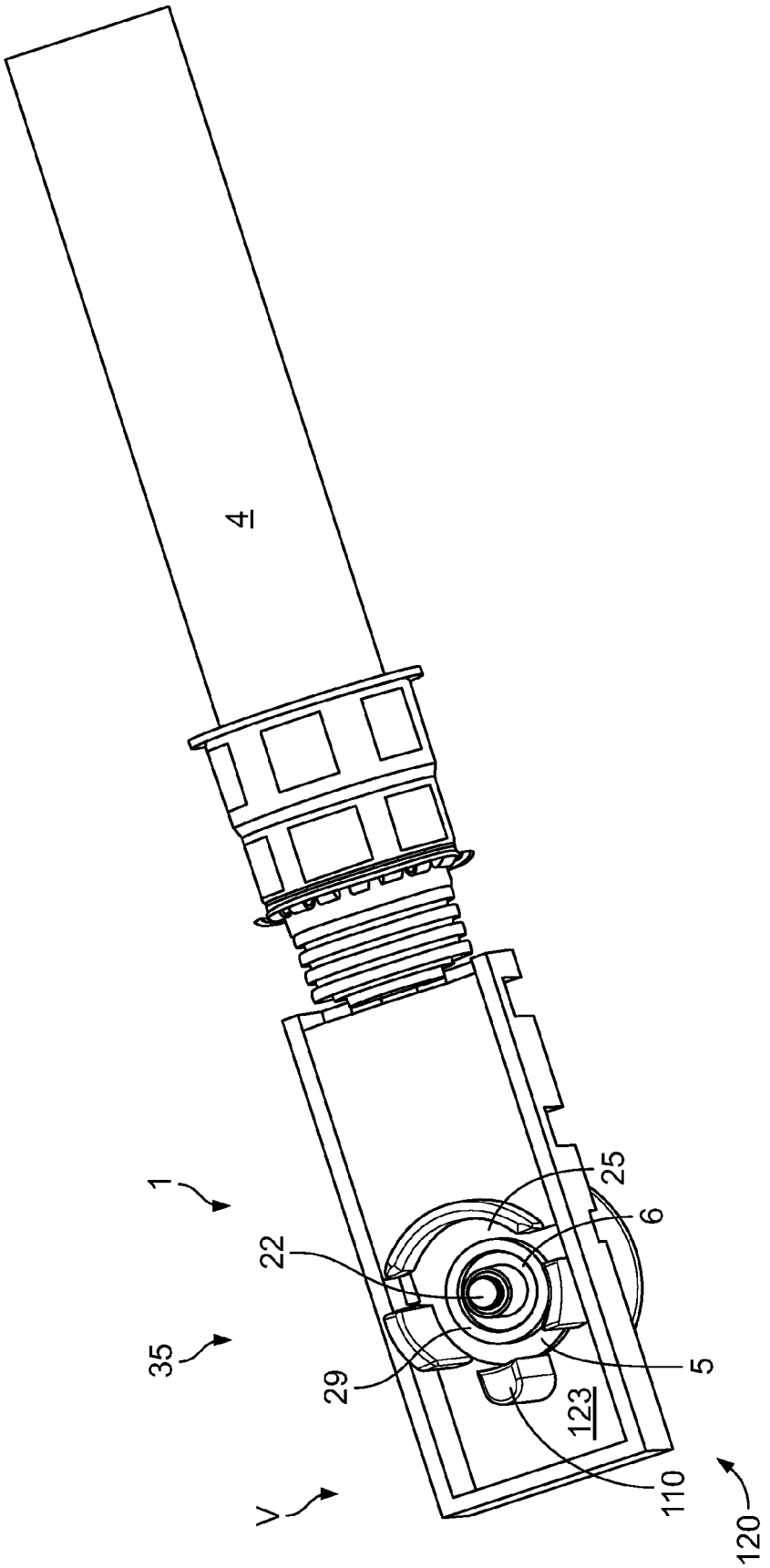

Fig. 3

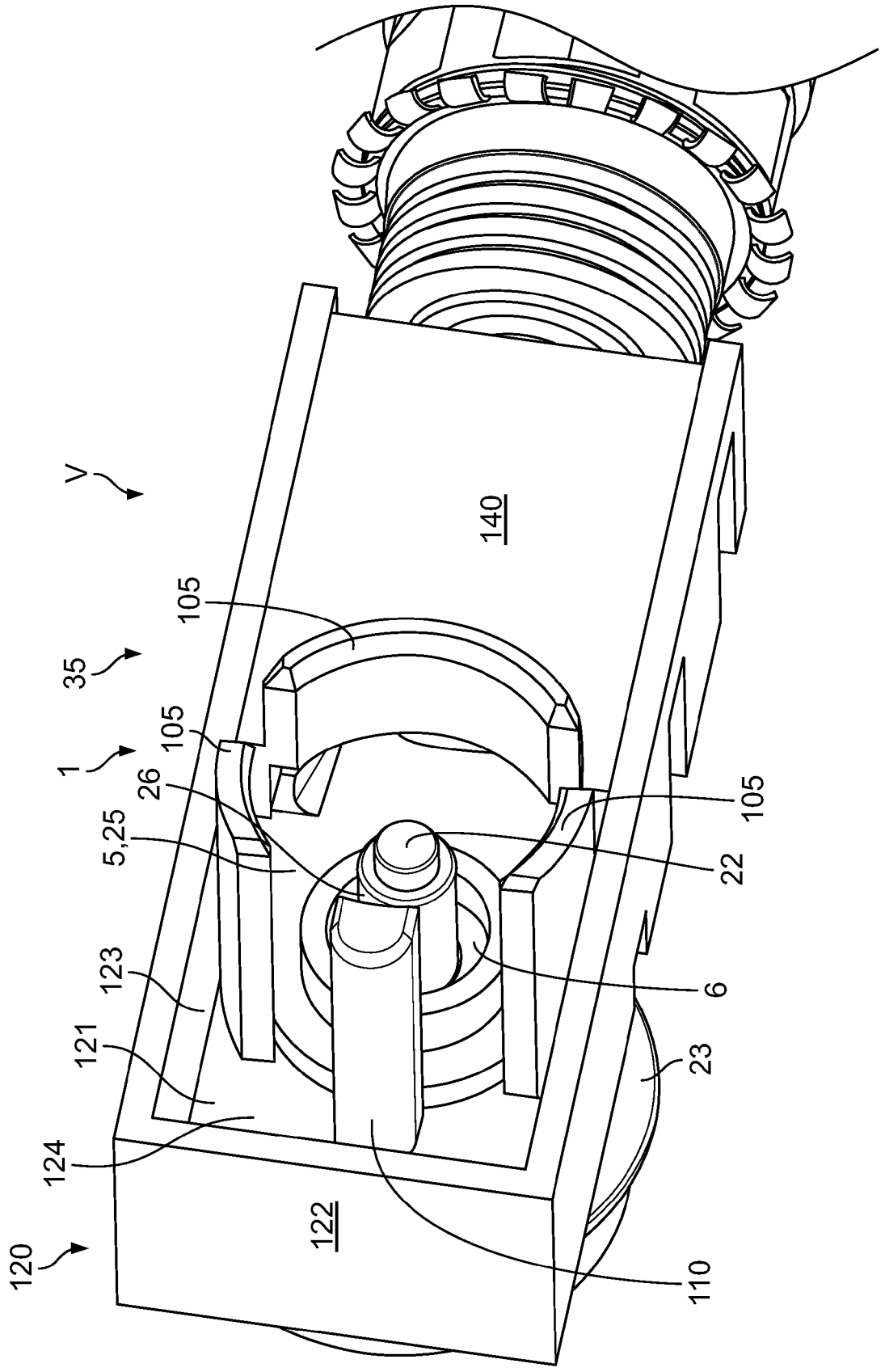

Fig. 4

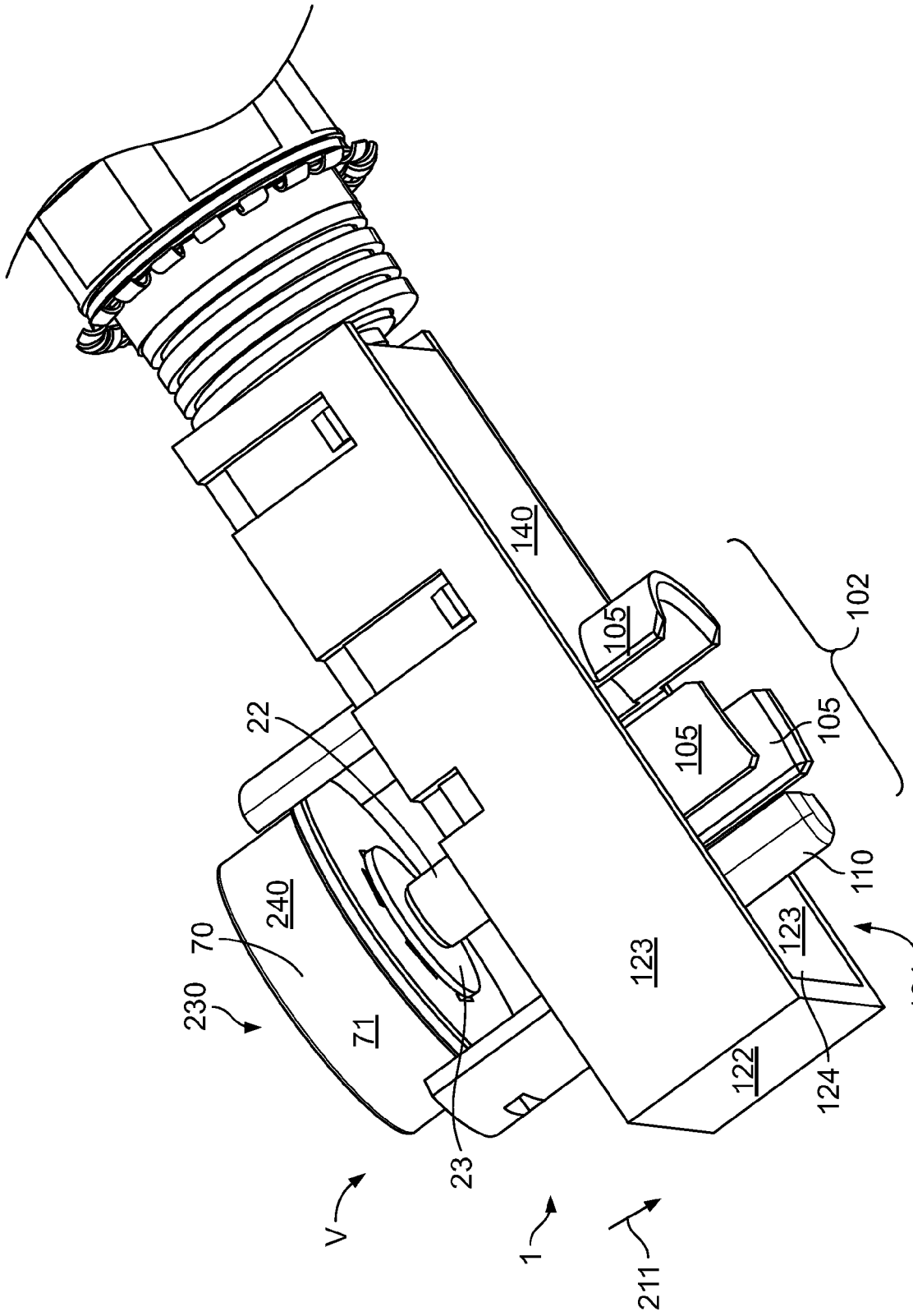
140
105
102
105
105
22
110
240
70
123
123
230
71
124
122
124
23
V
1
211

Fig. 5

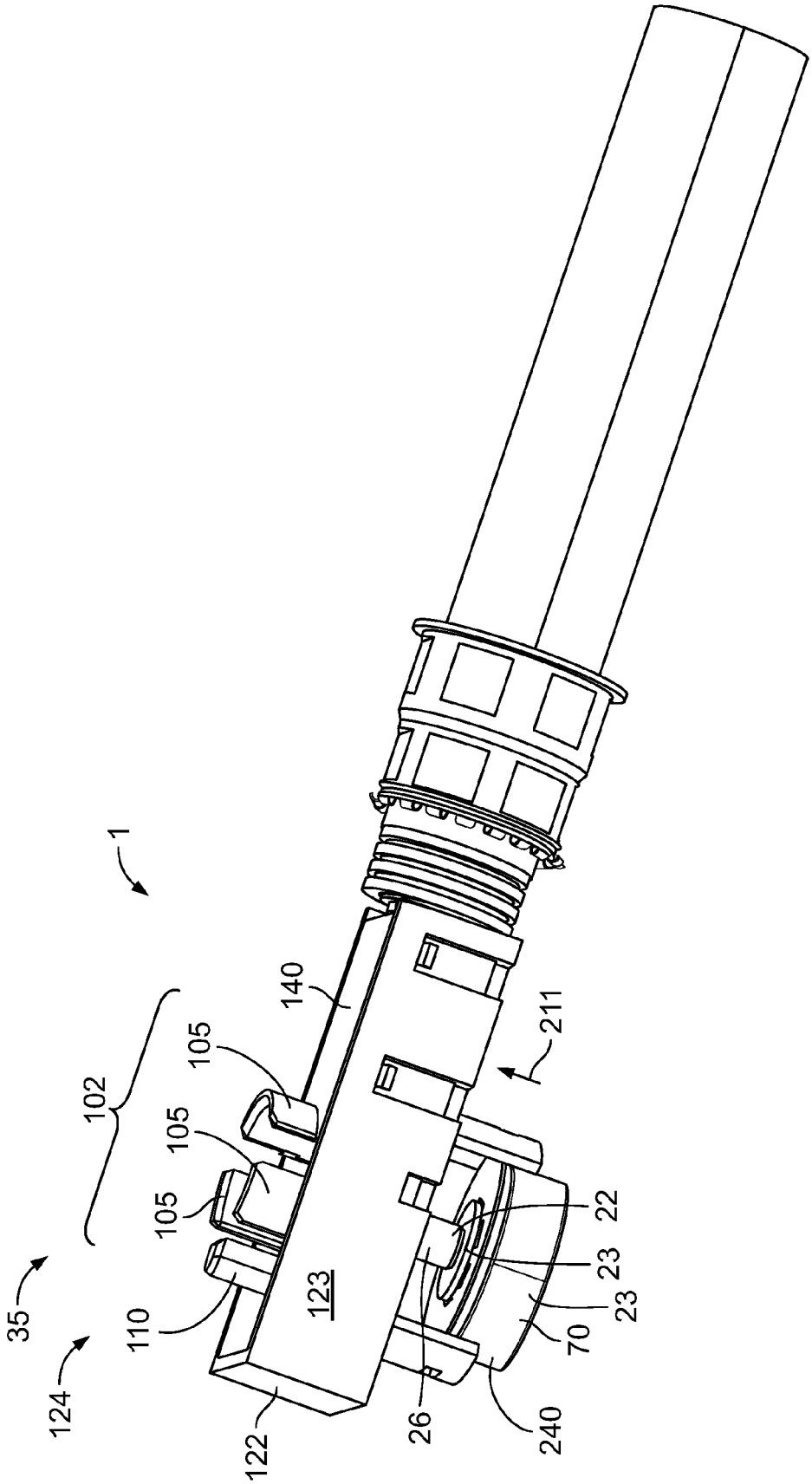

Fig. 6

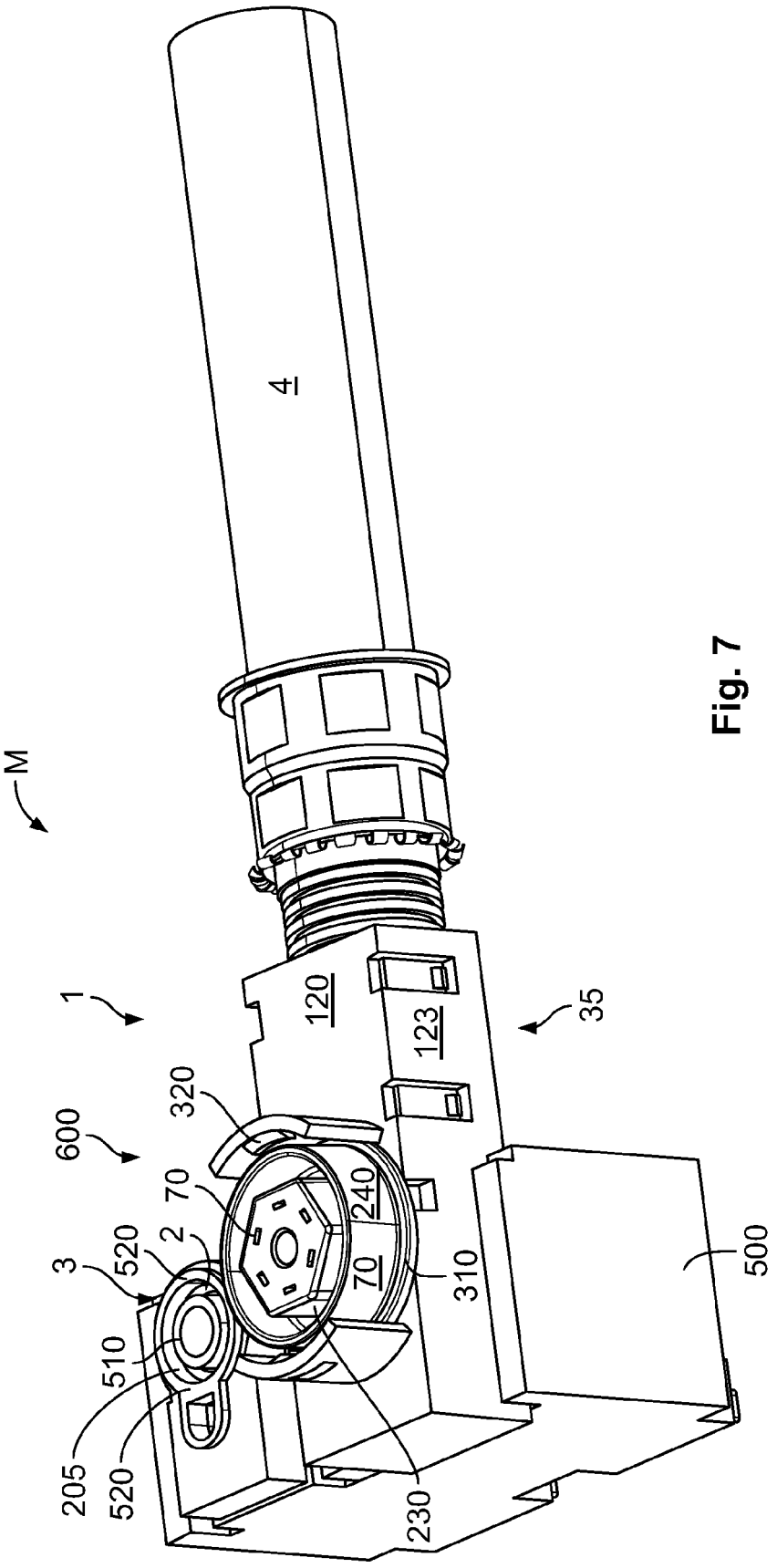

Fig. 7

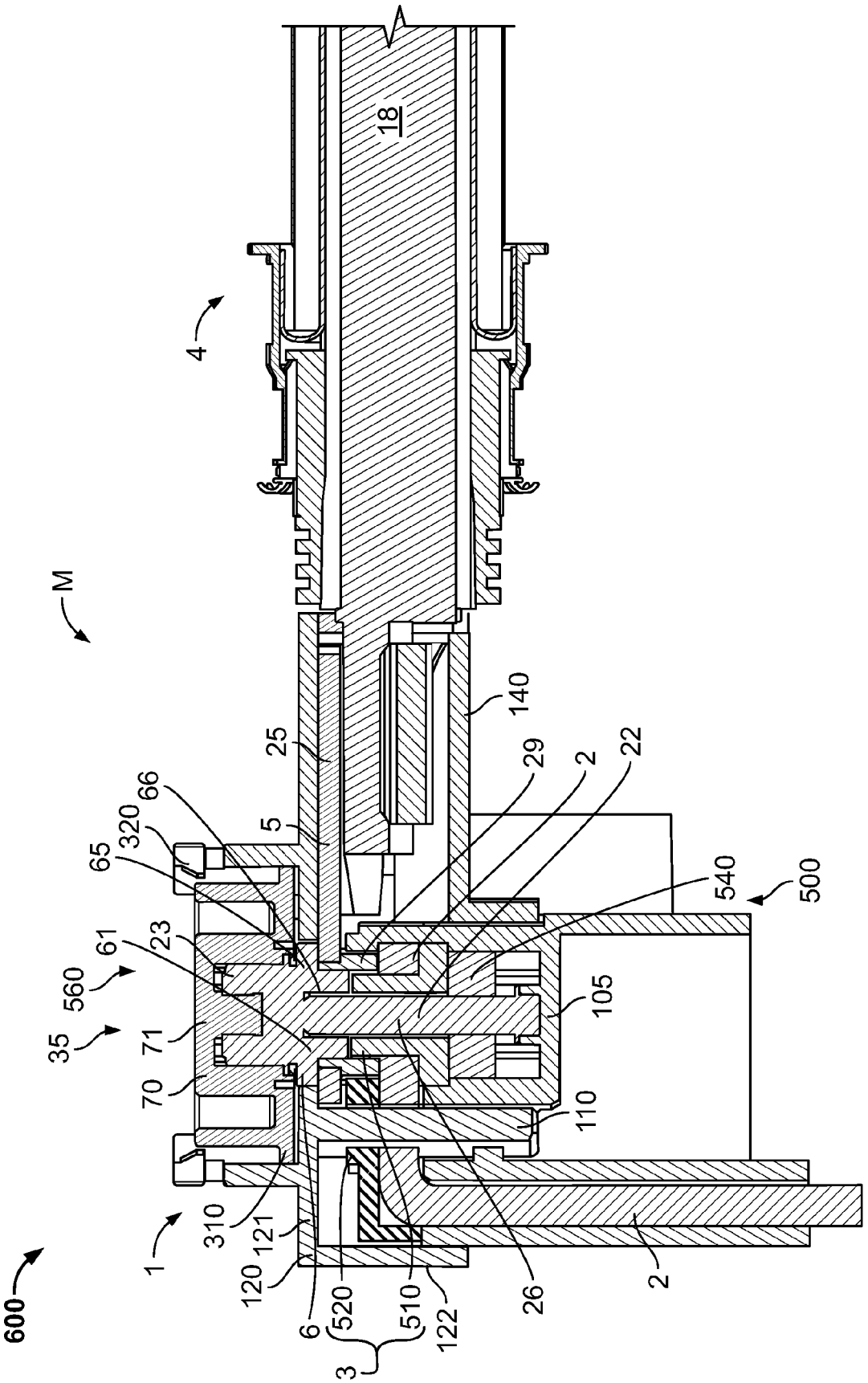
600
1
310
121
120
6
520
510
122
3
26
2
110
105
500
540
140
25
5
66
320
65
61
23
560
35
71
70
M
4
18
29
2
22

Fig. 8

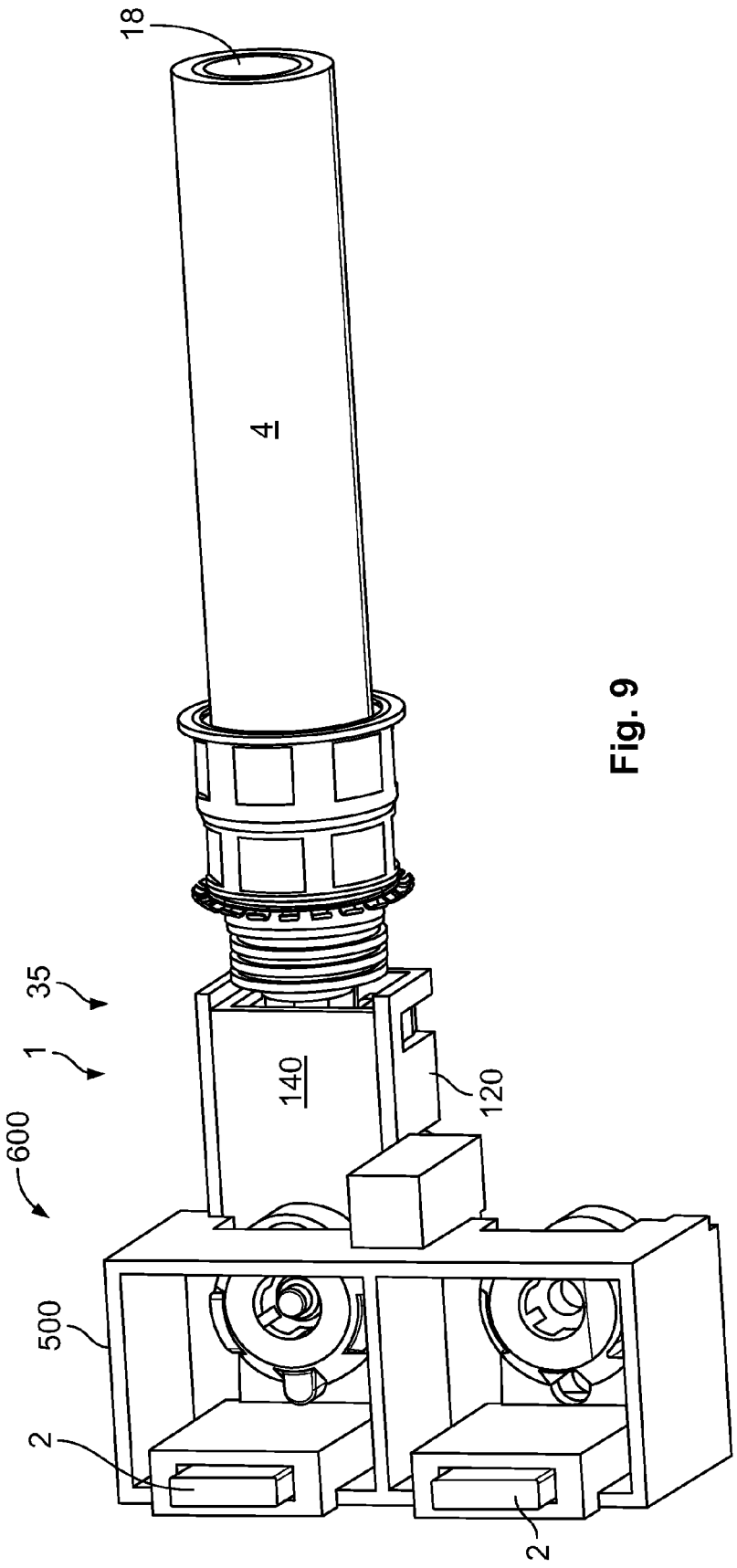

Fig. 9