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(54) **Workpiece carrier device**

(57) The invention relates to a workpiece carrier device for the production of connectors and/or cables having connectors. The object of the present invention is to make the production of connectors and/or cables having connectors less time and cost intensive and to reduce the percentage of deficient products. The object is solved by providing a workpiece carrier device (1) comprising: a machine adapter part (2) having a housing (3) adapted to mate with workpiece holders of at least two production modules; and a connector adapter part (5) located at a forward end (6) of the housing adapted to hold and position a connector workpiece (4) from which the connectors are produced.

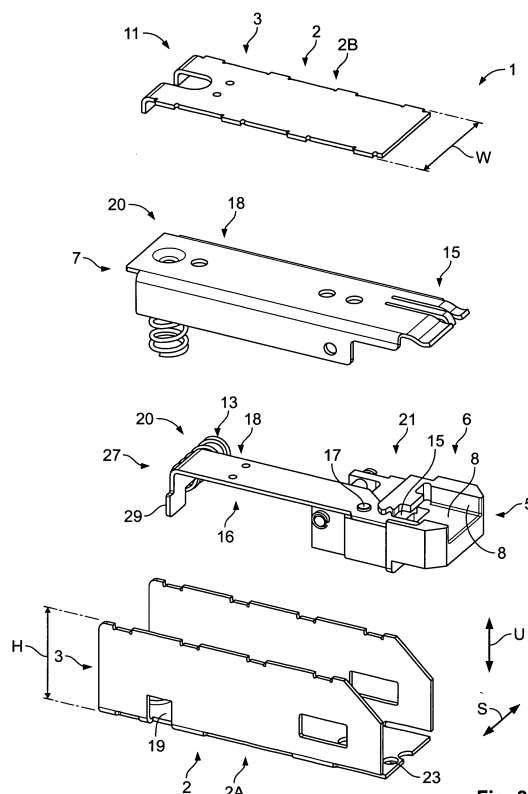


Fig. 3

Description

[0001] The invention relates to a workpiece carrier device for the production of connectors and/or cables having connectors from connector workpieces. When a connector or a cable having a connector is produced, the production usually includes a plurality of production steps carried out by at least two different production modules which work on the connector workpieces. Such a workpiece could be half finished. It could be plastic piece created by moulding and having electrical contacts in it already. For example, electrical conductors could then be soldered to the connector workpiece, shieldings could be attached or parts of the connector workpiece could be over-moulded. In each step, the connector workpiece grows and after the final production step the connector is completed. Each of the production steps requires that the connector workpiece is positioned and aligned in the respective production module. This is time and cost intensive. Further, the connector workpieces can be damaged during each of the positioning and alignment steps. This problem is in particular important for small connectors like HDMI or micro-USB connectors.

[0002] The object of the present invention is to make the production of connectors and/or cables having connectors less time and cost intensive and to reduce the percentage of deficient products.

[0003] The object is solved by providing a workpiece carrier device comprising: a machine adapter part having a housing adapted to mate with workpiece holders of the at least two production modules; and a connector adapter part located at a forward end of the housing adapted to hold and position a connector workpiece.

[0004] The solution according to the invention has the advantage that the connector workpiece has to be attached to the workpiece carrier device only once. Different production steps can be carried out in the at least two production modules on the connector workpiece without further positioning and aligning. This makes the production process less time and cost intensive and further reduces the risk of damage.

[0005] The solution according to the invention may be combined as desired with the following further advantageous improvements.

[0006] The connector adapter part can, at least partially, be shaped complementary to the connector workpiece. Such a design makes the positioning easier and reduces the risk of damage even further.

[0007] The connector adapter part can be configured to be detachable from the machine adapter part. This design makes the production even more time- and cost-efficient as different connector adapter parts can be attached to one machine adapter part. Accordingly, only the connector adapter part has to be changed when a different connector is produced. Preferably, the connector adapter part is repeatedly attachable to and detachable from the machine adapter part. In a preferred embodiment, no tools or only simple tools are necessary for

attaching the connector adapter part to or detaching the connector adapter part from the machine adapter part. For example, the connector adapter part could be attached to the machine adapter part by a spring-loaded latching mechanism that automatically engages a counter part when the connector adapter part is attached to the machine adapter part. The connector adapter part could then for example be detached by deflecting the latching mechanism.

[0008] As it is in many cases necessary to precisely position the connector workpiece, the workpiece carrier device can comprise at least one positioning mechanism for positioning the connector workpiece, the positioning mechanism comprising a pushing element adapted to push the connector workpiece in a direction towards a limit stop. The limit stop can have a fixed position relative to the rest of the workpiece carrier device so that, when the connector workpiece is pushed against the limit stop, the position of the connector workpiece relative to the workpiece carrier device and thus the position in the production module is fixed. The limit stop can for example be located on the connector adapter part, which can in turn be fixed relative to the machine adapter part. Further positioning and/or alignment steps during the production can thus be avoided, at least in the direction in which the positioning mechanism acts. The pushing element can, for example, be an element that is spring-loaded or the pushing element can itself be designed as a spring, e.g. a leaf spring. The pushing element could also be designed without a spring or an elastic element. It could, for example, be operated manually or by a machine part and only position the carrier workpiece when it is necessary to position the connector workpiece.

[0009] The positioning mechanism can be attachable to and detachable from the connector adapter part. The positioning mechanism can be adapted to be used with different connector adapter parts. In an alternative, the positioning mechanism is designed to match only one connector adapter part. If the connector adapter part is detachable from the machine adapter part, the positioning mechanism can also be detachable together with the connector adapter part.

[0010] The positioning mechanism can extend into a rearward end of the housing. The rearward end of the housing can be opposite the forward end of the housing. The positioning mechanism can extend over the entire length of the workpiece carrier device from the forward end to the rearward end. In such a configuration, one end of the positioning mechanism can serve to be actuated upon, whereas the other end serves to act upon the connector workpiece. The fact that the positioning mechanism extends from one end of the housing to the other end of the housing provides a clear separation between the part that is acted upon and the part that acts.

[0011] The positioning mechanism can have a force contact point at which a force is applicable to the positioning mechanism from outside the housing and the force contact point can be located in the rearward end of

the housing. In this design, the rearward end is designed to be the part where actuations from the machine are received in the workpiece carrier device and the forward end is the end where the workpiece carrier device acts on the connector workpiece.

[0012] The workpiece carrier device can comprise at least two positioning mechanisms for positioning the connector workpiece in at least two dimensions or directions. Each of the positioning mechanisms can be independent from the other mechanism or mechanisms. The at least two positioning mechanisms preferably act in at least two directions that are perpendicular to each other. This decouples one positioning process from the other and makes it easier to position the connector workpiece.

[0013] When there are two or more positioning mechanisms, at least one of the positioning mechanisms can provide a locking mechanism for locking the other positioning mechanism. It can, for example, lock the other positioning mechanism in a release state or in a positioning state. In order to position the connector workpiece, a first positioning mechanism can position the connector workpiece in a first direction. Subsequently, a second positioning mechanism can position the connector workpiece in a second direction and, at the same time, lock the first positioning mechanism.

[0014] In a preferred embodiment, at least one of the positioning mechanisms is biased towards an adjustment state in which the pushing element pushes the connector workpiece against the limit stop. Thereby, the connector workpiece can automatically be positioned in the correct position without further actions from an operator or a machine. In order to insert the connector workpiece, the positioning mechanism can be operated manually or by a machine part against the biasing. Once the connector workpiece is inserted, the manual operation can stop and the positioning mechanism automatically positions the connector workpiece in the correct position by pushing it against the limit stop. The biasing can, for example, be achieved by a spring, an elastic element or the like.

[0015] At least one of the positioning mechanisms can comprise a pivotable lever, the lever having a connector section adapted to contact the connector workpiece, an axis located on the connector adapter part of the workpiece carrier device, and an operator section opposite the connector section adapted to be operated from outside the housing. The operator section can, for example, be located in a rearward end of the housing, which can be the part that is designed to receive actuation actions from outside, e.g. from the production module. The pivotable lever can transfer the actuation actions from the rearward end to the forward end. The axis that is located between the connector section and the operator section can act to change the direction of the actuation action. For example, it can be designed such that, when the actuation action in the rearward end is directed downwards, the movement of the lever in the connector section is upward. As the pivotable lever is usually supported at the axis, the axis is preferably located at the connector adapter

part, in order to allow a better control of the movement of the positioning mechanism.

[0016] The workpiece carrier device can comprise a handling section which is accessible from outside for receiving actuation actions applied for example by the production module to the workpiece carrier device, and an actuation section for acting on the connector workpiece, wherein the actuation actions are transmitted from the handling section to the actuation section by a downscaling mechanism, minimizing the amplitude of the actuation action, preferably by a factor of at least 2. The downscaling mechanism receives the actuation actions in the handling section. These actuations actions are often performed with a large amplitude. As the connectors to be produced are in many cases small, the amplitude of the movements acting on the connector workpiece have to be small. The downscaling mechanism reduces the amplitude of the movement. This can, for example, be done by a lever that is pivotable about an axis. The actuation action coming from the production module is for example applied at a long distance away from the axis. The distance between the axis and the part in the actuation section can in turn be very short. Due to the different distances, the amplitude of the movement is minimised or reduced by the downscaling mechanism.

[0017] In a preferred embodiment, the downscaling mechanism is formed by the positioning mechanism described above, which comprises a pivotable lever, the lever having a connector section adapted to contact the connector workpiece, an axis located on the connector adapter part of the workpiece carrier device, and an operator section opposite the connector section adapted to be operated from outside the housing. The operator section can, for example, be long and located in the rearward end of the housing; the connector section can be short and located in the forward end of the housing.

[0018] The workpiece carrier device can comprise a handling section receiving actuation actions applied to the workpiece carrier device and an actuation section for acting on the connector workpiece, wherein the handling section can be located at the rearward end of the workpiece carrier device and the actuation section can be located at the forward end of the workpiece carrier device.

[0019] The workpiece carrier device is designed to hold the connector workpiece. However, in order to prevent the connector from sliding or falling out of the workpiece carrier device, the workpiece carrier device can comprise at least one positive locking element locking the connector workpiece in at least one direction, preferably in two or three directions that are perpendicular to each other. Such a positive locking element could for example engage with a recess or hole in the connector workpiece. The positive locking can be independent from other elements of the workpiece carrier device.

[0020] In a preferred embodiment, the positive locking element is arranged on a positioning mechanism. It can be configured to act together and/or simultaneously with the positioning mechanism. This can in particular pro-

ceed automatically, for example if the positioning mechanism is biased. The biasing can then also act on the positive locking element and automatically lock the connector workpiece. In such a configuration, only one single action can be necessary for releasing the connector workpiece from the positioning mechanism and from the positive locking element. The positive locking element and the positioning mechanism can be formed in one piece, for example as a metal sheet that acts as a positioning mechanism and that has one section for locking.

[0021] A workpiece carrier device preferably has a housing that is substantially closed. This makes handling easier and prevents the workpiece carrier device from getting stuck when it is transferred from one production module to another production module. However, certain parts should be accessible from outside, e.g. force contact points or receiving sections at which actuation actions are received from the machine.

[0022] In order to allow that the housing can be mounted in different positions, the housing can be designed symmetrically, for example with a discrete rotational symmetry. For example, the housing height can have the same value as the housing width. Thus, if the production process requires different relative positions of the connector workpiece and a part of the production modules, the two different relative positions can be achieved by rotating the housing instead of rotating a part of the production module.

[0023] The machine adapter part can substantially be made up by a folded metal sheet. A first metal sheet could be for example form a bottom and two side elements of the machine adapter part. A fourth side can be formed by a second metal sheet that is attached to the first metal sheet for example by welding, clinching or the like.

[0024] The connector adapter part can substantially be made up by a metal piece, preferentially by an injection-moulded metal piece. An injection-moulded metal piece can be produced with low production costs.

[0025] If the connector adapter part is detachable, different connector adapter parts can be attached to the machine adapter part. Accordingly, a kit for workpiece carrier devices for the production of connectors and/or cables having connectors can comprise a machine adapter part adapted to mate with at least two workpiece holders in two different production modules of two production steps and at least two connector adapter parts for different connectors adapted to hold at least a connector workpiece when it is processed.

[0026] The kit according to the invention can also comprise two positioning mechanisms for positioning the connector workpiece, each positioning mechanism comprising a pushing element adapted to push the connector workpiece in the direction towards a limit stop, wherein each positioning mechanism is adapted to mate with one of the at least two connector adapter parts.

[0027] The solution according to the invention also includes a method of producing a connector or a cable with a connector, wherein the method comprises at least two

production steps carried out in at least two different production modules, and wherein a connector workpiece is held by the same workpiece carrier device when it is processed in the two different production modules.

[0028] The invention will be described hereinafter in greater detail and in an exemplary manner using advantageous embodiments and with reference to the drawings. The described embodiments are only possible configurations in which, however, the individual features as described above can be provided independently of one another or can be omitted:

[0029] In the drawings:

Fig. 1 shows a schematic perspective view of a first embodiment of a workpiece carrier device according to the invention;

Fig. 2 shows a schematic perspective view of the workpiece carrier device of Fig. 1 from behind;

Fig. 3 shows a schematic perspective exploded view of the workpiece carrier device of Figs. 1 and 2;

Fig. 4 shows a schematic perspective view of a second embodiment of workpiece carrier device according to the invention;

Fig. 5 shows a schematic perspective view of the workpiece carrier device of Fig. 4 from behind;

Fig. 6 shows a schematic perspective view of a third embodiment of a workpiece carrier device according to the invention;

Fig. 7 shows a schematic perspective view of the workpiece carrier device of Fig. 6 from behind;

Fig. 8 shows a schematic perspective view of a fourth embodiment of a workpiece carrier device according to the invention.

[0030] In Fig. 1, a first embodiment of a workpiece carrier device 1 for the production of connectors and/or cables having connectors from connector workpieces 4 is depicted. The workpiece carrier device 1 can be used in at least two different production modules for at least two different production steps. To achieve this, the workpiece carrier device 1 comprises a machine adapter part 2 having a housing 3, which is adapted to mate with workpiece holders of the at least two production modules. In order to hold and position a connector workpiece 4, the workpiece carrier device 1 comprises a connector adapter part 5 which is located at a forward end 6 of the housing 3.

[0031] The workpiece carrier device 1 according to Fig. 1 can be inserted into different production modules for different production steps. For example, electrical conductors could be soldered to the connector workpiece 4, shieldings could be attached or the connector workpiece

4 could, at least partially, be over-moulded in different production modules. During each of these steps, the connector workpiece 4 is held by the workpiece carrier device 1. To achieve a good match and to further reduce the risk of damage, the connector adapter part 5 is partially complementary to the connector workpiece 4. In an alternative, the connector adapter part 5 could have a more generic design that allows it to mate with several different connector workpieces 4.

[0032] The connector workpiece 4 is held by being pushed downwards by a first positioning mechanism 7. Thereby, the connector workpiece 4 is not only positioned in the up-down direction by being pushed onto a limit stop 8 of the connector adapter part 5, but rather, at the same time, it is also held in the connector adapter 5 by the force that the first positioning mechanism 7 exerts onto the connector workpiece 4.

[0033] On the first positioning mechanism 7, a positive locking element 9 is provided in the form of a finger or latch that engages with a recess 10 of the connector workpiece 4. The positive locking element 9 therefore prevents the connector workpiece 4 from being separated from the workpiece carrier device 1, in particular in a length direction L of the workpiece carrier device 1. The positive locking element 9 would also avoid that the connector workpiece 4 can be removed sideways. However, the movement of the connector workpiece 4 is limited by two limit stops of the connector adapter part 5 in this direction anyway.

[0034] The first positioning mechanism 7 extends from the forward end 6 of the workpiece carrier device 1 all the way to a rearward end 11 of the workpiece carrier device 1 opposite the forward end 6. In the rearward end 11, the housing 3 has a U-shaped hole 12, which allows the first positioning mechanism 7 to be operated from outside the housing 3.

[0035] Fig. 2 shows the workpiece carrier device 1 of Fig. 1 from behind. It can be seen that the first positioning mechanism 7 is spring-loaded. The spring 13 biases the first positioning mechanism 7 towards an adjustment state in which a pushing element 14 located on a connector section 15 of the first positioning mechanism 7 pushes the connector workpiece 4 against the limit stop 8 on the connector adapter part 5.

[0036] The first positioning mechanism 7 comprises a pivotable lever 16 having a connector section 15 that is adapted to contact the connector workpiece 4, an axis 17 about which the pivotable lever 16 can rotate and an operator section 18, which is opposite the connector section 15 and is adapted to be operated from outside the housing 3. The spring 13 biases the operator section 18 upwards. Due to the axis 17, the connector section 15 is thus biased downwards at the forward end 6, thereby holding, positioning and, by means of the positive locking element 9, locking the connector workpiece 4. In order to release the connector workpiece 4 at least in the up-down direction U, an actuation action can be applied through the U-shaped hole 12 located at the rearward

end 11 to a force contact point 29 of the first positioning mechanism 7. This actuation action counteracts the spring force of the spring 13 and the connector workpiece 4 is no longer held.

[0037] In Fig. 3, the workpiece carrier device 1 of Figs. 1 and 2 is shown in an exploded view. It can be seen that, in addition to the first positioning mechanism 7 that positions the connector workpiece in the up-down direction U, the workpiece carrier device 1 also comprises a second positioning mechanism 27 that positions the connector workpiece sideways in a sideways direction S. The second positioning mechanism 27 is also located on the inside of the housing 3.

[0038] The second positioning mechanism 27 also comprises a pivotable lever 16 that can rotate around an axis 17 located on the connector adapter part 5. The pivotable lever 16 comprises a connector section 15 that is adapted to contact and push the connector workpiece against a limit stop 8, which limits the sideways movements, and an operator section 18 opposite the connector section 15, which is adapted to be operated from outside the housing 3. The housing 3 has a rectangular hole 19 on the lower left end to enable access to the second positioning mechanism 27. Through the rectangular hole 19, an operator or a machine part can push against the operator section 18 at a force contact point 29 of the second positioning mechanism 27, counter-acting the spring force of the spring 13 which biases the second positioning mechanism 27 into an adjustment state in which the connector workpiece 4 is pushed against the limit stop 8.

[0039] The workpiece carrier device 1 of Figs. 1 to 3 comprises a handling section 20 that is located at a rearward end 11 and which is accessible from outside for receiving actuation actions applied to the workpiece carrier device 1. The housing 3 has a U-shaped hole 12 and a rectangular hole 19 to allow this actuation of the handling section 20. The workpiece carrier device 1 further comprises an actuation section 21 located at the forward end 6 for acting on the connector workpiece 4. The first positioning mechanism 7 and the second positioning mechanism 27 act as downscaling mechanisms 22, which reduce or minimize the amplitude of the actuation actions applied at the handling section 20 by a factor of at least 2 when the actuation action is transmitted from the handling section 20 to the actuation section 21. This is achieved by the fact that the connector sections 15 of the first positioning mechanism 7 and the second positioning mechanism 27 are shorter than the operator sections of the first positioning mechanism 7 or the second positioning mechanism 27, respectively. The handling section 20 takes up about 70% of the inner volume of the housing 3. The actuation section 21 takes up about 30% of the inner volume of the housing 3.

[0040] The machine adapter part 2 of the first embodiment is substantially made from folded metal sheet. A first metal sheet makes up the lower part 2A. The lower part 2A comprises two side sections and one bottom sec-

tion. The two side sections are configured to match the top part 2B, which is also made from metal sheet. The lower part 2A and the top part 2B can be welded to each other, e.g. by laser welding.

[0041] The housing height H, which is basically defined by the height of the side sections of the lower part 2A, corresponds to the width W of the housing 3, which is basically defined by the width of the top part 2B. With such a workpiece carrier device 1, the connector workpiece 4 can be inserted into the production modules in two positions that are rotated by 90° to each other. Accordingly, if it is necessary to have two different rotational positions between the connector workpiece 4 and a part of the production module, the workpiece carrier device 1 can be rotated, which can be much easier than rotating the part of the production module.

[0042] The connector adapter part 5 can be made from a variety of materials. It could for example be made from plastic by injection moulding. However, as plastic is usually not very resistant to wear, other materials like ceramics or metal can be used. The connector adapter part 5 can for example be made from a block of metal by cutting or milling. As such a cutting or milling process is usually quite expensive, the connector adapter part 5 can also be made by metal injection moulding (MIM). In the metal injection moulding process, a metal powder is mixed with a solvent and the mixture is then moulded into a desired shape. Subsequently, the solvent is removed and the metal particles are sintered together by applying heat.

[0043] The pivotable levers 16 of the first positioning mechanism 7 and the second positioning mechanism 27 are also formed from sheet metal by punching and stamping. Accordingly, the entire workpiece carrier device 1 is lightweight, easy to produce and comparatively cheap.

[0044] The connector adapter part 5 and the machine adapter part 2 are detachable from each other. Accordingly, if a different type of connector is to be produced, the connector adapter part 5 of Figs. 1 to 3 can be exchanged to a different type of connector adapter part 5. The machine adapter part 2, however, stays the same, which allows the workpiece carrier device 1 to be used in the same production modules as with the first type of connector adapter part 5, without changing parts of the production modules.

[0045] The first positioning mechanism 7 and the second positioning mechanism 27 are also detachable from the connector adapter part 5 and the machine adapter part 2. They could, for example, be used together with a different type of connector adapter part 5, or they could be designed specifically for one type of connector adapter part 5.

[0046] The connector adapter part 5 and the machine adapter part 2 can be designed to be detachable from each other without tools. For example, the connector adapter part 5 could be inserted into the lower part 2A of the machine adapter part 2 and then be held in the lower part 2A by means of a positive locking. For example, a protrusion on the lower side of the connector adapter part

5 could engage with the hole 23 on the bottom of the lower part 2A. However, the connector adapter part 5 could also only be held in the machine adapter part 2 by friction force when the top part 2B has been welded to the lower part 2A.

[0047] In Fig. 4, a second embodiment of a workpiece carrier device 1 is depicted. The second embodiment is adapted to mate with a different type of connector workpiece 4. Thus, the connector adapter part 5 of the second embodiment has a different shape, this shape being at least partially complementary to the different connector workpiece 4.

[0048] The machine adapter part 2 of the second embodiment is the same machine adapter part 2 used for the first embodiment shown in Figs. 1 to 3. Therefore, the production modules used for producing the first type of connector can be used to produce the second type of connector without major changes.

[0049] The second embodiment comprises a first positioning mechanism 7 that pushes the connector workpiece 4 down, thereby positioning and holding the connector workpiece 4. The second embodiment also comprises a second positioning mechanism 27 that pushes the connector workpiece 4 sideways to a limit stop 8, thus positioning the connector workpiece 4 in the sideways direction S. Like in the first embodiment, the positioning mechanisms 7, 27 comprise pivotable levers 16 that rotate about two axes 17 located on the connector adapter part 5. One of the axes 17 is hidden below the first positioning mechanism 7.

[0050] In contrast to the first embodiment, the second embodiment does not comprise a positive locking element 9 that is located on the first positioning mechanism 7. Rather, the first positioning mechanism 7 only holds the connector workpiece 4 by frictional forces.

[0051] Fig. 5 shows that the first positioning mechanism 7 of the second embodiment is also biased to an adjustment state in which the first positioning mechanism 7 holds the connector workpiece 4. This is again achieved by a spring 13 located at a rearward end 11 of the workpiece carrier device 1. Again, the connector workpiece 4 can be released, at least in the up-down direction U, by pushing on a force contact point 29 of the operator section 18 of the pivotable lever 16. In order to also release the connector workpiece 4 from the second positioning mechanism 27, the operator section 18 of the second positioning mechanism 27 can be pushed inwards at a force contact point 29 of the second positioning mechanism 27.

[0052] In Figs. 6 and 7, a third embodiment of a workpiece carrier device is depicted. Again, the machine adapter part 2 of the first and the second embodiment is used for the third embodiment. However, the connector adapter part 5 is different and designed to be partially complementary to a third type of connector workpiece 4.

[0053] The first positioning mechanism 7 and the second positioning mechanism 27 of the third embodiment are similar to the ones used in the second embodiment.

The two positioning mechanisms 7, 27 can be detached from the second and the third embodiment and be used for the respective other embodiment, thereby reducing the number of parts that have to be designed and manufactured for each embodiment.

[0054] A kit for workpiece carrier devices 1 can, for example, comprise one machine adapter part 2 and two different connector adapter parts 5. Preferably, the kit also comprises one or more positioning mechanisms 7, 27, wherein the positioning mechanisms 7, 27 are adapted to be used together with both of the two different kinds of connector adapter parts 5. In an alternative, the kit comprises several positioning mechanisms 7, 27, where one positioning mechanism 7, 27 is adapted to match only one type of connector adapter part 5 and one connector workpiece 4. For example, one type of positioning mechanism 7, 27 can comprise a positive locking element 9, whereas a second type of positioning mechanism 7, 27 does not provide a positive locking element 9.

[0055] Fig. 8 shows that the workpiece carrier device 1 can also be made from solid parts. The machine adapter part 2 of this fourth embodiment is connected to a connector adapter part 5 to which a connector 24 together with a cable 25 is attached. The machine adapter part 2 can again be used together with different types of connector adapter parts 5.

[0056] The fourth embodiment also has a first positioning mechanism 7 acting in the up-down direction U and a second positioning mechanism 27 acting in the sideways direction S. The second positioning mechanism 27 also locks the first positioning mechanism 7 by positive locking. A fork-like section of the second positioning mechanism 27 is arranged around a protrusion 28 of the first positioning mechanism 7, thereby acting as a locking mechanism 26 that locks the first positioning mechanism 7.

Reference Signs

1	workpiece carrier device
2	machine adapter part
2A	lower part
2B	top part
3	housing
4	connector workpiece
5	connector adapter part
6	forward end
7	first positioning mechanism
8	limit stop
9	positive locking element
10	recess
11	rearward end
12	U-shaped hole
13	spring
14	pushing element
15	connector section
16	pivotable lever

(continued)

17	axis
18	operator section
19	rectangular hole
20	handling section
21	actuation section
22	downscaling mechanism
23	hole in the bottom
24	connector
25	cable
26	locking mechanism
27	second positioning mechanism
28	protrusion
29	force contact point
H	height
W	width
U	up-down direction
S	sideway direction

Claims

1. Workpiece carrier device (1) for the production of connectors (24) and/or cables having connectors (24) from connector workpieces (4), the production including a plurality of production steps carried out by at least two different production modules working on the connector workpieces (4), the workpiece carrier device (1) comprising: a machine adapter part (2) having a housing (3) adapted to mate with workpiece holders of the at least two production modules; and a connector adapter part (5) located at a forward end (6) of the housing (3) and adapted to hold and position a connector workpiece (4).
2. Workpiece carrier device (1) according to claim 1, wherein the connector adapter part (5) is at least partially shaped complementary to the connector workpiece (4).
3. Workpiece carrier device (1) according to claim 1 or 2, wherein the workpiece carrier device (1) comprises at least one positioning mechanism (7, 27) for positioning the connector workpiece (4), comprising a pushing element (14) adapted to push the connector workpiece (4) in a direction towards a limit stop (8).
4. Workpiece carrier device (1) according to claim 3, wherein the connector adapter part (5) and the positioning mechanism (7, 27) are configured to be attachable to and detachable from the machine adapter part (2).

5. Workpiece carrier device (1) according to one of claims 3 or 4, wherein the positioning mechanism (7, 27) extends into a rearward end (11) of the housing (3).
6. Workpiece carrier device (1) according to claim 5, wherein a force contact point (29) at which a force is applicable to the positioning mechanism (7, 27) from outside the housing (3), is located in the rearward end (11) of the housing (3).
7. Workpiece carrier device (1) according to one of claims 3 to 6, wherein the workpiece carrier device (1) comprises at least two positioning mechanisms (7, 27) for positioning the connector workpiece (4) in at least two dimensions.
8. Workpiece carrier device according to claim 7, wherein at least one of the positioning mechanisms (7, 27) provides a locking mechanism (26) for locking the other positioning mechanism (27, 27).
9. Workpiece carrier device (1) according to one of claims 3 to 8, wherein at least one of the positioning mechanisms (7, 27) is biased towards an adjustment state in which the pushing element (14) pushes the connector workpiece (4) against the limit stop (8).
10. Workpiece carrier device (1) according to one of claims 3 to 9, wherein at least one of the positioning mechanisms (7, 27) comprises a pivotable lever (16), the lever having a connector section (15) adapted to contact the connector workpiece (4), an axis (17) located on the connector adapter part (5) of the workpiece carrier device (1), and a operator section (18) opposite the connector section (15) adapted to be operated from outside the housing (3).
11. Workpiece carrier device (1) according to one of claims 1 to 10, wherein the workpiece carrier device (1) comprises a handling section (20) which is accessible from outside for receiving actuation actions applied to the workpiece carrier device (1), and an actuation section (21) for acting on the connector workpiece (4), wherein the actuation actions are transmitted from the handling section (20) to the actuation section (21) by a downscaling mechanism (22) minimizing the amplitude of the actuation action, preferably by a factor of at least 2.
12. Workpiece carrier device (1) according to one of claims 3 to 11, wherein the workpiece carrier device (1) comprises a positive locking element (9) for locking the connector workpiece (4) in at least one direction, preferably in two or three directions that are perpendicular to each other, wherein the positive locking element (9) is arranged on the at least one positioning mechanism (7, 27).
13. Kit for workpiece carrier devices (1) for the production of connectors (24) and/or cables having connectors (24), comprising: a machine adapter part (2) adapted to mate with at least two workpiece holders in two different production modules of two production steps; and at least two connector adapter parts (5) for different connectors (24) adapted to hold at least a connector workpiece (4) when it is processed.
14. Kit according to claim 13, wherein the kit comprises at least two positioning mechanisms (7, 27) for positioning the connector workpiece (4), each positioning mechanism (7, 27) comprising a pushing element (14) for pushing the connector workpiece (4) in a direction towards a limit stop (8), wherein each positioning mechanism (7, 27) is adapted to mate with one of the at least two connector adapter parts (5).
15. Method of producing a connector (24) or a cable with a connector (24), wherein the method comprises at least two production steps carried out in at least two different production modules, wherein a connector workpiece (4) is held by the same workpiece carrier device (1) when it is processed in the two different production modules.

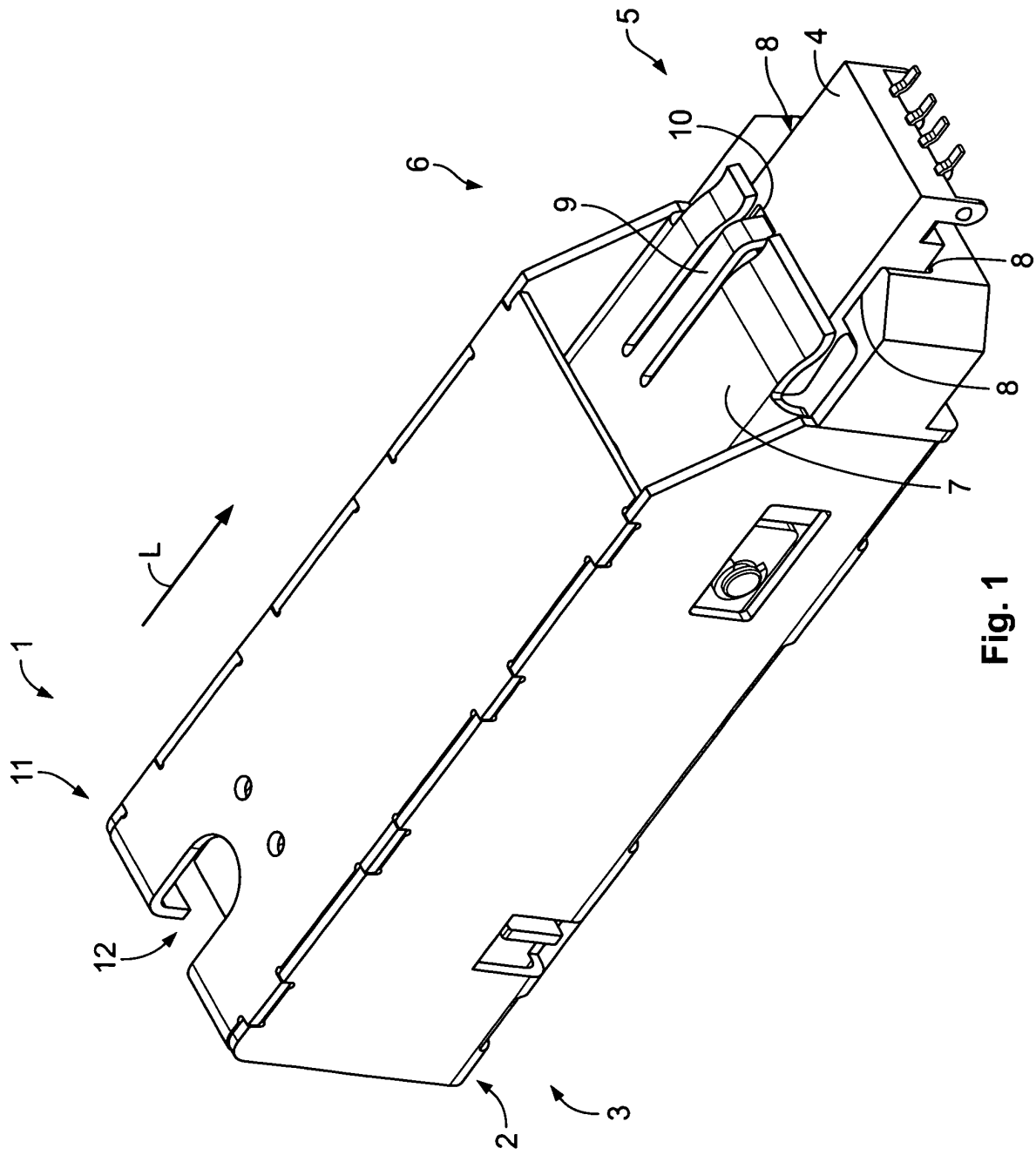


Fig. 1

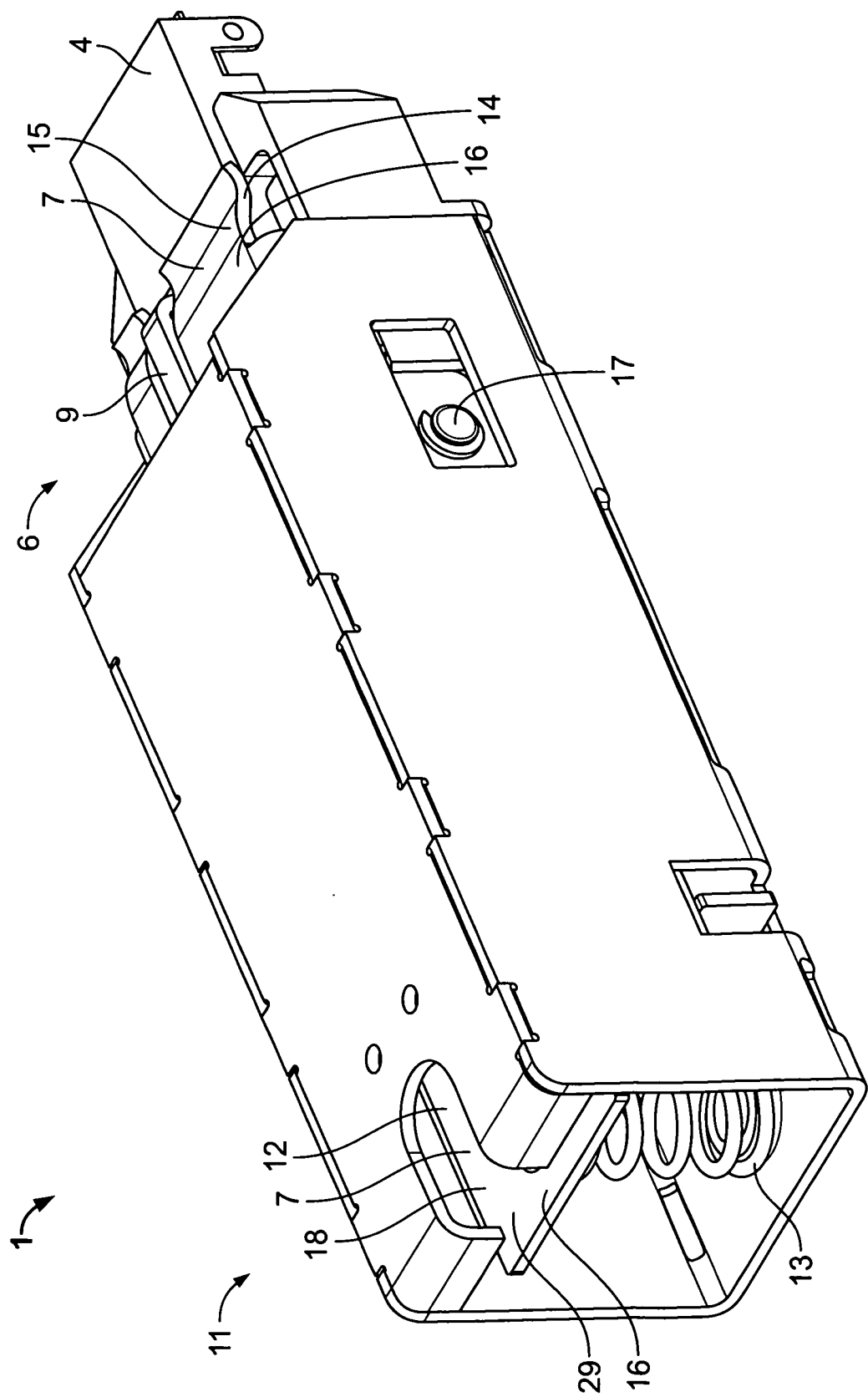


Fig. 2

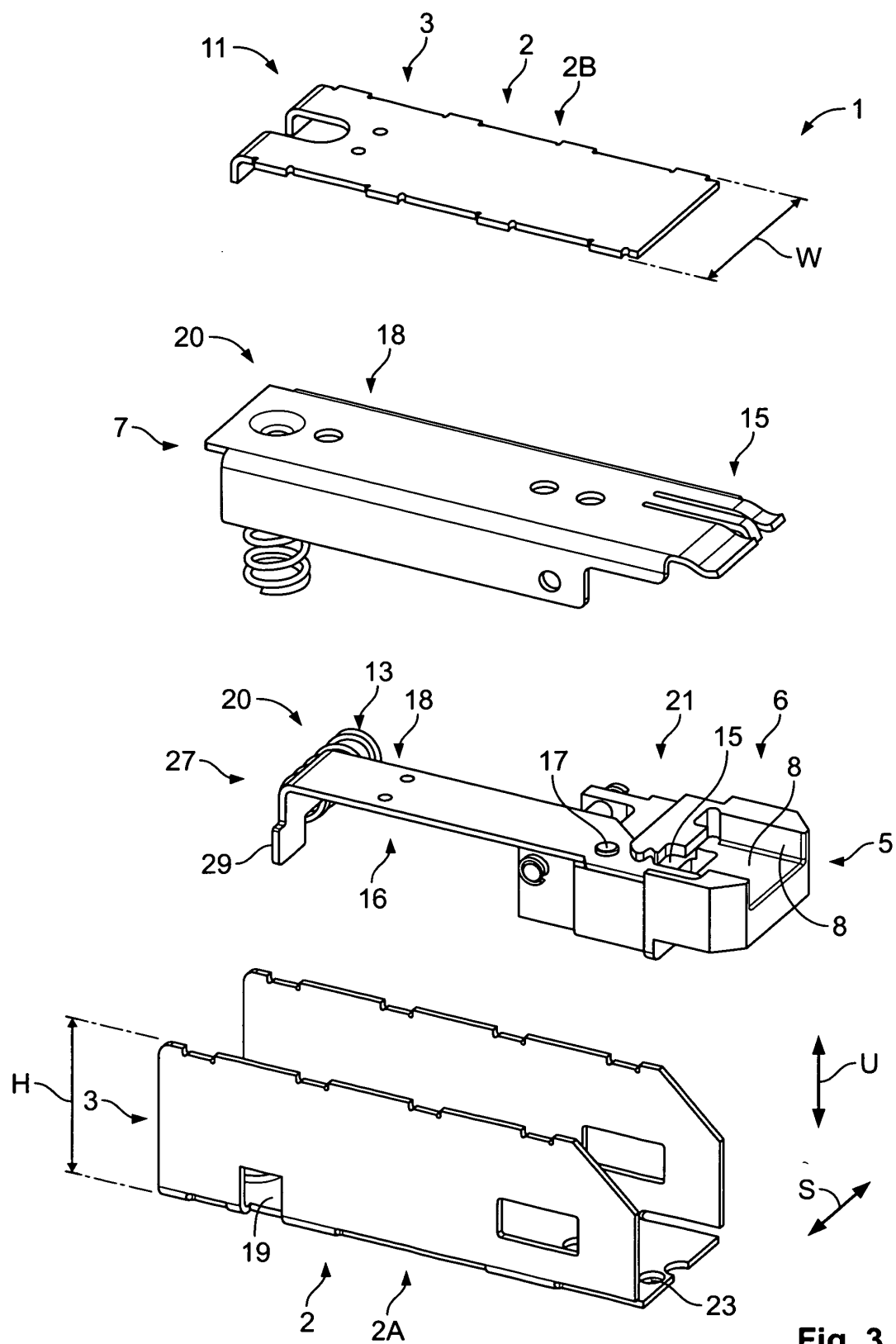


Fig. 3

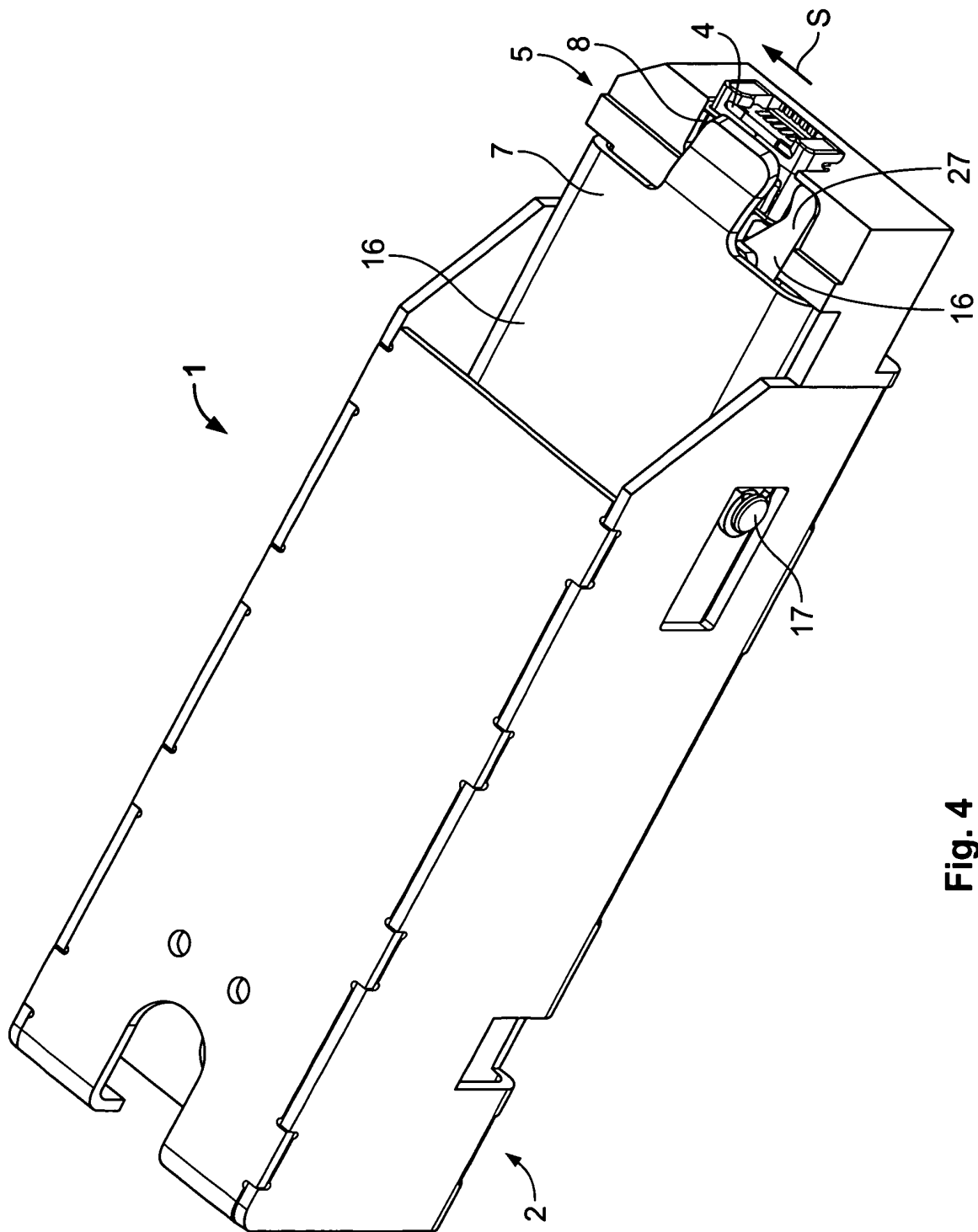


Fig. 4

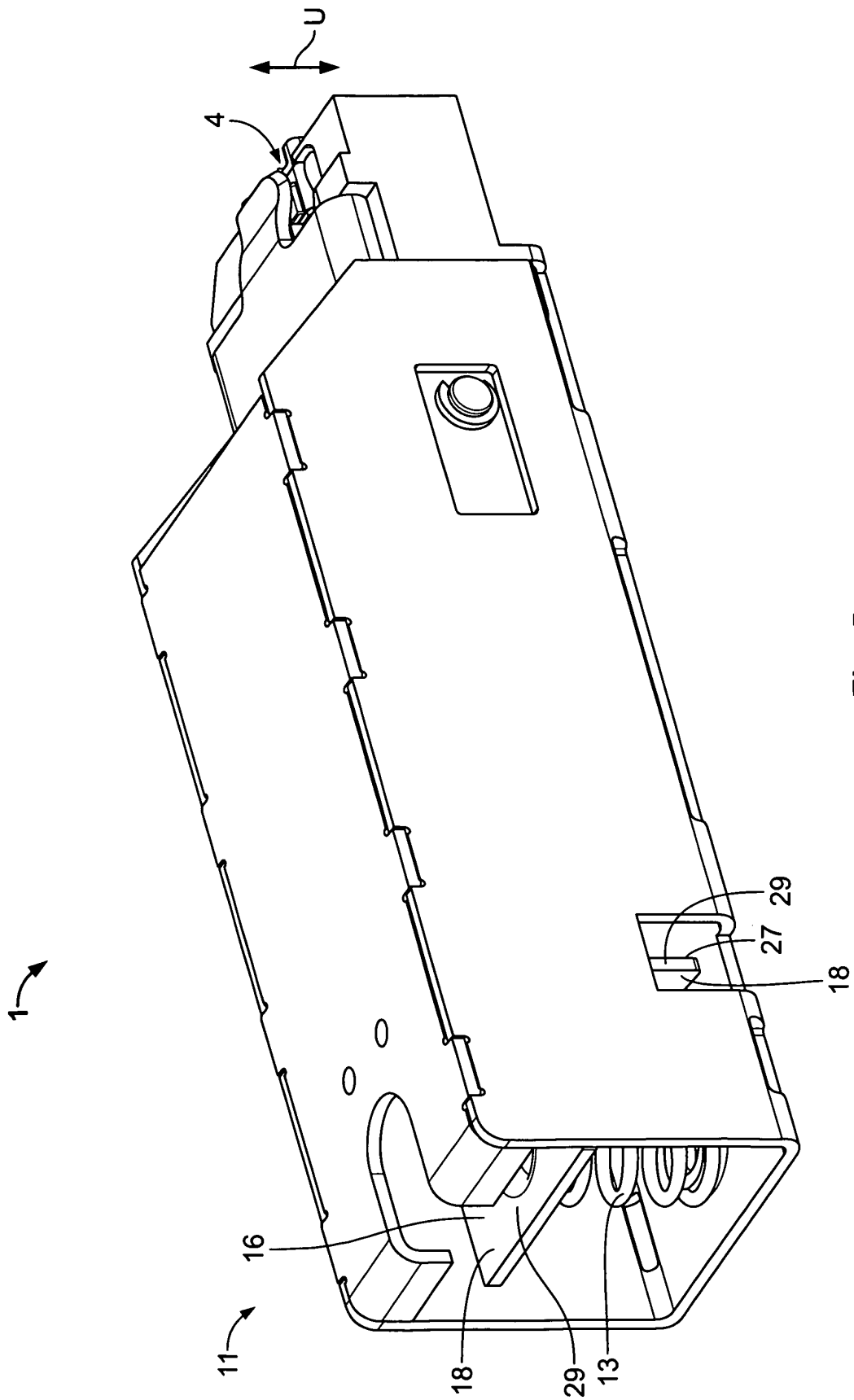


Fig. 5

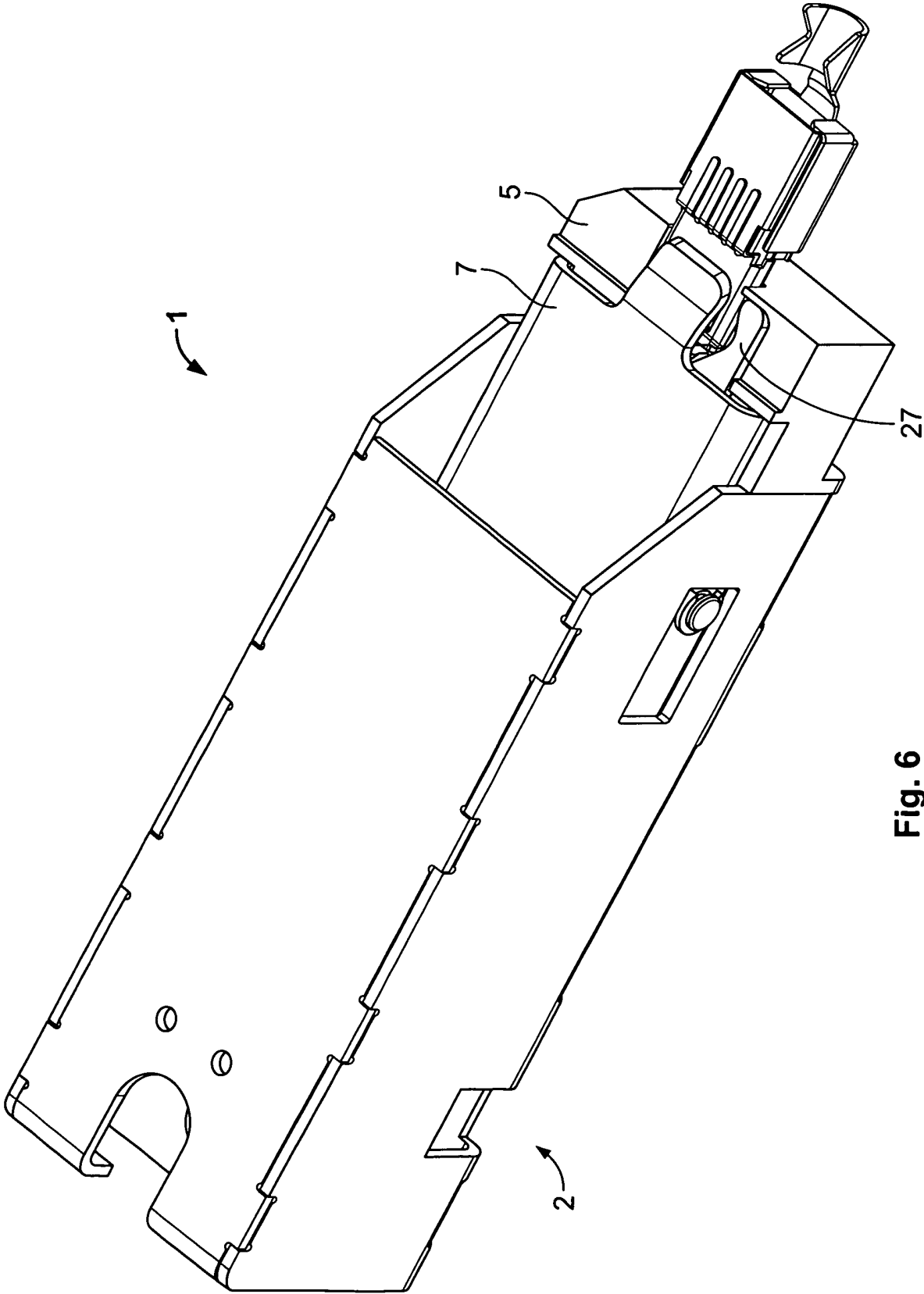


Fig. 6

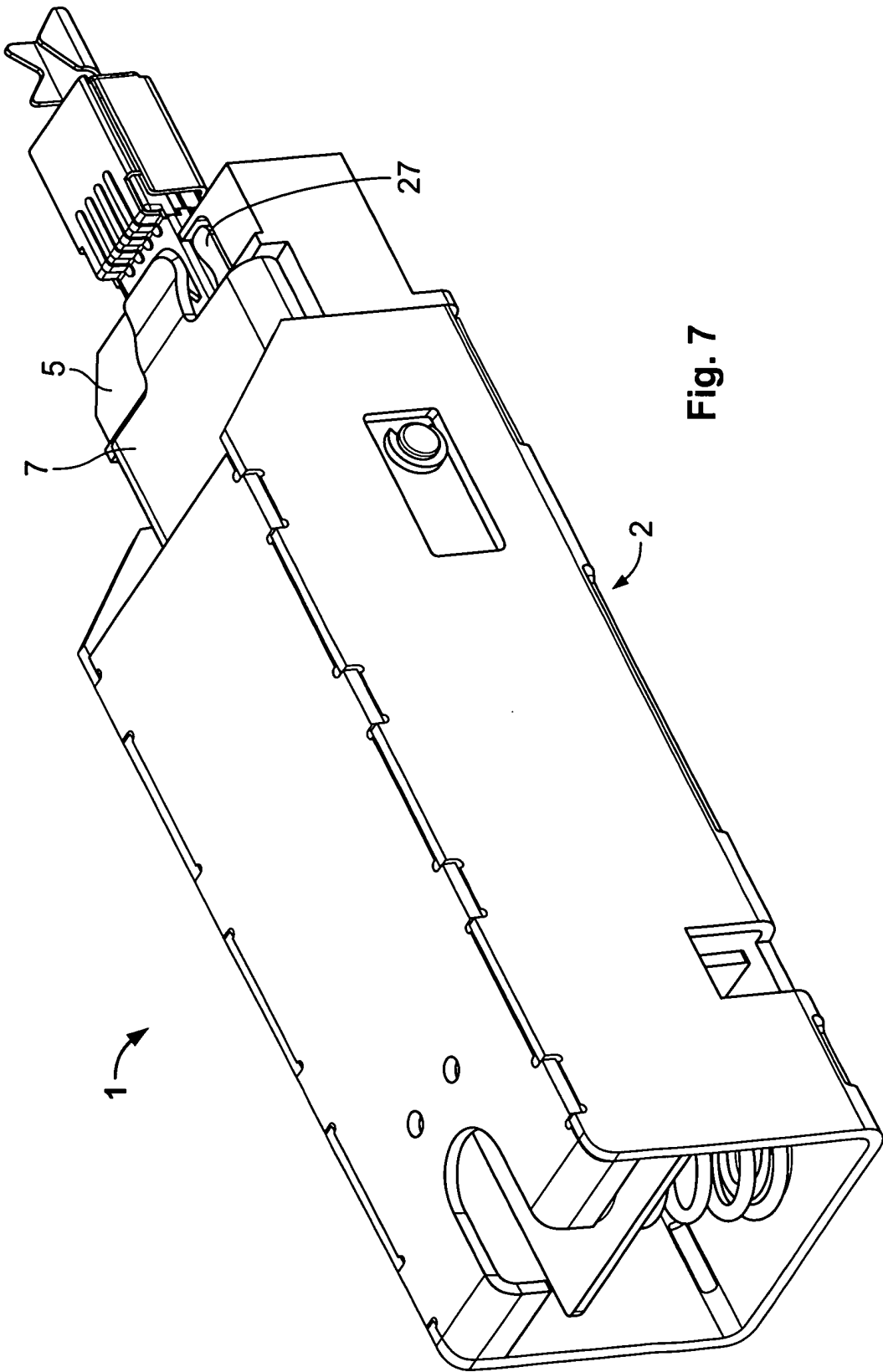


Fig. 7

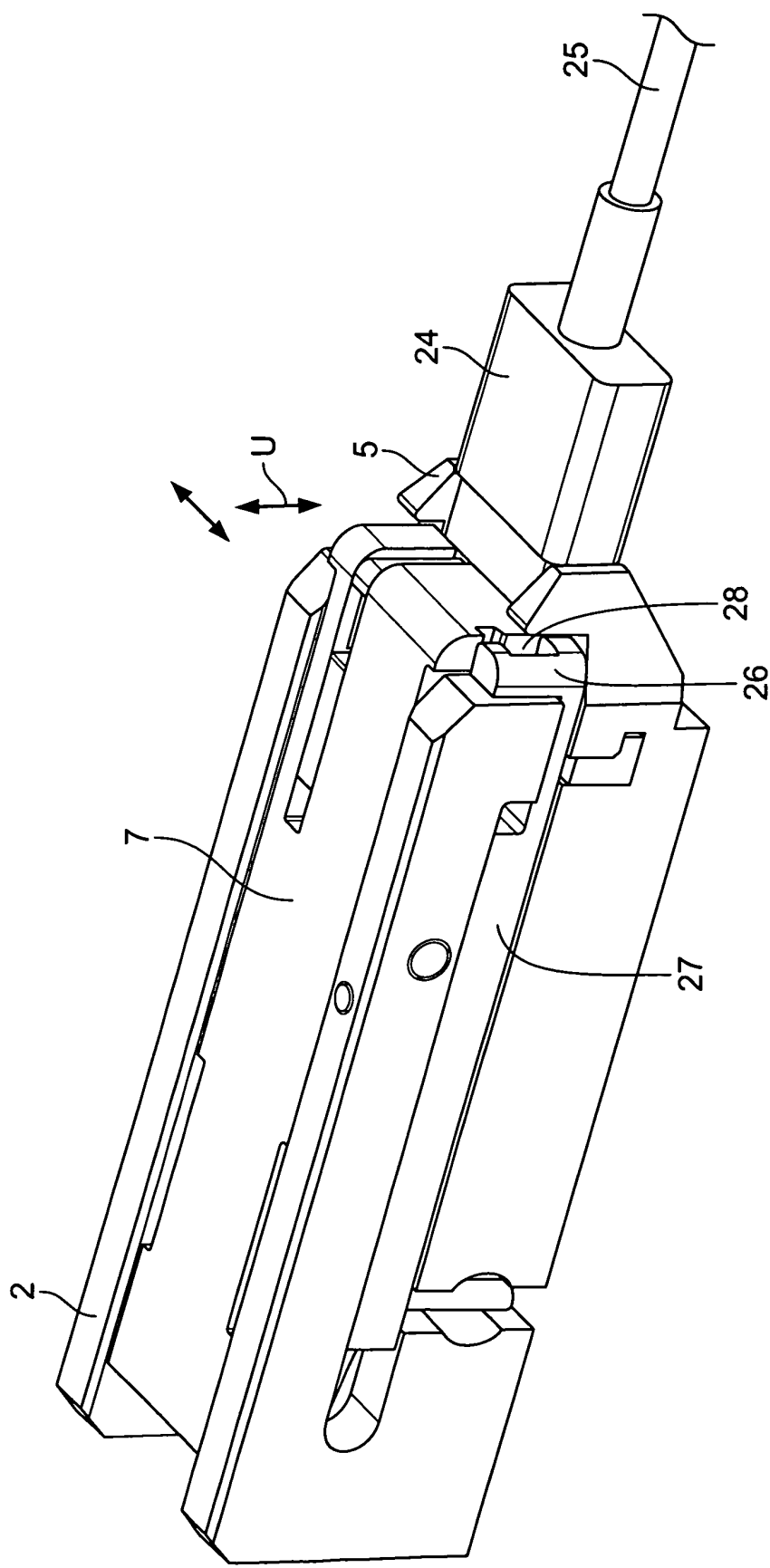


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
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			H01R
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Place of search The Hague		Date of completion of the search 10 September 2013	Examiner Kandyla, Maria
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X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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