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(54) Wire organizer

(57) The present invention relates to a wire organizer (1, 1') for holding at least one electrical line (4, 4'), with an organizer body (2') comprising at least one lead-through opening (20, 20') extending from a back side (23) to a front side (24) of the organizer body (2, 2') in an insertion direction (I, I') for leading the electrical line (4) from the back side (23) to the front side (24). Further, the present invention relates to a clamping element (3) for clamping at least one electrical line (4) within the organizer body (2, 2') as well as to a construction kit for a wire organizer (1, 1') and a method for fastening at least one electrical line (4) within the wire organizer (1, 1'). In order to fasten the electrical line (4) in a simple, reliable and cost-efficient way, the present invention provides that the at least one lead-through opening (20, 20') is at least partly laterally intersecting with the shaft (21) receiving the clamping element (3) fastening the at least one electrical line (4).

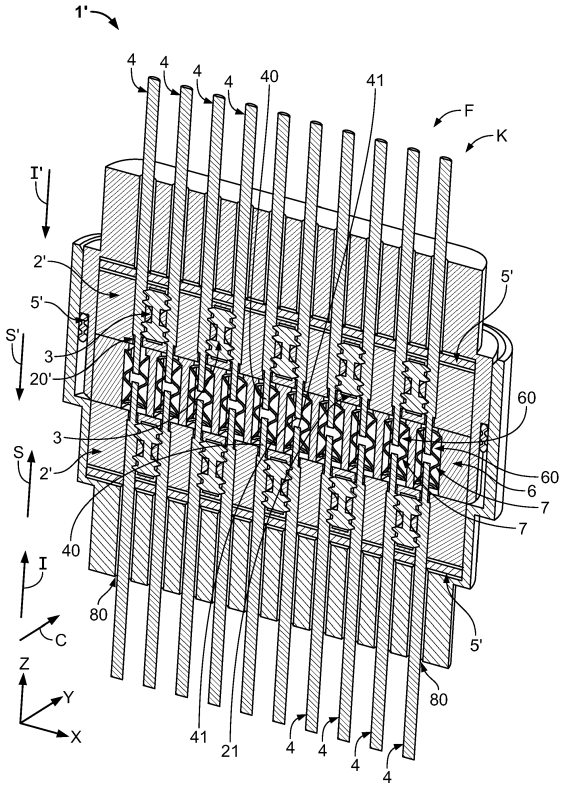

Fig. 11

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Description

[0001] The present invention relates to an organizer body for holding at least one electrical line in a wire organizer, the organizer body comprising at least one lead-through opening extending from a back side to a front side of the organizer body in an insertion direction for leading the electrical line from the back side to the front side.

[0002] Further, the present invention relates to a clamping element for clamping at least one electrical line with an organizer body of a wire organizer.

[0003] Additionally, the present invention relates to a construction kit for a wire organizer, comprising at least one organizer body.

[0004] Furthermore, the present invention relates to a wire organizer for holding at least one electrical line, comprising an organizer body.

[0005] Finally, the present invention relates to a method for fastening at least one electrical line within a wire organizer, the method comprising the steps of introducing the at least one electrical line in an insertion direction into a through-hole of an organizer body of the wire organizer, such that the at least one electrical line enters the lead-through opening at a back side of the wire organizer and exits the lead-through opening at a front side of the wire organizer.

[0006] Organizer bodies of wire organizers, the wire organizers themselves, construction kits therefor and methods for fastening at least one electrical line within a wire organizer, as mentioned above, are known from the prior art. The wire organizers may e.g. be used for holding electrical lines with pigtail connections in order to connect the lines to printed circuit boards (PCB) or to simply attach the lines to a carrier or to electrically connect lines to each other. Known solutions therefor work e.g. with a direct contact unit for connecting the lines to the PCB. Commonly, the line then has to be connected to a housing of the direct contact unit by a harness maker and the PCB will be assembled at a different manufacturing location. A wire organizer comprising such a housing has to fulfill several very strict requirements. Firstly, a positioning tolerance of an end of the electrical line may be lesser than +/-0.2 mm in a longitudinal direction as well as a transverse direction of the wire organizer. A positioning tolerance in a height direction may be less than +/-0.3 mm. According to the state of the art, these specifications may only be met by very complex and thus expensive solutions which may not be feasible for every desired application.

[0007] In view of the disadvantages and problems of wire organizers according to the prior art, an problem underlying the present invention is to provide a wire organizer which allows for precise positioning of electrical lines and which is more cost-efficient as well as easy to handle.

[0008] This problem is solved with the above-mentioned organizer body according to the present invention in that the at least one lead-through opening is at least partly laterally intersecting with a shaft adapted for receiving a clamping element.

[0009] For a clamping element mentioned in the beginning of the description, the above-mentioned problem is solved in that the clamping element is formed complementary to the at least one shaft of an organizer body according to the present invention.

[0010] For the construction kit mentioned in the beginning of the description, the above-mentioned problem is solved according to the present invention in that the construction kit comprises at least one organizer body according to the present invention and at least one clamping element according to the present invention.

[0011] For a wire organizer mentioned in the beginning of the description, the above-mentioned problem is solved in that the wire organizer comprises an organizer body according to the present invention and at least one clamping element according to the present invention, wherein at least one electrical line enters the lead-through opening at the back side and exits the lead-through opening at the front side, and wherein the at least one clamping element is received within the shaft and fastens the at least one electrical line.

[0012] For a method mentioned in the beginning of the description, the above-mentioned problem is solved according to the present invention in that the method further comprises the step of introducing in a clamping direction extending transversely to the insertion direction a clamping element into a shaft of the organizer body, such that the clamping element fastens the at least one electrical line within the lead-through opening at an intersection of the lead-through opening and the shaft.

[0013] The solution allows the electrical line to be easily fastened within the organizer body in that the clamping element is introduced into the shaft when the electrical line is in the desired position. Thereby, the electrical line, especially an end section of the electrical line, may be precisely positioned in the longitudinal, transverse and height direction. The lead-through opening may intersect with the shaft in a plane extending in parallel to the insertion direction and the longitudinal direction of the clamping element. Both the lead-through opening and the shaft may be formed channel-like. The line may be clamped e.g. in a sheath of the line. The clamping may be achieved manually or automatically by hand or machine-operated tools, respectively. The parts of the wire organizer as well as the tools for its manufacturing and handling may have a simple design and thus be efficiently manufactured and handled, which helps in minimizing the costs involved for producing and handling the wire organizer.

[0014] In the following, further improvements of an organizer body, a clamping element, a construction kit, a wire organizer and a method according to the present invention are described. These additional improvements may be combined independently of each other, depending on whether a particular advantage of a certain im-

provement is needed a specific application.

[0015] According to a first advantageous improvement of the organizer body, the shaft may open against a clamping direction extending transversely to the insertion direction. The clamping direction may extend essentially perpendicularly to the insertion direction. The clamping element may thereby be inserted in parallel to the clamping direction into the shaft. A transition between the shaft and the lead-through opening may thereby essentially extend in a direction extending transversely or essentially perpendicularly to the insertion direction as well as the clamping direction. In other words, a passage between the lead-through opening and the shaft may constitute an opening between the lead-through opening and the shaft extending essentially in a plane in parallel with the insertion direction and the clamping direction. The clamping element may thereby be easily pushed with its front end beyond the electrical line in the clamping direction, so that the clamping element clamps the electrical line within the lead-through opening by means of its side face.

[0016] The wire organizer may comprise at least one further lead-through opening intersecting with the at least one shaft. Thereby, two electrical lines accommodated in the at least two lead-through openings may be fastened by introducing a single clamping element into the shaft.

[0017] The at least one shaft may be arranged between the at least two lead-through openings. Thereby, two electrical lines, each received in a lead-through opening, may be fastened simultaneously when introducing the clamping element into the shaft.

[0018] The at least one lead-through opening may intersect with the at least one shaft at at least two intersections distanced from each other along the insertion direction. Thereby, the electrical line may be fastened at two fastening regions or points distanced from each other in the insertion direction. Thus, the electrical line can be securely fastened within the lead-through opening, so that movements of the electrical line in the insertion direction may be prevented and especially an end section of the electrical line may be precisely located in the insertion direction.

[0019] The at least one shaft may be mirror-symmetrically shaped with respect to a plane extending in parallel to the insertion direction and the clamping direction. Thereby, a clamping element, which may also be mirror-symmetrically shaped with respect to said plane, may be introduced into the shafted in at least two and up to four different orientations which facilitates handling the organizer body and the clamping element.

[0020] Malleable leading elements may extend essentially in parallel to the insertion direction within the at least one lead-through opening at least in the vicinity of the front side. The leading elements may be flexible, elastically and/or plastically deformable. The leading elements may be shaped rib- or tongue-like and may extend essentially in parallel to the insertion direction while protruding from an inner circumference of the lead-through opening into the lead-through opening. Thereby, especially a positioning of an end section of the electrical line in the vicinity of the front side of the lead-through opening in the longitudinal and the transverse direction may be improved.

[0021] The leading elements may be arranged concentrically with respect to a middle axis of the at least one lead-through opening, extending in parallel to the insertion direction. Thereby, the electrical line may be easily centered within the lead-through opening.

[0022] For a clamping element mentioned in the beginning of the description, the solution according to the present invention may be further improved in that the clamping element and at least one further clamping element are connected to each other by at least one connecting part. The clamping element, the at least one further clamping element and the connecting part may be integrally formed. The connecting part may be formed as a material bridge between the at least one and the at least one further clamping element. Thereby, the at least two clamping elements may be handled as one piece when e.g. they are fed to a tool for applying the clamping elements. The connecting part may be discarded when applying the clamping elements. The number of clamping elements connected to each other as one production unit may match the number of shafts within the organizer body. This helps in facilitating the handling of a wire organizer according to the present invention.

[0023] The clamping element may comprise at least one clamping block from which at least one rib extending in parallel to the clamping direction protrudes. The clamping block may provide a desired stability to the clamping element while the at least one rib may help to notch the electrical line or a sheath thereof in order to precisely fasten the electrical line within the shaft.

[0024] For a construction kit mentioned in the beginning of the description, the solution may be further improved in that the construction kit further comprises at one of a housing providing a cavity for accommodating the at least one organizer body, a sealing element for sealing up between the housing and the organizer body, and a contact block adapted to accommodate contact elements for electrically connecting a tip of an electrical line held in the organizer body to a tip of another electrical line held in another organizer body. Thereby, the construction kit may enable the organizer body to be protectively accommodated within the housing and the housing may be sealed. By means of the contact block, two organizer bodies and, if desired, their respective housing may each form a sort of plug element providing a plug-connector for electrically connecting the tips of electrical lines to each other.

[0025] In the following, the invention and its improvements are described in greater detail by using exemplary embodiments thereof and with reference to the accompanying drawings. As described above, the various features shown in the embodiments may be used independently of each other according to the respective requirements of specific applications.

[0026] In the drawings:

Fig. 1 shows a schematic perspective view of a first embodiment of a wire organizer according to the present invention;

Fig. 2 shows a schematic perspective cross-sectional view of the wire organizer shown in Fig. 1;

Fig. 3 shows a schematic perspective view of a detail X of the wire organizer shown in Fig. 2;

Fig. 4 shows another perspective cross-sectional view of the wire organizer shown in Figs. 1 to 3;

Fig. 5 shows a schematic perspective detailed view of the tip of an electrical line exiting a lead-through opening of the wire organizer shown in Figs. 1 to 4;

Figs. 6a-h show a schematic perspective views of the wire organizer shown in Figs. 1 to 5 as it is being equipped with electrical lines;

Fig. 7 shows a schematic perspective view of several clamping elements integrally formed together with connecting parts connecting the clamping elements to each other according to the present invention;

Fig. 8 shows a schematic front view of the clamping elements illustrated in Fig. 7;

Fig. 9 shows a schematic cross-sectional view of the clamping elements shown in Figs. 7 and 8 along the cross-sectional line A-A depicted in Fig. 8;

Fig. 10 shows a schematic top view of the clamping elements shown in Figs. 7 to 9;

Fig. 11 shows a schematic perspective cross-sectional view of another embodiment of a wire organizer according to the present invention;

Figs. 12a-h show the wire organizer illustrated in Fig. 11 as it is being assembled in order to electrically connect electrical lines held thereby to each other; and

Fig. 13 shows a schematic perspective view of a first embodiment of a contact element used for electrically connecting the tips of electrical lines opposing each other in the embodiment of a wire organizer according to the present invention shown in Figs. 11 to 12h;

Fig. 14 shows a schematic perspective view of another embodiment of a contact element according to the present invention;

Fig. 15 shows a schematic cross-sectional view of the contact element illustrated in Fig. 14, electrically connecting end sections of two electrical lines opposing each other within a contact receptacle of a wire organizer according to the present invention;

Fig. 16 shows a schematic perspective view of a further embodiment of a contact element according to the present invention; and

Fig. 17 shows a schematic cross-sectional view of the contact element illustrated in Fig. 16 electrically connecting end sections of two electrical lines opposing each other within a contact receptacle of a wire organizer according to the present invention.

[0027] Fig. 1 shows a first embodiment of a wire organizer 1 in a fully assembled state F. The wire organizer 1 extends in a longitudinal direction X, a transverse direction Y and a height direction Z, which together define a Cartesian coordinate system. The wire organizer 1 comprises an organizer body 2, a number of clamping elements 3, a number of electrical lines 4 and sealing elements 5. Electricals lines 4 are each held in one of a number of lead-through openings 20 (not yet shown) provided in the organizer body and extending from a back side 23 to a front side 24 (not yet shown) thereof. Shafts 21 formed in the organizer body 2 each intersect with the lead-through openings 20 at two intersections 22, where the clamping elements 3 fasten the electrical lines 4. The electrical lines 4 are inserted into the organizer body in an insertion direction I extending in parallel to the height direction Z. The clamping elements 3 are inserted into the organizer body 2 at a lateral side thereof in a clamping direction C extending in parallel to the transverse direction Y. Further, the organizer body 2 is provided with a receptacle 26 opening in a plug direction S wherein the wire organizer 1 may be mated with another wire organizer or any connecting means in an electrical component, PCB or the like.

[0028] Fig. 2 shows a schematic cross-sectional view of the wire organizer 1 in the fully assembled state F along a cross-sectional plane extending in parallel to the longitudinal direction X and the height direction Z through

the lead-through openings 20 formed in the organizer body 2 as well as the electrical lines received therein. The lead-through openings 20 extend in parallel to the insertion direction I from the back side 23 to the front side 24, which forms a bottom of the receptacle 26. The electrical lines 4 are received in the lead-through openings 20 such that a stripped-off end section 40 of the electrical line 4 and hence a bare tip 41 thereof juts above the front side 24 of the organizer body 2 while a section of the electrical line 4 provided with an insulating sheath 42 is arranged within the respective lead-through opening 20 and extends beyond the back side 23 of the organizer body 2. Each of the shafts 21 is arranged between two of the lead-through openings 20. With the first of the two lead-through openings, the shaft intersects at two intersections 22a and 22b distanced from each other in the insertion direction I. With the second of the two lead-through openings 20, the shaft intersects at two intersections 22c and 22d also following each other in the insertion direction I. Further, it becomes apparent in Fig. 2 that along the inner circumference of the receptacle 26 another sealing element 5 is arranged near or abutting the front side 24.

[0029] Fig. 3 is a schematic perspective cross-sectional view of a detail X depicted in Fig. 2. Here it becomes apparent that the two intersections 22a and 22b are separated from each other by a beam 27 running in parallel to the clamping direction C. The clamping element 3 comprises two clamping blocks 30a and 30b which are arranged in the intersections 22a and 22b respectively and are connected to each other via a bridge 31. In the region of the bridge 31, a groove 32 is formed at each of the lateral sides of the clamping element 3 in order to receive the beam 27 and to provide guidance in the clamping direction C. Two ribs 33 are formed to each of the sides of each clamping block 30a, 30b so that they jut into the lead-through openings 20 at each of the intersections 22a to 22d and penetrate the electrical line 4 or at least the sheath 42 thereof in order to secure the electrical line 4 and inhibit any movements thereof in parallel to the insertion direction I. Clamping forces F_C act in parallel to a fastening direction D from the clamping element 3 and in particular the ribs 33 thereof in and against the longitudinal direction X, i.e. perpendicularly to the insertion direction I and the clamping direction C.

[0030] Further, in an upper end region 20a of the lead-through opening 20 in the vicinity of the front side 24, leading elements 20 are provided at the inner circumference of the lead-through opening 20 so that they center the end section 40 of the electrical line with respect to a middle axis M_{20} of the lead-through opening 20. At the front side 24, the lead-through opening 20 is extended in the insertion direction I by a rim 29 surrounding the lead-through opening 20 at the front side 24 and protruding therefrom.

[0031] Fig. 4 is a schematic perspective cross-sectional view of the wire organizer 1 in the fully assembled state F along a middle axis M_3 of the clamping element 3 and a middle axis M_{21} of one of the shafts 21, respectively, in a plane extending in parallel to the transverse direction Y and the height direction Z. Here it becomes apparent that the fastening directions D point away from each of the middles axes M_3 of the clamping element 3 and the middle axes M_{21} of the shafts 21 essentially in parallel, i.e. in and against the longitudinal direction X, or in other terms perpendicularly to the insertion direction L as well as to the clamping direction C. Further, the clamping element is provided with a cavity 34 in each clamping block 30a and 30b towards each of its front faces facing in and against the clamping direction C. The cavities 34 help to enhance a resiliency, i.e. flexibility or elastic deformability of the clamping element such that it may be compressed when being inserted into the respective shaft 21 in order to be snugly sitting therein while be held by force fit and/or positive fit in order to not accidentally be removed from the shaft 21. The shaft 21 extends from one of the lateral sides 25 of the organizer body 2 to the opposing lateral side 25 of the organizer body 2, i.e. through the entire organizer body 2. Hence, the clamping elements 3 within the shaft 21 may be accessed from both lateral sides 25 of the organizer body 2 in order to be able to remove the clamping element 3 from the shaft 21 by pushing it out of the shaft 21 from either of the lateral sides in the clamping direction C.

[0032] Fig. 5 is a schematic perspective detailed view of the end section 40 of the electrical line 4 as it exits one of the lead-through openings 20. Here it becomes apparent that the leading elements 24 within the end region 20a of the lead-through opening 20 are arranged concentrically with respect to the middle axis M_{20} of the lead-though opening 20. Each of the leading elements 28 is connected to the circular inner circumference of the lead-through opening 20 via a base 28a while a point 28b of the leading elements 28 is directed towards the middle axis M_{20} of the lead-through opening 20 superimposed upon a middle axis M_4 of the electrical line 4. The point 28b enhances the malleability of the leading elements 28 and thereby facilitates centering the electrical line 4 or the stripped-off end section 40 thereof and thus the tip 41 in the lead-through opening 20.

[0033] Figs. 6a-h each show the wire organizer 1 in a schematic perspective view from an unassembled state U in Fig. 6a over a first pre-assembled state P_1' in Fig. 6b to a fifth pre-assembled state P_5 in Fig. 6h. In Fig. 6a, one of the electrical lines 4 is arranged below the organizer body 2 with its middle axis M_4 aligned with the middle axis M_{20} of the first lead-through opening 20 in the row of the lead-through openings. In Fig. 6b, the electrical line 4 is inserted into the lead-through opening 20 in a first step of a pre-assembled state P_1'. In Fig. 6c, a second electrical line 4 is inserted into the lead-through opening 20 next to the first lead-through opening 20 in a second step of a pre-assembled state P_1". In Fig. 6d, in a third step of a pre-assembled state P_1"', one of the clamping elements 3 is arranged such that its middle axis M_3 is aligned with the middle axis M_{21} of the shaft 21 connect-

ing the lead-through openings 20 accommodating the two electrical lines 4 inserted therein. In Fig. 6e, in a first pre-assembled state P_1, the clamping element 3 is inserted into the shaft 21 between the two lead-through openings 20 accommodating the first two electrical lines 4. Thereby, a first pair of electrical lines 4 is simultaneously fastened within the respective pair of lead-through openings 20 intersecting with the shaft 21 arranged therebetween.

[0034] In Fig. 6f, in a second step of a second pre-assembled state P_2", another pair of electrical lines 4 is inserted into the pair of lead-through openings 20 arranged next to the first pair of lead-through openings 20 already equipped with electrical lines 4 which are fastened by means of the first clamping element 3. In Fig. 6g, the second pair of electrical lines 4 is fastened within the second pair of lead-through openings 20 by means of a second clamping element 3, which, analogously to the first clamping element 3 sits between the first pair of electrical lines 4, is inserted into the shaft 21 arranged therebetween connecting the second pair of lead-through openings 20. In Fig. 6h, a fifth pre-assembled state P_5 is shown, wherein all five pairs of lead-through openings of the wire organizer body 5 are equipped with electrical lines 4 such that the wire organizer body holds ten electrical lines 4. Between each of the five pairs of lead-through openings 20 holding a pair of electrical lines 4, a clamping element 3 is inserted into the respective shafts 21 connecting the respective lead-through openings 20 to each other.

[0035] Fig. 7 shows a schematic perspective view of a number of clamping elements 3 which are linked to each other so as to form as a clamping unit 300 which may be easily manually or automatically applied in a method for fastening at least one electrical line 4 within the wire organizer 1, e.g. as described with reference to Figs. 6a-h above. In particular, five clamping elements 3, which may be distanced from each other in the longitudinal direction X, at the same distance as the shafts 21 of the organizer body 2, are linked to each other via a first and a second connecting part 35a and 35b, respectively. Each of the connecting parts 35a and 35b comprises a bar 36 extending in parallel to the longitudinal direction X and link sections 37 extending from the bar 36 in and against the height direction Z, respectively, such that the link section 37 links the respective bar 36 to the clamping element 3. The link sections 37 taper from the bar 36 towards the clamping element 3 such that a cross-section of the link section 37 near the clamping element 3 is smaller than a cross-section of the link section 37 at the bar 36. This enables the clamping elements 3 to be easily separated, e.g. broken off, from the connecting parts 35a and 35b. Further, the connecting parts 35a, 35b, in particular the bars are provided with studs 38 facilitating an alignment and handling of the clamping unit 300. An additional handling means 39 in the form of an eyelet formed at the connecting part 35a further facilitates handling and orientating the clamping unit 300.

[0036] Figs. 8, 9 and 10 show the clamping unit 300 illustrated in Fig. 7 in a schematic front view, a cross-sectional view along the cross-sectional line A-A depicted in Fig. 8, and a schematic top view, respectively. Here it becomes apparent that the clamping unit 300 is shaped mirror-symmetrically with respect to a plane extending in the middle of the connecting parts 35a and 35b i.e. in a plane extending in parallel to the longitudinal direction X and the height direction Z. Thereby, the clamping unit 300 and the clamping elements 3 therein may be applied in the clamping direction C and a counter-clamping direction C', running opposite to the clamping direction C, which further facilitates applying the clamping unit 300 and the clamping elements 3 therein.

[0037] Fig. 11 shows a schematic cross-sectional view of another embodiment of a wire organizer 1' according to the present invention in a cross-sectional plane extending through the middle axes M_{20} of the lead-through openings 20' of the wire organizer 1' in a plane extending in parallel to the longitudinal direction X and the height direction Z. The wire organizer 1' comprises two organizer bodies 2', a number of clamping elements 3', is equipped with electrical lines 4', and further comprises sealing elements 5', a contact block 6', contact elements 7' and housings 8a, 8b. In the fully assembled state F of the wire organizer 1', the electrical lines 4' are fastened within the lead-through openings 20' by means of the clamping elements 3' as described above with respect to the wire organizer 1. The opposing tips 41 of the stripped-off end sections 40 of the electrical lines 4 are electrically connected to each other by means of the contact elements 7 which are accommodated in a contact receptacle 60 of the contact blocks 6 extending essentially in parallel to the insertion direction I and thereby in parallel to the plug direction S as well as a counter plug direction S' running opposite to the plug direction S. The clamping block 6' is sandwiched between the two organizer bodies 2'. The arrangement of the two organizer bodies 2' and the contact block 6' therebetween is protectively held within the housings 8a, 8b and sealed-up against the environment by the sealing elements 5', each arranged between the respective organizer body and the housing 8a, 8b, thereby forming a so-called family seal. The electrical lines 4 enter the housings 8a, 8b through respective passages 80 formed therein, which are aligned to the lead-through openings 20' of the organizer bodies 2'.

[0038] Figs. 12a-h show the wire organizer 1' in schematic perspective views illustrating the steps of pre-assembling and combining the parts of the wire organizer 1' until it has reached a fully assembled state F and a fully mated position K. Fig. 12a shows the organizer body 2' fully equipped with electrical lines 4 and clamping elements 3 in the fully assembled state F. In a first combined state Q_1 shown in Fig. 12b, the organizing body 2' is provided with a sealing element 5'. In a first step of a second combined state Q_2 shown in Fig. 12c, the contact block 6 is positioned with respect to one of the contact

elements 7 such that the contact element 7 may be inserted into one of the ten contact receptacles 60 of the contact block 6 in or against the insertion direction I and the counter insertion direction I'. In Fig. 12d, a cross-sectional view of the contact block 6 along the middle axis M_{60} of the contact receptacles 60 and the middle axis M_7 of the contact elements 7 is illustrated. Each of the ten contact receptacles 60 is equipped with a contact element.

[0039] In a first step of a third combined state Q_3' illustrated in Fig. 12e, the contact block 6 fully equipped with contact elements 7 is arranged above the housing 8b accommodating the organizer body 2' such that the contact block 6 may be inserted into a receptacle 86b of the housing opening against the plug direction S. In Fig. 12f, the contact block 6 is fully inserted into the receptacle 86b of the housing 8b. The wire organizer 2', the housing 8b and the contact block 6 thereby form a female plug element 100b ready to be mated with a plug element 100a in the counter-plug direction S'. Fig. 12g shows the plug element 100a and the counter-plug element 100b in a pre-mated position J where they are ready to be mated by being plugged together in the plug direction S or counter-plug direction S', respectively. The housing 8a is provided with a receptacle 86a, which is designed to receive a plug portion 81 of the housing 8b, i.e. the plug element 100b. Fig. 12h shows the plug element 100a and the counter-plug element 100b in the fully mated position K, i.e. the wire organizer 1' in a fifth or final combined state Q_5 with both its organizer bodies 2' in the fully assembled states F. The family sealing element 5' seals up between the receptacle 86a of the plug element 100a and the plug portion 81 of the counter-plug element 100b, while the further sealing elements 5' between the back sides of the organizer bodies 2' and the bottoms of the respective receptacles 86a and 86b provide that a connecting region of the electrical lines 4 within the contact block 6 is protected against moisture or other harmful environmental influences such as corrosive liquids or gases.

[0040] Fig. 13 shows a schematic perspective view of a contact element 7 according to an embodiment of the present invention. The contact element may be formed as a single metal piece of e.g. stamped and bent sheet metal. The contact element 7 has an interior 70 which is surrounded by two wall portions 71 at lateral sides of the contact element 7 and is surrounded by two bottoms 72 facing in and against the plug direction S, respectively. A plug opening 33 is formed in each of the bottoms 72. Through the plug openings 33, the end sections 40 of two electrical lines 4 may be inserted in the plug direction S and the counter-plug direction S', respectively, such that the end sections 40 are received in the interior 70. The wall portions 71 are provided with sinusoidal bends 74 and are mirror-symmetrically shaped with respect to the middle axis M_7 of the contact element 7 in such a way that two contact regions 75 distanced from each other along the plug direction S are formed. The end section 40 may be accommodated within these contact regions 75 so that peaks 76 of the bends 74 opposing each other with respect to the middle axis M_7 electrically contact the respective end section 40 arranged between the opposing peaks 76 such that the contact element 7 electrically overrides a distance between the tips 41 of opposing electrical lines 4 in the plug direction S. In other words, the contact element 7 thereby serves as a sort of bridge or jumper in order to electrically connect the end sections 40 of opposing electrical lines 4 to each other.

[0041] Fig. 14 shows a schematic perspective view of another embodiment of a contact element 7' according to the present invention. The contact element 7' is shaped as a U-profile with bends 74' formed in its opposing side-walls. Analogously to the contact element 7', these bends provide two contact regions 75' distanced from each other in the plug direction S. In the plug direction S and the counter-plug direction S', the contact regions 75' with peaks 76' are accessible through plug openings 73' at the ends of the contact element 7'.

[0042] Fig. 15 shows the contact element 7' received in one of the contact receptacles 60 of the contact block 6. The tips 41 of the electrical lines 4 are opposing each other. In each of the contact regions 75', the end section 40 of an electrical line 4 is electrically contacted by the peaks 76' opposing each other. Contact forces between the bends 74' and the end section 40 are supported via the wall portions 71' at opposing inner walls 61 of the contact receptacle 60. Further, it becomes apparent in Fig. 15 that the contact element 7' is mirror-symmetrically shaped with respect to its middle axis $M_{7'}$.

[0043] Fig. 16 shows another embodiment of a contact element 7" according to the present invention in a schematic perspective view. The contact element 7" is shaped as a U-profile with bends 74" formed as tongue-like contact springs in opposing wall portions 71" of the contact element 7". The opposing bends 74" define contact regions 75" with peaks 76" between each other.

[0044] Fig. 17 shows the contact element 7" received in a contact receptacle 60 of the contact block 6 in a schematic cross-sectional view along the middle axis $M_{7"}$ of the contact element 7". The peaks 76" of the bends 74" electrically contact the stripped-off end sections 40 of the two electrical lines 4, the tips 41 of which oppose each other. Like in the embodiment shown in Fig. 15, contact forces acting between the peaks 76" and the electrical line 4 perpendicularly to the plug direction S, i.e. in and against the longitudinal direction X are supported via the side walls 71" or the contact element 7" at the inner walls 61 of the contact receptacle 60.

[0045] Deviations from the above-described embodiments of a wire organizer 1,1' according to the present invention are possible within the inventive idea. The wire organizer 1,1' may comprise organizer bodies 2, 2', clamping elements 3, electrical lines 4, contact blocks 6, contact elements 7 and housings 8a, 8b in any number and form desired in order to be able to organize and attach electrical lines 4 within an electronic component, on

a PCB or in order to form plug elements 100a, 100b.

[0046] The organizer body 2, 2' may have lead-through openings 20, 20', shafts 21, intersections 22, 22a-22d, back sides 23, front sides 24, lateral sides 25, receptacles 26, beams 27, leading elements 28, bases 28a, points 28b, and rims 29 in any number and form desired according to a certain application.

[0047] The clamping element 3 may comprise clamping blocks 30a, 30b, bridges 31, grooves 32, ribs 33, cavities 34, connecting parts 35a, 35b, bars 36, link sections 37, studs 38, and handling means 39, which may combined in clamping units 300 in any number and form desired for a certain application.

[0048] The electrical lines 4 may have end sections 40, tips 41 and sheaths 42 in any number and form desired for a certain application. Stripped end sections 40 may be tinned and/or compacted wires or preassembled wires with final wire sleeves.

[0049] The sealing elements 5, 5' may be formed and arranged as desired in order to seal-up a wire organizer 1, 1' as required for a certain application.

[0050] The contact block 6 may have contact receptacles 60 with inner walls 61 in any number and form desired for receiving contact elements 7 according to the requirements of a certain application.

[0051] The contact elements 7, 7', 7" may have an interior 70, 70', 70", wall portions 71, 71', 71", bottoms 72, 72', 72", plug openings 73, 73', 73", bends 74, 74', 74", contact regions 75, 75, 75" and peaks 76, 76', 76" in order to electrically contact an end section 40 or tip 41 of an electrical line 4 at as many contact points as desired for a certain application.

[0052] The electrical line 4, i.e. its end section 40 and/or tip 41 may at one side of the contact element 7, 7', 7" e.g. at one of the contact regions 75, 75', 75" be connected to the contact element 7, 7', 7" by welding, soldering, crimping, etc. in a firmly bonded, force-fitted, frictionally engaged and/or positive-fit manner. Further features for absorbing shock and vibration may be added to the contact element 7, 7', 7" which may be produced from stamped sheet material or any other desired manufacturing technique or material.

[0053] The housings 8a, 8b may be provided with passages 80, plug portions 81, receptacles 86a and 86b in any number and form required by a certain application.

Reference Signs

[0054]

1, 1'	wire organizer
100a	plug element
100b	counter-plug element
2, 2'	organizer body
20, 20'	lead-through opening
20a	end region
21	shaft
22	intersection
22a-22d	intersection
23	back side
24	front side
25	lateral side
26	receptacle
27	beam
28	leading elements
28a	base of leading element
28b	point of leading element
29	rim
3	clamping element
30a, 30b	clamping block
31	bridge
32	groove
33	rib
34	cavity
35a, 35b	connecting part
36	bar
37	link section
38	stud
39	handling means
300	clamping unit
4	electrical line
40	end section
41	tip
42	sheath
5, 5'	sealing element
6	contact block
60	contact receptacle
61	inner wall of contact receptacle
7	contact element
70, 70', 70"	interior
71, 71', 71"	wall portion
72, 72', 72"	bottoms
73, 73', 73"	plug opening
74, 74', 74"	bend
75, 75', 75"	contact region
76, 76', 76"	peak
8a, 8b	housing
80	passage
81	plug portion
86a	receptacle/cavity
86b	receptacle/cavity
P_1'	first step of first pre-assembled state
P_1"	second step of first pre-assembled state
P_1"'	third step of first pre-assembled state
P_1	first pre-assembled state
P_2	second pre-assembled state
P_3	third pre-assembled state
P_4	fourth pre-assembled state
P_5	fifth pre-assembled state

Q_1	first combined state
Q_2	second combined state
Q_3	third combined state
Q_4	fourth combined state
Q_5	fifth combined state
F	fully assembled state
F_c	clamping force
J	pre-mated position
K	fully mated position
M_{20}	middle axis of lead-through opening
M_{21}	middle axis of shaft
M_3	middle axis of clamping element
M_4	middle axis of electrical line
M_{60}	middle axis of contact receptacle
M_7	middle axis of contact element

I'	counter-insertion direction
I	insertion direction
C, C'	clamping direction
D	fastening direction
S	plug direction
S'	counter-plug direction

X	longitudinal direction
Y	transverse direction
Z	height direction

Claims

1. Organizer body (2, 2') for holding at least one electrical line (4) in a wire organizer (1, 1'), the organizer body (2, 2') comprising at least one lead-through opening (20, 20') extending from a back side (23) to a front side (24) of the organizer body (2, 2') in a insertion direction (I, I') for leading the electrical line (4) from the back side (23) to the front side (24), **characterized in that** the at least one lead-through opening (20, 20') is at least partly laterally intersecting with a shaft (21) adapted for receiving a clamping element (3).

2. Organizer body (2, 2') according to claim 1 above, **characterized in that** the shaft (21) opens against a clamping direction (C) extending transversely to the insertion direction (I, I').

3. Organizer body (2, 2') according to claim 1 or 2 above, **characterized in that** the organizer body (2, 2') comprises at least one further lead-through opening (20, 20') intersecting with the at least one shaft (21).

4. Organizer body (2, 2') according to claim 3 above, **characterized in that** that the at least one shaft (21) is arranged between the at least two lead-through openings (20, 20').

5. Organizer body (2, 2') according to one of claims 1 to 4 above, **characterized in that** the at least one lead-through opening (20, 20') intersects with the at least one shaft (21) at least two intersections (22, 22a-22d) distanced from each other along the insertion direction (I).

6. Organizer body (2, 2') according to one of claims 1 to 5 above, **characterized in that** the at least one shaft (21) is mirror-symmetrically shaped with respect to a plane extending in parallel to the insertion direction (I) and the clamping direction (C).

7. Organizer body (2, 2') according to one of claims 1 to 6 above, **characterized in that** malleable leading elements (28) are extending essentially in parallel to the insertion direction (I') within the at least one lead-through opening (20, 20') at least in the vicinity of the front side (24).

8. Organizer body (2, 2') according to claim 7 above, **characterized in that** the leading elements (28) are arranged concentrically with respect to a middle axis (M_{20}) of the at least one lead-through opening (20, 20') extending in parallel to the insertion direction (I).

9. Clamping element (3) for clamping at least one electrical line (4) within an organizing body (2, 2') of a wire organizer (1, 1'), **characterized in that** the clamping element (3) formed complementary to the at least one shaft (21) of the organizer body (2, 2') according to at least one of claims 1 to 8 above.

10. Clamping element (3) according to claim 9 above, **characterized in that** the clamping element (3) and at least one further clamping element (3) are connected to each other by at least one connecting part (35a, 35b).

11. Clamping element (3) according to at least one of claims 9 or 10 above, **characterized in that** the clamping element (3) comprises at least one clamping block (30a, 30b) from which at least one rib (33) extending in parallel to the clamping direction (C) protrudes.

12. Construction kit for a wire organizer (1, 1'), comprising at least one organizer body (2, 2') according to one of claims 1 to 8 and at least one clamping element (3) according to at least one of claims 9 to 11 above.

13. Construction kit according to claim 12 above, **characterized in that** the construction kit further comprises at least one of a housing (8a, 8b) providing a cavity for accommodating the at least one organizer body (2, 2'), a sealing element (5, 5') for sealing up between the housing (8a, 8b) and the organizer body

(2, 2'), and a contact block (6) adapted to accommodate contact elements (7) for electrically connecting a tip (41) of an electrical line (4) held in the organizer body (2, 2') to a tip of another electrical line (4) held in another organizer body (2, 2').

14. Wire organizer (1, 1') for holding at least one electrical line (4), comprising an organizer body (2, 2') according to at least one of claims 1 to 8 above and at least one clamping element (3) according to at least one of claims 9 to 11 above, wherein at least one electrical line (4) enters the lead-through opening (20, 20') at the back side (23) and exits the lead-through opening (20, 20') at the front side (24), and wherein the at least one clamping element (3) is received within the shaft (21) and fastens the at least one electrical line (4).

15. Method for fastening at least one electrical line (4) within a wire organizer (1, 1'), the method comprising the steps of introducing the at least one electrical line (4) in an insertion direction (I) into a lead-through opening (20, 20') of an organizer body (2, 2') of the wire organizer (1, 1'), such that the at least one electrical line (4) enters the lead-through opening (20, 20') at a back side (23) of the wire organizer (1, 1') and exits the lead-through opening (20, 20') at a front side (24) of the wire organizer (1, 1'), **characterized in that** the method further comprises the step of introducing in a clamping direction (C) extending transversely to the insertion direction (I) a clamping element (3) into a shaft (21) of the organizer body (2, 2'), such that the clamping element (3) fastens the at least one electrical line (4, 4') within the lead-through opening (20, 20') at an intersection (22, 22a-22d) of the lead-through opening (20, 20') and the shaft (21).

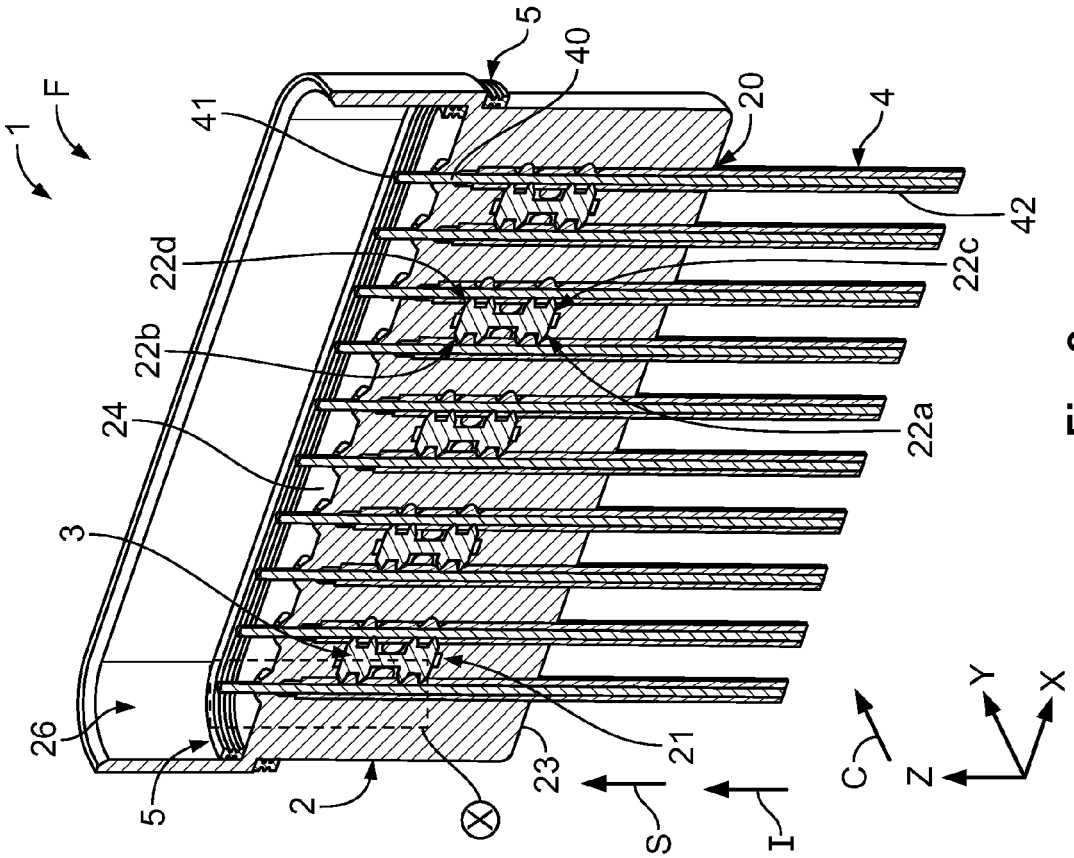

1
F
5
40
41
20
4
42
22d
22c
22b
22a
24
3
26
5
2
23
21
S
I
C
Z
Y
X

Fig. 2

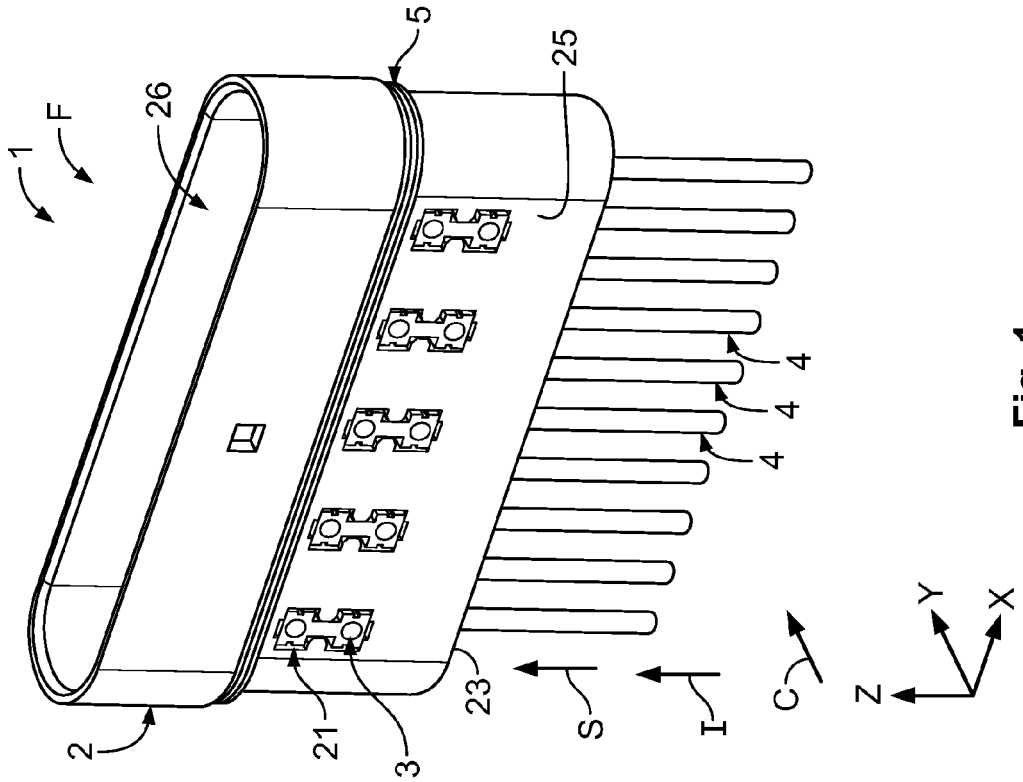

1
F
26
5
25
4
4
4
2
21
3
23
S
I
C
Z
Y
X

Fig. 1

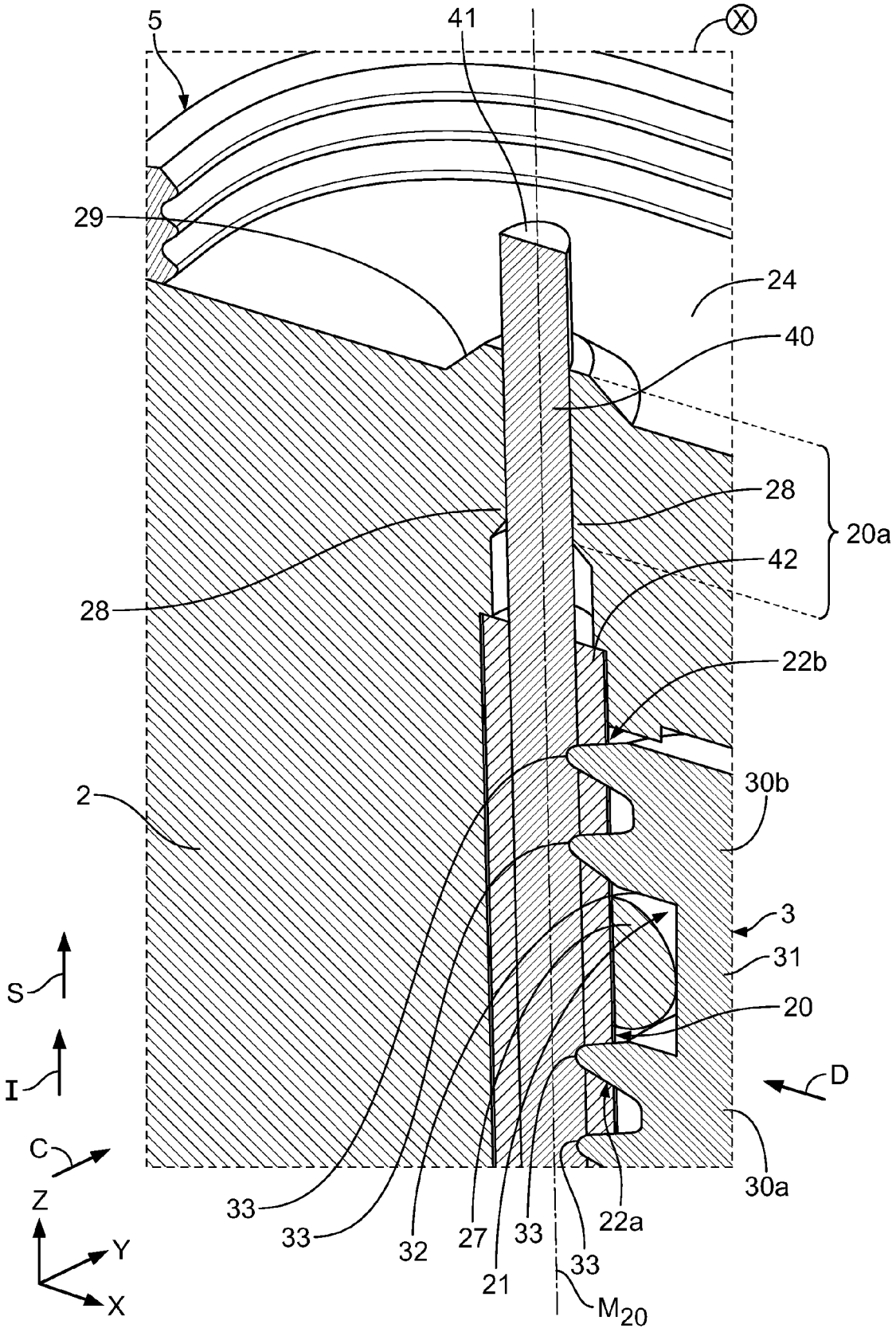
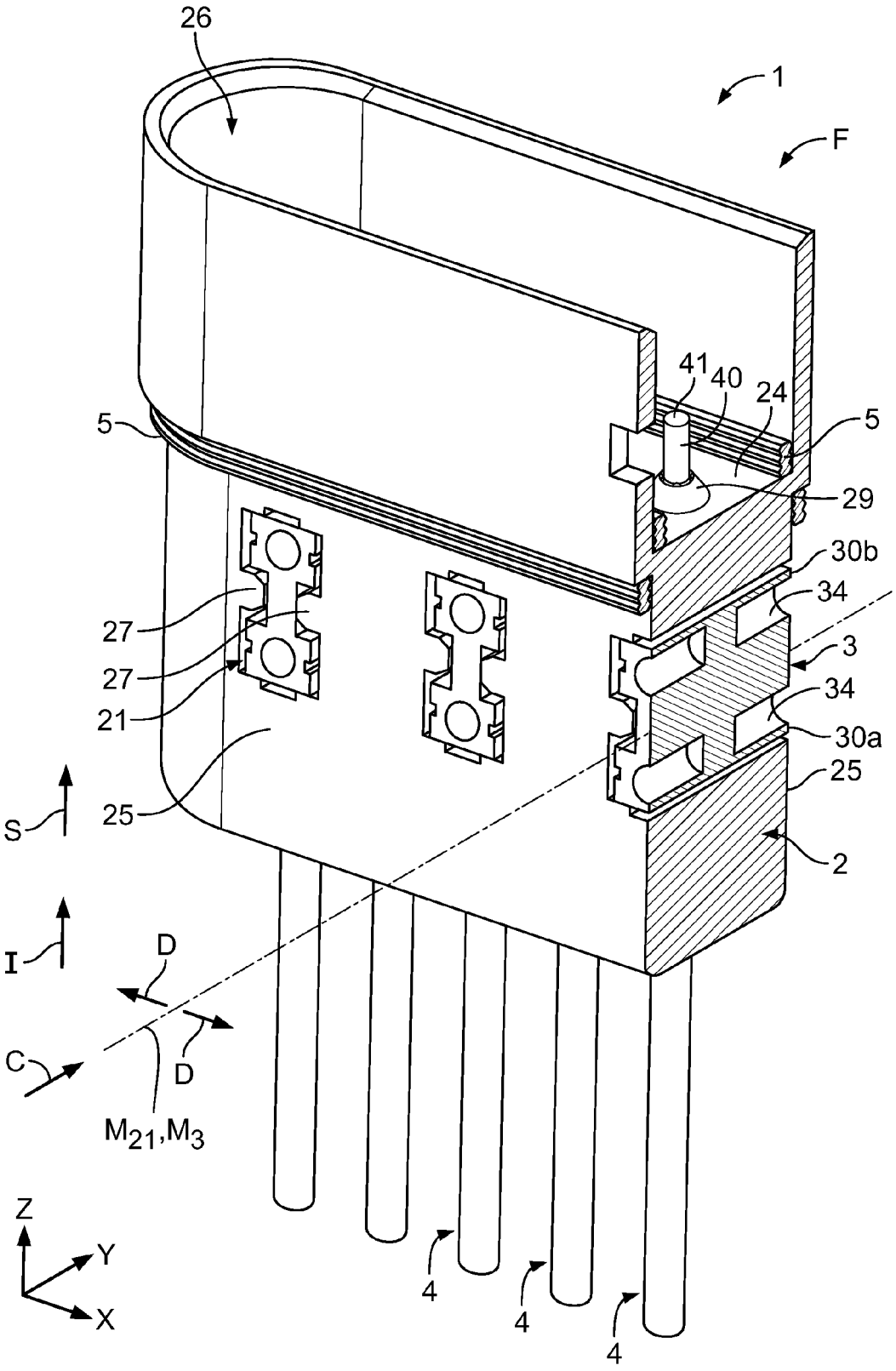

5
41
X
29
24
40
28
20a
42
28
22b
2
30b
3
31
20
D
30a
S
I
C
Z
Y
X
33
33
32
27
33
22a
33
21
M_{20}

Fig. 3


26
1
F
41
40
24
5
5
29
30b
34
27
27
21
3
34
30a
25
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S
2
I
D
C
D
M_{21},M_3
Z
Y
X
4
4
4

Fig. 4

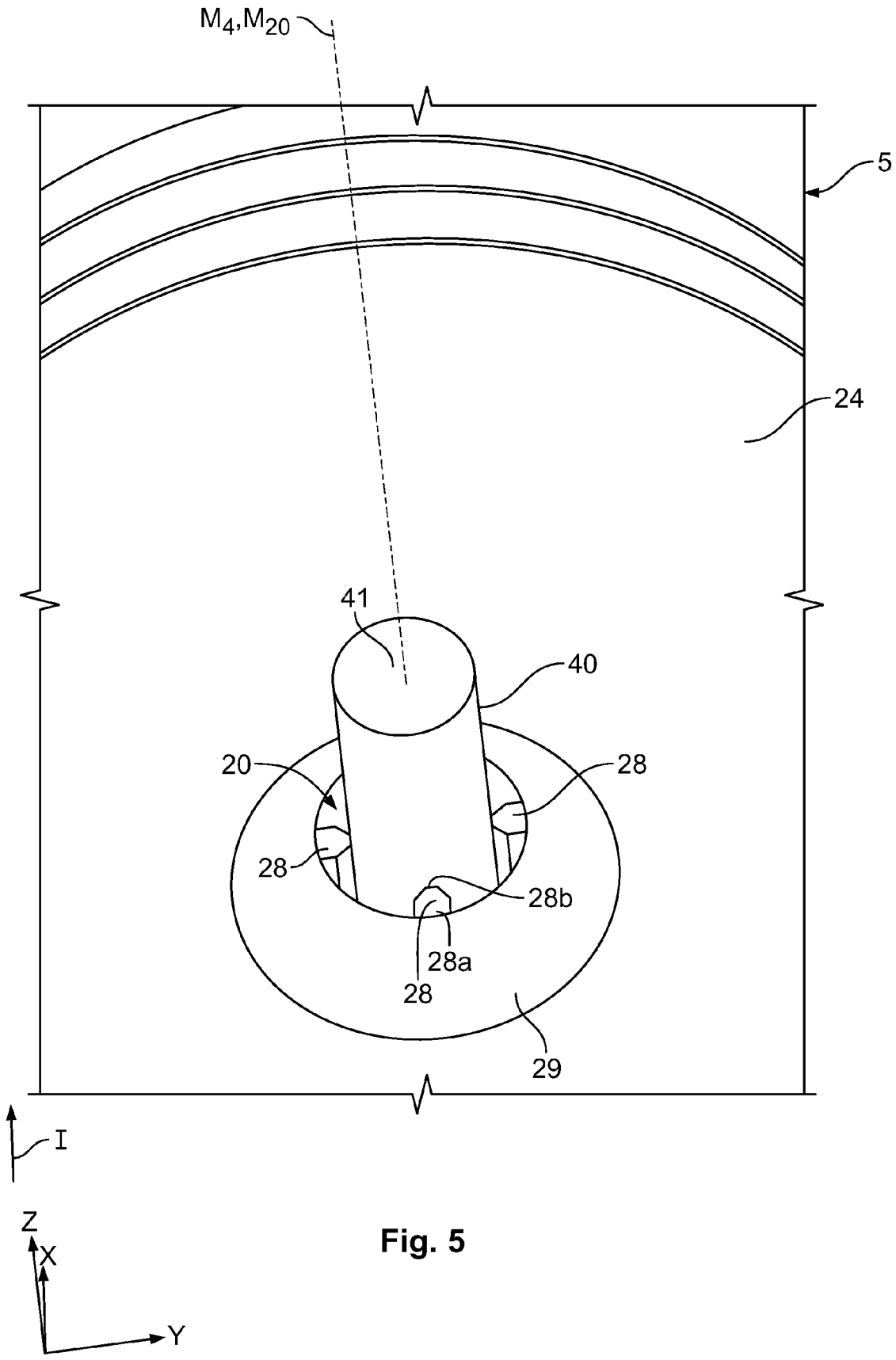

Fig. 5

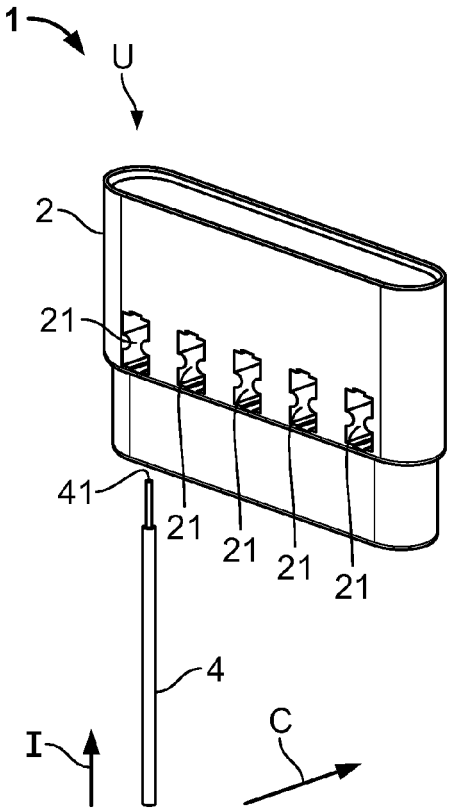

Fig. 6a

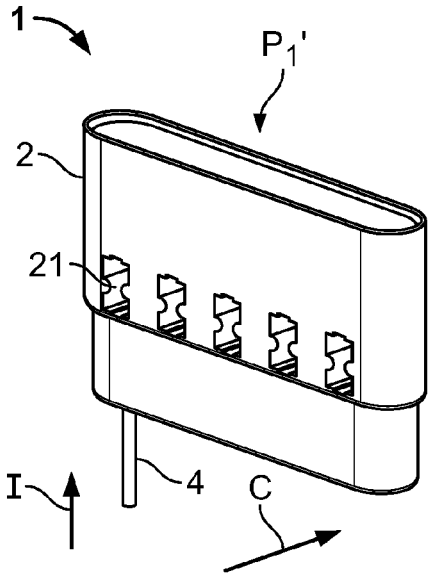

Fig. 6b

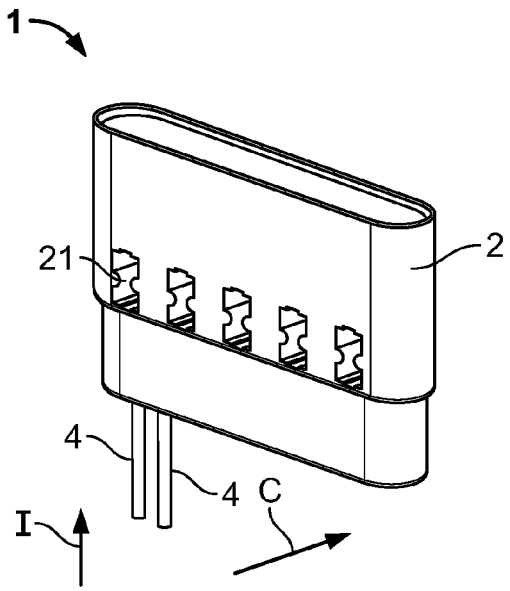

Fig. 6c

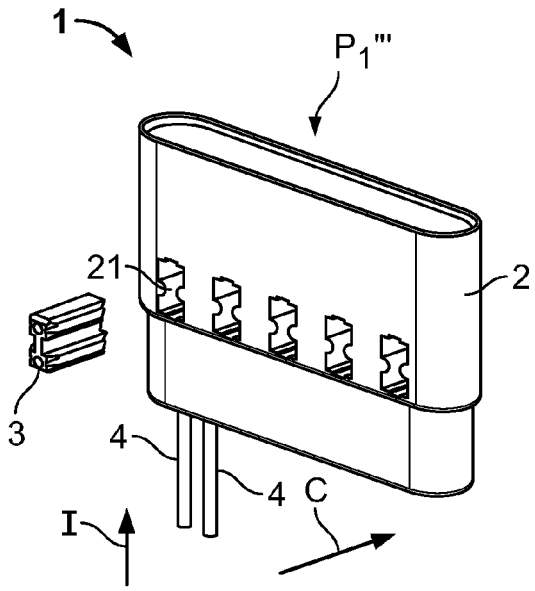

Fig. 6d

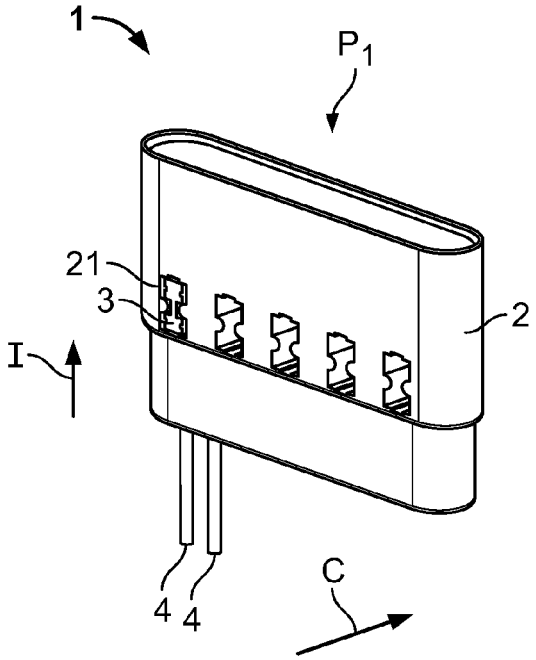

Fig. 6e

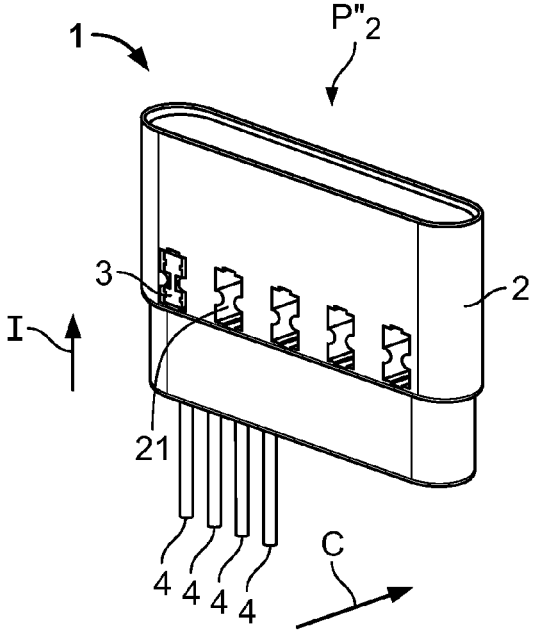

Fig. 6f

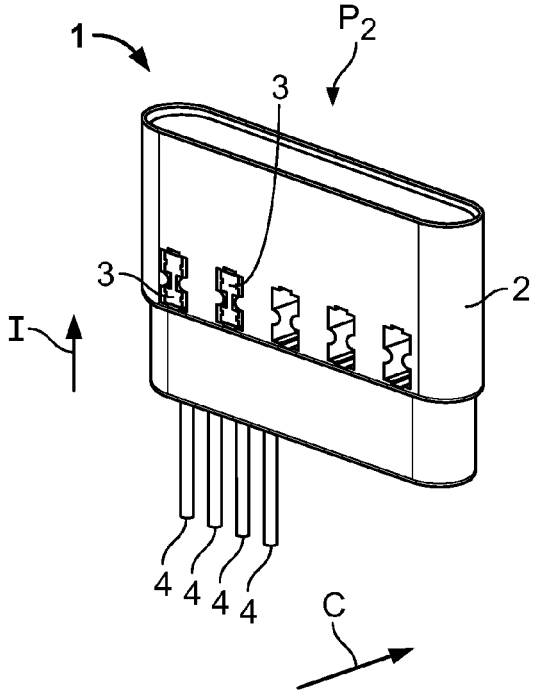

Fig. 6g

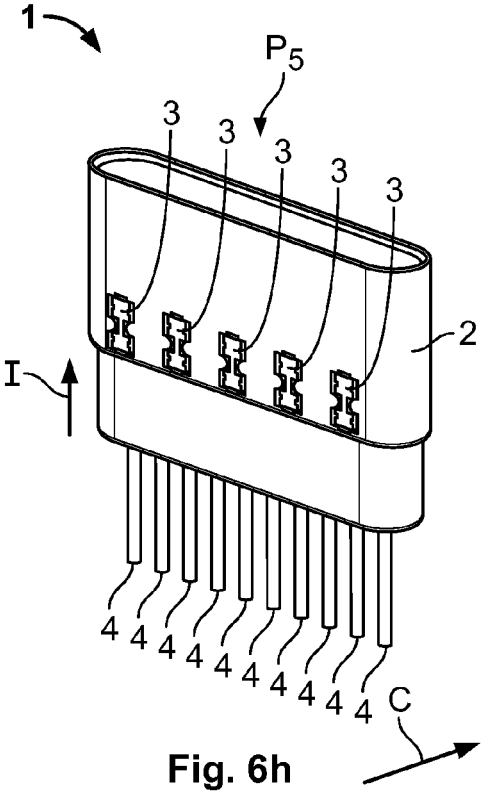

Fig. 6h

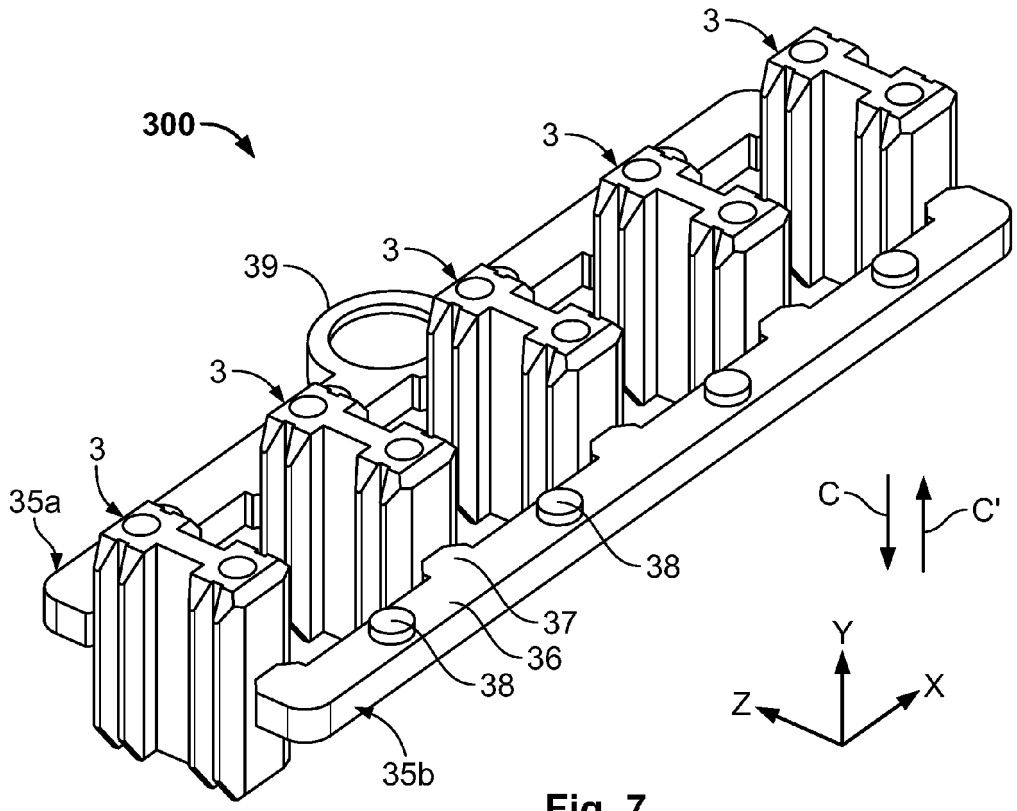

Fig. 7

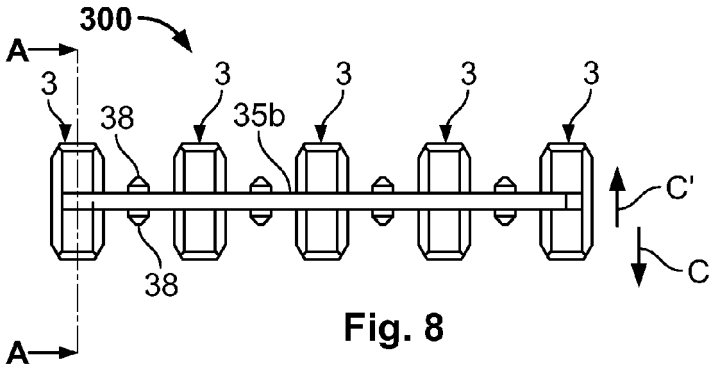

Fig. 8

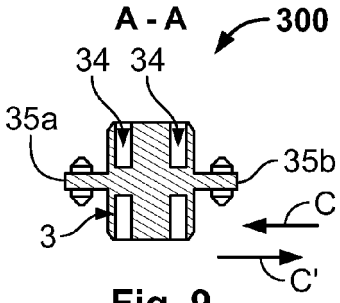

Fig. 9

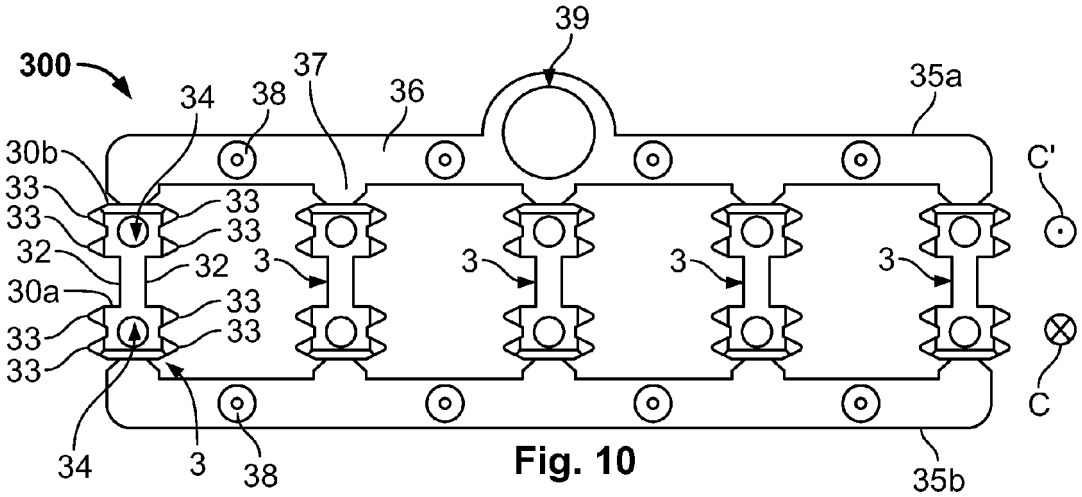

Fig. 10

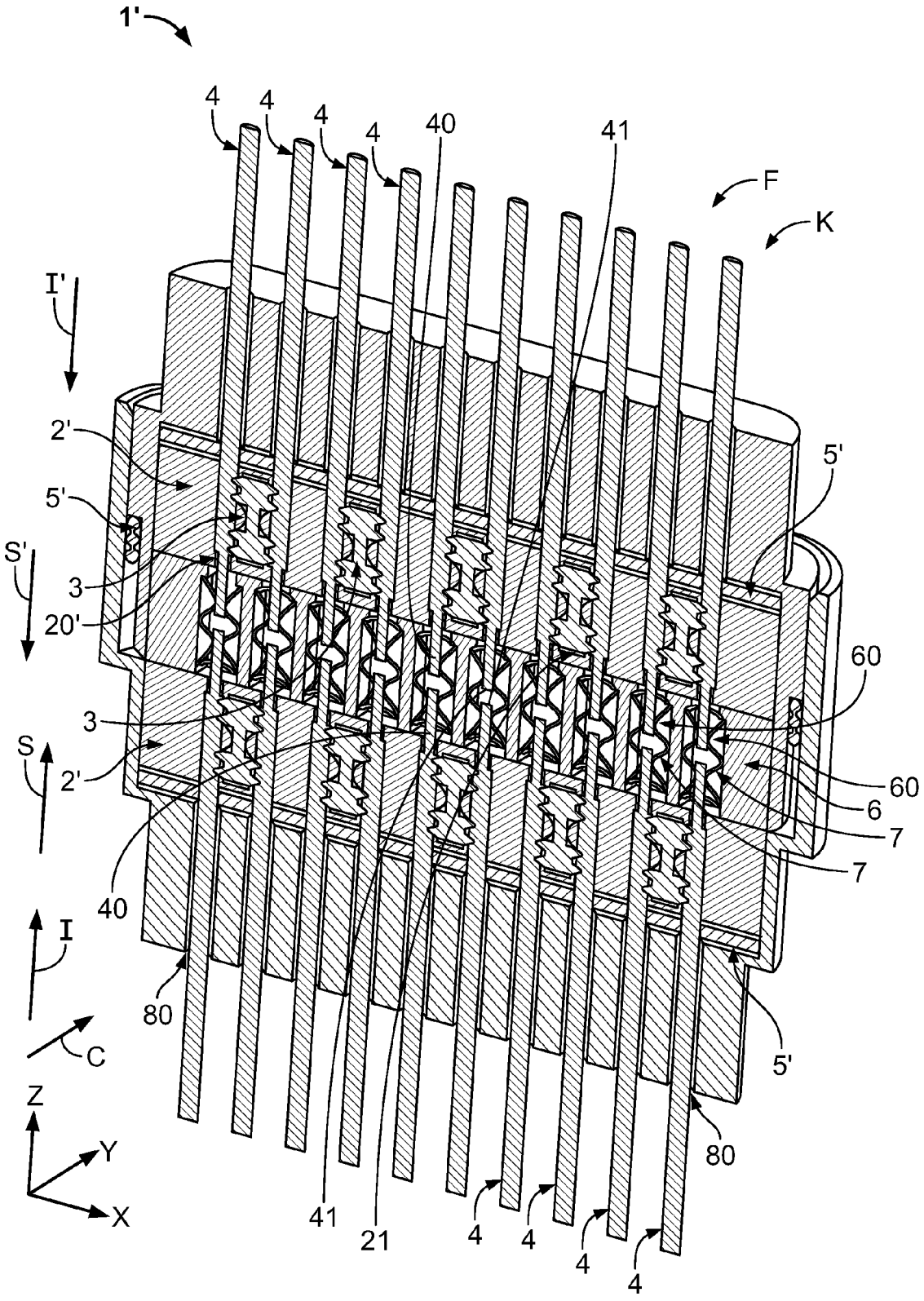

Fig. 11

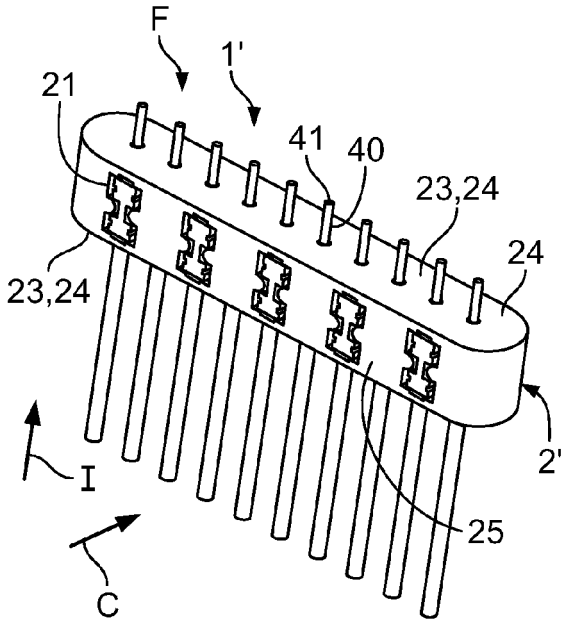

Fig. 12a

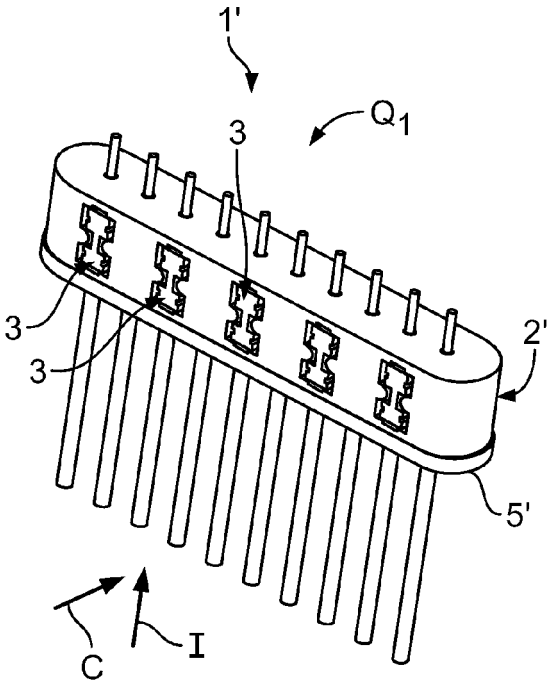

Fig. 12b

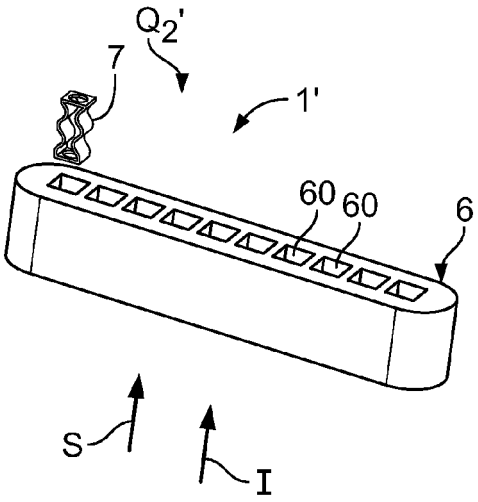

Fig. 12c

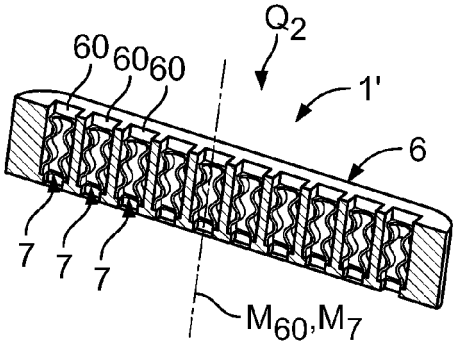

Fig. 12d

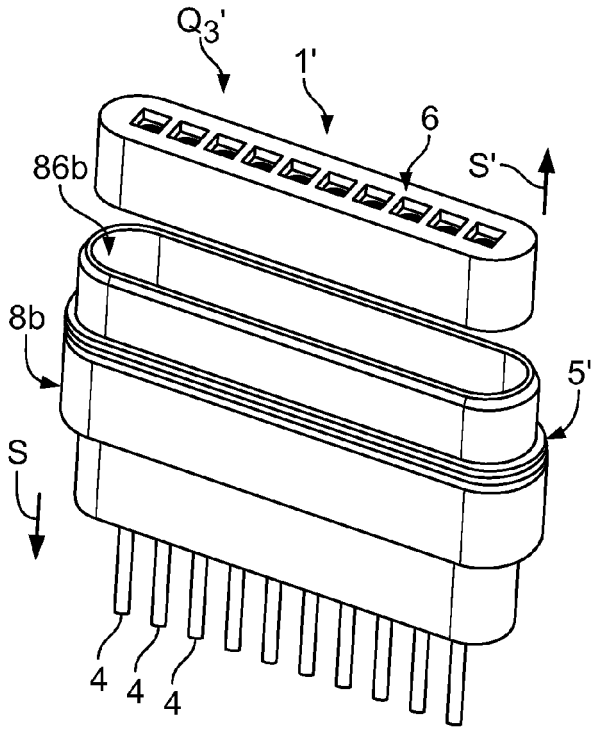

Fig. 12e

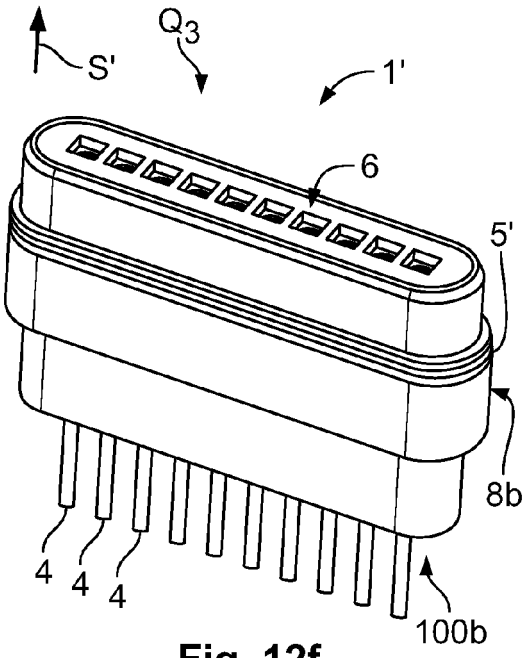

Fig. 12f

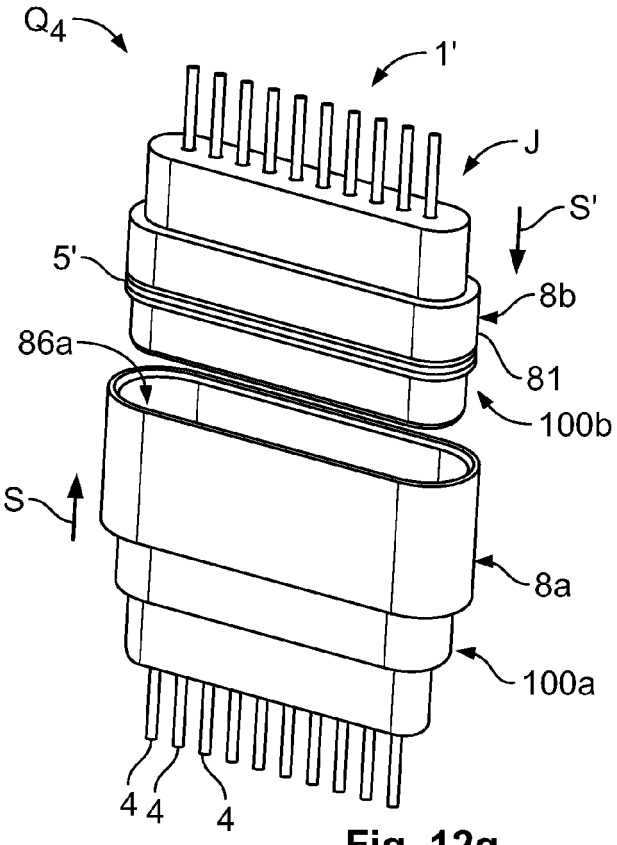

Fig. 12g

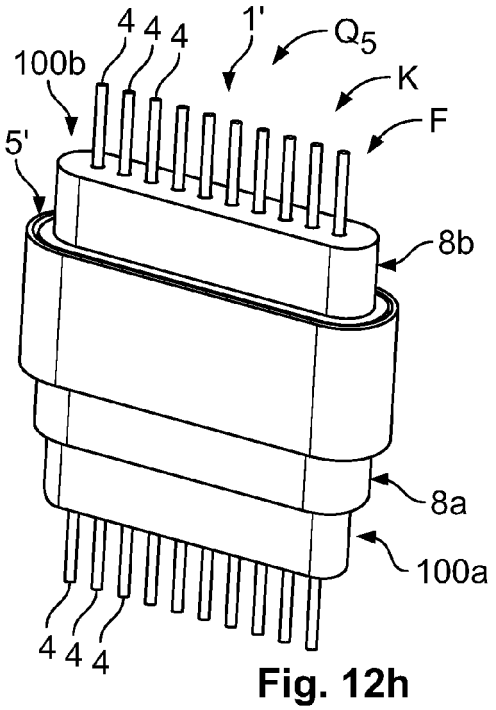

Fig. 12h

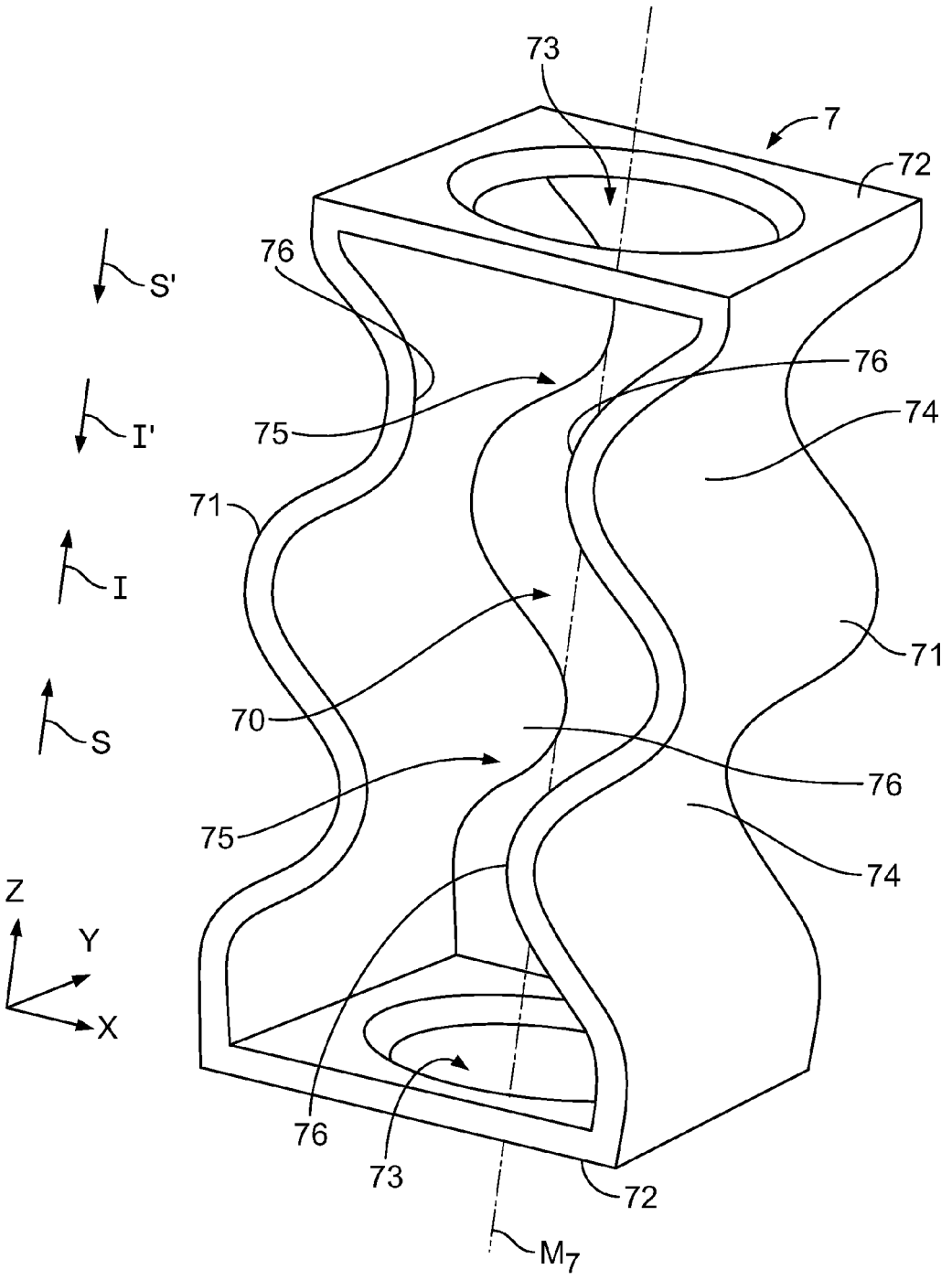

Fig. 13

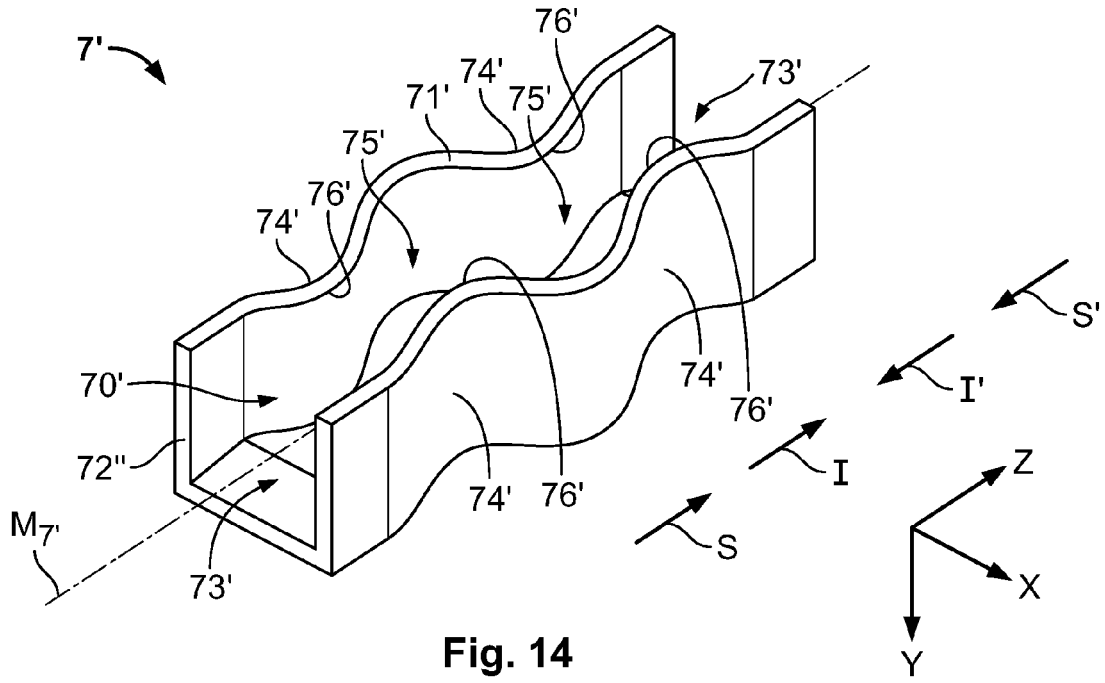
7'
76'
74'
71'
75'
73'
75'
76'
74'
70'
72"
$M_{7'}$
73'
74'
76'
74'
76'
S'
I'
I
S
Z
X
Y

Fig. 14

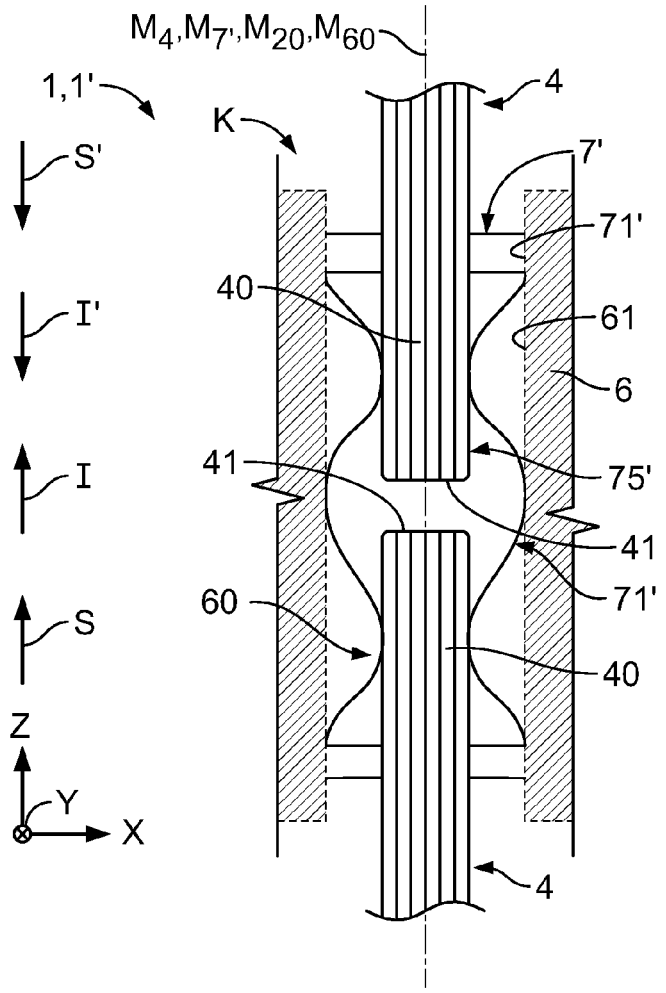
$M_4,M_{7'},M_{20},M_{60}$
1,1'
K
4
S'
7'
71'
I'
40
61
6
I
41
75'
41
S
60
71'
40
Z
Y
X
4

Fig. 15

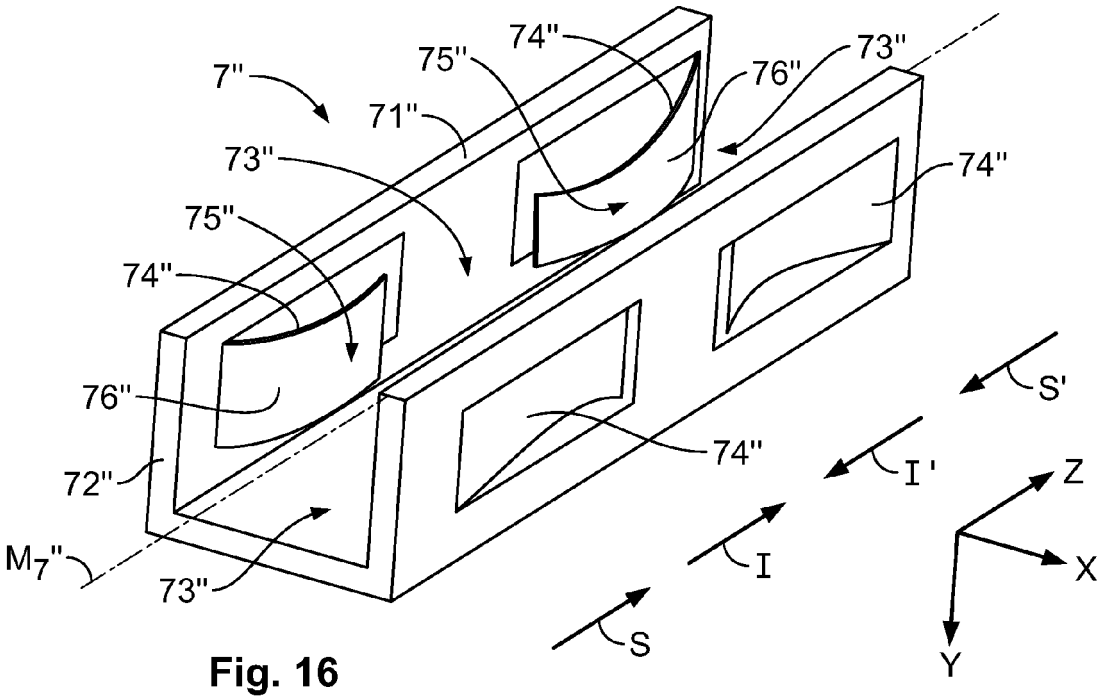
7"
71"
73"
74"
75"
76"
72"
M7"
S'
I'
I
S
Z
X
Y

Fig. 16

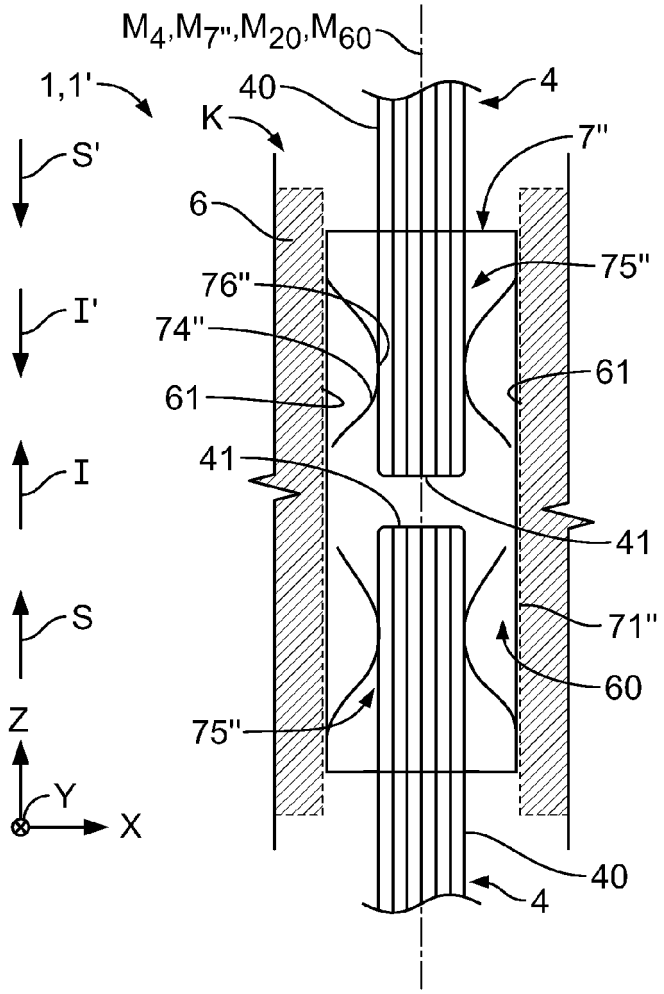
M4,M7",M20,M60
1,1'
K
40
4
7"
S'
6
I'
76"
74"
75"
61
41
I
S
71"
60
Z
Y
X

Fig. 17

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 14 18 8813

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 4 879 810 A (SERGEANT RONALD G [US] ET AL) 14 November 1989 (1989-11-14) * column 3, line 41 - column 5, line 25 * * figures 1-8 * -----	1-3,5-9, 11-15 4,10	INV. H01R13/52 H01R13/58 H01R11/09 H01R11/01
Y	US 2006/189184 A1 (ONUMA MASANORI [JP]) 24 August 2006 (2006-08-24) * figures 4, 6A, 6B * -----	4,10	

TECHNICAL FIELDS SEARCHED (IPC)
H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 February 2015	Henrich, Jean-Pascal

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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D : document cited in the application
L : document cited for other reasons
.....
& : member of the same patent family, corresponding document

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