(19) DANMARK

(10) DK/EP 3545595 T3

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: ***H 02 G 3/22 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2024-07-22**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2024-07-03**

(86) Europæisk ansøgning nr.: **17804892.2**

(86) Europæisk indleveringsdag: **2017-11-27**

(87) Den europæiske ansøgnings publiceringsdag: **2019-10-02**

(86) International ansøgning nr.: **EP2017080484**

(87) Internationalt publikationsnr.: **WO2018096136**

(30) Prioritet: **2016-11-25 DE 102016223425**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

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(54) Benævnelse: **KABELGENNEMFØRING MED EN DELBAR RAMME**

(56) Fremdragne publikationer:
DE-A1- 3 610 353
DE-U1-202015 102 280
US-A- 1 133 976
DE-U1- 202015 102 280

Cable leadthrough with a divisible frame

The invention relates to a cable leadthrough with a divisible frame of the type defined in more detail in the preamble of claim 1.

Such cable leadthroughs or cable holders are used to group and hold a number of cables or other strands that are inserted into bushings. The frame can be divided and is U-shaped, for example. It therefore has two side strips and a longitudinal strip connecting the two. A second longitudinal strip or a second U-shaped frame as a cover closes the structure. Partition walls are provided inside the frame, between which the grommets are held. The grommets that can be accommodated in the frame have at least one hole for a cable to pass through. The grommets are made of elastic material. The individual grommet often has a slit so that the grommet can be folded open or spread out in order to easily insert the cable. This also makes it possible to insert cables that are already fitted with plugs. The grommets fitted with cables are then inserted into the interior of the frame and fill it. The frame is then closed with the cover. This exerts pressure on the grommets so that all of the grommets fitted with cables are pressed inside the frame, creating a good seal.

WO 01/42046 A2 shows such a structure with two-part or multi-part frames which can be locked by screwing. EP 2 746 634 A1 shows frames that can be locked by clipping. A similar structure is also described in WO 2014/180993 A1. A further variant of this is also described in DE 10 2011 001 868 A1.

US 2 417 260 describes a similar embodiment, from which a cover can be seen which rests on one leg of the U-shaped frame and is firmly connected to the leg by a screw. In the assembled state, the grommets are again clamped in place with the cables inserted in them.

Furthermore, WO 2016/0177364 A1 shows a wall feed-through arrangement for several cables. This arrangement has a frame which cannot be divided in the plane transverse to the running direction of the cables, in which the grommets are inserted into an existing cross-shaped or double-cross-shaped element consisting of individual partitions. The inserted cables, together with the grommets and the double-cross-shaped element, are then pushed into the non-divisible frame in the direction in which the cables run. The frame is then closed with a split end cover, again in the running direction of the inserted cables. This is extremely complex to assemble.

An essentially similar technique is also known from DE 10 2007 060 100 A1. Here, individual elements are inserted into an undivided frame in the running direction of the cables and are clipped to the frame. In this way, the cover required in the WO publication mentioned above to close the frame in the direction in which the cables run can be dispensed with.

A disadvantage in most prior art publications is the fact that the individual frames or the crosses or double crosses inserted in the running direction of the cables must be manufactured to match the grommets used. If different grommets are to be used during installation, for example when installing on a control cabinet that is set up on site, the fitter must carry a large number of different frames or crosses or double crosses with him in order to be able to meet the respective requirements for installing the cable leadthrough. This involves considerable effort in terms of logistics for the fitter. As the parts are typically manufactured by injection molding, production also involves considerable effort and high costs, as it is known that expensive tools are required to produce injection molded parts. If a large number of individual injection-molded parts need to be produced, the tool costs are very high and the frames produced are correspondingly expensive.

Another cable holder in which grommets for the cables are clamped between two plates is known from US 1,133,976. Further prior art can also be found in DE 36 10 353 A1.

The invention is based on the object of designing a cable leadthrough according to claim 1 in such a way that it is even easier and more efficient to install.

This object is solved with a cable leadthrough according to claim 1.

Advantageous designs and further developments result from the subclaims dependent thereon.

The cable leadthrough according to the invention provides a divisible frame comprising at least two longitudinal strips and at least two side strips, comparable to the structures in the prior art. The longitudinal strips and side strips together span a plane which is perpendicular to the direction in which the cables run. There are separating elements between the longitudinal strips, at least one of which forms an intermediate space between itself and the adjacent separating element or one of the side strips. This intermediate space is designed to accommodate at least one

grommet, which is known from the prior art. This grommet, which is usually made of elastic material and has at least one hole for a cable to pass through, can also be provided with a slot between the hole and the edge circumference so that it can be opened up in order to insert the cable easily and efficiently and, in particular, to accommodate pre-assembled cables with plugs.

In practice, these grommets are available as elements quasi-standardized to their grid dimension. This makes it possible to use different grommets within one frame. Until now, this has required frames with differently arranged separating elements. In order to remedy this problem, it is provided according to the invention that each of the longitudinal strips now has a plurality of holes or recesses on at least its side facing the respective other longitudinal strip. Each separating element corresponds at least in the region of at least one of its front ends with the holes or recesses in the longitudinal strips, so that the separating elements can be inserted into the holes or recesses transversely to the direction in which the cables run.

One or more of the separating elements can therefore be inserted into the frame, which previously did not have to have any separating elements, in the cable leadthrough designed according to the invention. The separating elements can then be inserted into the holes or recesses at an angle in one direction or preferably parallel to the side strips in the longitudinal strips. Due to the large number of holes or recesses, it is possible to arrange the separating elements at different positions in relation to the width of the frame, i.e. at different distances from each other or from the side rails of the divided frame. In this way, the intermediate spaces between the separating elements and/or a separating element and the side strips can be adapted on site during assembly so that the corresponding grommets can be reliably accommodated. To do this, the worker only has to carry the frame and a certain number of separating elements with him, which are, however, in principle all the same or, according to an advantageous further development of the idea, of different lengths. With just a few individual parts, practically any assembly task and the accommodation of different types of grommets in the cable leadthrough can be accomplished very easily and efficiently on site.

In accordance with the invention, the separating elements have a waisted design in the running direction of the inserted cables with at least one recess. These are thus correspondingly waisted, for example by providing a double-T-shaped profile of the separating elements. Other variants such as a double cross-shaped profile or similar

are also conceivable. This results in a form-fit connection with the grommets designed with a comparable profile in addition to pressing the material of the elastic grommets onto the separating elements, so that secure strain relief of the grommets is guaranteed while at the same time ensuring a high level of tightness of the structure. Alternatively, the separating elements can also be bulged. They then also offer the option of making positive contact with the individual grommets. Bulged separating elements positioned centrally on the respective longitudinal strip in the running direction of the inserted cables also allow the material of the grommets to largely surround the separating elements and lie against each other with a minimal gap or in contact with each other, which ensures a very high level of sealing of the structure, as the seal can then be created predominantly by the elastic material of the grommets.

A very favorable design of the cable leadthrough provides for each separating element to be provided with pins or insertion strips on at least one of its sides facing the longitudinal strips, which correspond in each case to the holes or recesses in the longitudinal strips. As an alternative to inserting the entire separating element into the corresponding recess or hole, the separating element can therefore also have pins or insertion strips so that the separating element can be inserted into the holes or recesses with these pins or insertion strips. This typically results in the actual end faces, which carry the pins or insertion strips, resting against the longitudinal strip, so that reliable positioning of the height of the separating element is ensured regardless of the depth of the hole or recess.

According to an advantageous further development of the idea, it is provided that the holes or recesses in the longitudinal strips are designed in such a way that material of the longitudinal strip remains between the holes or recesses and both outer edges of the longitudinal strip in the running direction of the cable. The holes are therefore positioned within the material of the longitudinal strip or the recesses are designed in the form of grooves, for example, which are not open at the edges. This ensures that the separating elements can only be inserted in the direction of insertion at right angles to the running direction of the cables. On the one hand, the holes and recesses that are not open at the edges allow the structure to be sealed very well, so that the opening provided for the cable leadthrough, for example the opening in the wall of a control cabinet, is reliably sealed by the frame with inserted grommets pressed into the frame. On the other hand, the holes or recesses, which are not open at the edges in both directions, also provide good strain relief,

especially if the grommets, as is generally known and customary, rest against the side strips and the separating elements via a positive fit, so that strain relief is provided via the grommets at the same time. In contrast to the structures of the prior art, the recesses and holes that are not open at the edges reliably guarantee that no movement of the separating elements can occur in the running direction of the cables, i.e. in their axial direction.

Another very advantageous design of the cable leadthrough is that the holes are designed as blind holes or the recesses are designed as recesses that do not pass through the material of the longitudinal strip. This ensures that the structure remains sealed transverse to the running direction of the cable and that its sealing is not critical due to continuous grooves, holes or the like.

Another very advantageous design of the cable leadthrough provides that the geometric dimensions or the shape of the corresponding end faces, pins and holes or insertion strips and recesses are designed in such a way that the inserted separating elements have a tight fit in one of the longitudinal strips. This design, for example by selecting the dimensions so that there is a tight fit in the sense of an interference fit, enables a good seal on the one hand and on the other hand allows the separating elements to be inserted into one of the longitudinal strips and the grommets and cables to be inserted into this structure later without the risk of the separating elements coming loose again from their inserted position during assembly, which would considerably increase the assembly effort. In the other of the longitudinal strips, the separating elements then have a loose fit in the sense of a clearance fit. This ensures that when one longitudinal strip is loosened, for example to remove some of the mounted cables, the separating elements remain in the other longitudinal strip via the tight fit, so that the structure can also be easily dismantled and reassembled without the "inner workings" of the frame falling out during assembly.

According to a further very favorable design thereof, it can be additionally or alternatively provided that the tight fit is achieved via sealing elements which, in addition to the mechanical fixation during assembly, ensure a corresponding seal, which is a further advantage with regard to the tightness of the overall structure.

An extraordinarily favorable further development of the idea further provides that intermediate bases are provided between the side strips or between two of the

separating elements or between one of the side strips and one of the separating elements. Such intermediate bases can, for example, be inserted loosely in order to create additional stability in the width when the frame is fitted with the grommets and to distribute the pressure applied to the grommets when closing the frame evenly over all the grommets, so that a very good seal can be achieved.

According to a very advantageous further development thereof, it is provided in particular that intermediate bases between two of the separating elements or between one of the side strips and one of the separating elements are designed in such a way that they interact positively with the separating elements or the separating elements and the side strips, at least in the running direction of the inserted cables. This means that they cannot be pulled out of the mounted frame in the running direction of the cables and thus also ideally support the requirements on the frame with regard to strain relief for the inserted cables.

A further design can also provide that the intermediate bases are formed between the side strips. In this case, the intermediate bases are ideally firmly connected to the side rails or, in particular, are made in one piece with them. They then form an intermediate frame which can be inserted, for example, between a U-shaped lower frame part and a U-shaped frame cover, and as is known in principle from the above-mentioned WO 01/42046 A2, for example from Figs. 9/10. In the variant according to the invention, recesses or holes are then provided in the intermediate base, which now forms a kind of further longitudinal strip, at least on the two opposite sides facing the respective other longitudinal strips, in order to be able to insert separating elements here as well and to complete the structure of the frame in the sense according to the invention.

Furthermore, according to an advantageous further development, the separating elements can have a seal on their end face provided with the pins or insertion strips. This not only guarantees the tightness between the pins and the holes or the insertion strips and the recesses, but also between the separating elements and the longitudinal strip, so that this results in a further advantage with regard to the sealing of the structure, which can also achieve correspondingly high tightnesses, for example protection class IP65 and more.

In principle, the cable leadthrough with its divisible frame can be designed in such a way that it is constructed with two or three longitudinal strips, for example, which

are connected to each other via four or six side strips. The longitudinal strips and side strips can therefore be provided as individual components so that the frame is only actually assembled on site during installation. According to an exceptionally favorable design, however, the cable leadthrough is designed in such a way that a side strip is provided on each of the longitudinal strips, so that the longitudinal strip and the side strip form an L or, alternatively, that one of the side strips is provided at each end of at least one of the longitudinal strips, so that the longitudinal side and the side strip form a U. The first structure is the variant in which a side strip and the longitudinal strip form an L. Two similar components can be joined together, for example by screwing or clipping. The alternative is to connect two U-shaped parts together, for example, which also allows the use of identical parts. It is also possible to provide a U-shaped frame, which is then closed with one of the longitudinal strips as a cover. In the different variants, for example the two U-shaped variants of the upper part of the frame and the lower part of the frame or the U-shaped upper part of the frame with a straight cover, further intermediate elements can be inserted with a longitudinal strip and legs, which would then be correspondingly H-shaped, U-shaped or, in the case of the L-shaped design of the individual parts of the frame, designed in the form of a horizontal Z with right-angled transitions between the side strips and the longitudinal strip.

Another very advantageous design of the idea is that the separating elements are of different heights. The separating elements can therefore be inserted and held at different heights. This makes it possible, for example, to insert two small grommets with a grid dimension of 1:1 next to each other and a larger grommet, for example with a grid dimension of 2:2 or 2:1, above them. In addition, this area can then be closed off using a correspondingly higher separating element with a grid dimension of 2 or 3 and further grommets can then be positioned next to it. In the advantageous design described above with the loosely inserted intermediate base, this area can be closed off at the top with the shorter separating element or, in the case of reverse installation, also at the bottom, preferably with such an intermediate base. In order to enable the use of one of the separating elements with a shorter height on the intermediate base, it can be provided that the intermediate base, according to an advantageous further development of the idea, has a plurality of recesses or holes on at least one side analogous to those of the longitudinal strips.

The different heights of separating elements therefore increase flexibility. Due to

the tight fit of the individual grommets in one of the longitudinal strips, this is normally sufficient to ensure sufficient stability, given a corresponding depth of the end face of the grommet and the longitudinal strip, viewed in the running direction of the inserted cables, even if an upper end face of a shortened separating element only rests in the area of another grommet or a flat intermediate base and is not inserted into a recess or the holes in the upper longitudinal strip. An intermediate base provided with recesses or holes naturally offers further advantages here.

According to a very advantageous further development, it is provided that the separating elements with a height corresponding to the internal height of the frame have pins or insertion strips on both end faces, and that the separating elements with a shorter height have pins or insertion strips on only one of the end faces. This means that the shorter separating elements are flat on their side that is not connected to the longitudinal strip via insertion and thus ensure a sufficient seal when they come into contact with the underside or upper side of one of the grommets or a flat intermediate base.

According to an advantageous further development of the invention, in the case of waisted separating elements, it may be provided that the separating elements are provided with an elastic sealing material in at least one of the recesses of their waisted section. The separating elements themselves can therefore also have a sealing material. This can be advantageous, for example, if the grommets are not made of elastic material but of correspondingly stronger materials. In particular, it can also be advantageous if a certain number of grommets are inserted into the frame according to the grid dimension. If, for example, the frame is intended for a grid dimension of 5 in width and provides for the insertion of four separating elements in the normal case, so that each grid can be covered with a grommet with a grid dimension of 1:1, then in practice it can happen that when using, for example, two grommets with a grid dimension of 2:2 and one grommet with a grid dimension of 1:1, for example, installation space remains in the width of the frame, as this is intended for the use of four individual separating elements in the overall width, whereas now only two separating elements have been used. In this case, the overall width can be completely filled again very easily and efficiently by using two separating elements arranged directly next to each other, without having to provide special grommets or special separating elements. In this case, it is particularly advantageous if the separating elements are provided with elastic sealing material in a recess of their waist. This elastic sealing material can be provided directly on

the separating elements, for example by injection molding during the manufacturing process. However, it can also be applied very easily and efficiently during assembly by the fitter on site using a sealing tape glued into the recess of the waist. The adjacent separating elements then also ensure adequate sealing in the area where they are in direct contact, similar to the areas where the separating elements are in contact with the elastic grommets. This further increases the flexibility of the structure and ensures a high level of sealing of the overall structure in every installation situation.

A further very advantageous design of the separating elements can also provide that each of the separating elements is formed from at least two individual elements in the direction of travel of the inserted cables. Instead of the double T-shaped profile described above, only two individual elements, for example rectangular bars or round rods, can also be used as separating elements. The advantage over a single separating element, which could also be designed as a round bar according to the last described embodiment variant, for example, is that the forces applied for the strain relief and the seal are divided between two separate areas, so that the forces are applied more evenly to the longitudinal strips and thus to the cable leadthrough itself.

In principle, it is conceivable that the separating elements could be used at an angle, for example, to accommodate angled grommets for special applications. In practice, however, this will play a subordinate role. Rather, it is a decisive advantage here if the separating elements extend parallel to the side strips, which in turn are perpendicular to the longitudinal strips. All in all, this results in a structure with components that are perpendicular to each other when assembled, which is correspondingly easy to assemble and when using prefabricated separating elements and grommets.

The legs can be screwed together or clipped to one of the longitudinal strips as a cover, as is already known from the aforementioned prior art.

It is also conceivable, e.g. for very wide frames, to provide at least one fixed separating element in addition to the plug-in separating elements, e.g. in the form of a central partition wall. This can then support a screw connection, for example, so that a high level of stability and tightness is made possible by a strong and very uniform compression of the grommets.

Further advantageous designs and further developments of the cable leadthrough according to the invention also result from the remaining dependent subclaims and become clear with reference to the exemplary embodiment, which is described in more detail below with reference to the figures, which show in detail as follows:

Fig. 1 shows a cable leadthrough according to the prior art in a three-dimensional view.

Fig. 2 shows a cable leadthrough according to the prior art in an alternative embodiment in the closed state.

Fig. 3 shows a cable leadthrough according to the prior art in a further alternative embodiment.

Fig. 4 shows a perspective view of an embodiment of a cable holder according to the invention.

Fig. 5 shows a side view of the object in Fig. 2.

Fig. 6 shows a plan view of the object in Fig. 2.

Fig. 7 shows a sectional view along the sectional line VII-VII in Fig. 5.

Fig. 8 shows an alternative design in perspective view.

Fig. 9 shows the structure similar to the sectional view in Fig. 7 using the alternative embodiment of Fig. 8.

Fig. 10 shows a section of one of the longitudinal strips of an alternative embodiment variant with an attached two-part separating element.

Fig. 11 shows a sectional view in principle according to line XI-XI in Fig. 10.

Fig. 12 shows a sectional view in principle according to line XII-XII in Fig. 15 with a further alternative embodiment of the separating element.

Fig. 13 shows a sectional view in principle according to line XII-XII in Fig. 15 with yet another alternative embodiment of the separating element.

Fig. 14 shows a first mounting option for the cable leadthrough in perspective view.

Fig. 15 shows an alternative embodiment variant similar to that in Fig. 14, but in a front view.

Fig. 16 shows a further embodiment variant similar to that in Fig. 15 with a different frame structure.

Fig. 17 shows a further alternative embodiment variant analogous to that in Fig. 15.

Fig. 18 shows yet another alternative embodiment variant analogous to that shown in Figs. 15 and 17.

Fig. 19 shows a sectional view in principle according to line XIX-XIX in Figs. 17 and 18 without grommets.

The illustration in Fig. 1 shows a three-dimensional view of a cable leadthrough 100 according to the prior art. In the exemplary embodiment shown here, this has a split frame with a lower frame part 1 and a cover 2. The lower frame part 1 consists of a longitudinal strip 1.3 and two side strips 1.1 and 1.2. The cover 2 of the frame practically forms a second longitudinal strip 2.3. Between the side strips 1.1 and 1.2, a partition wall 30 can be seen in the U-shaped lower frame part 1, which in this exemplary embodiment of the prior art is designed in one piece with the lower frame part 1 and is accordingly firmly connected to the longitudinal strip 1.3. Between the partition wall 30 and the respective side strips 1.1 and 1.2 are intermediate spaces which, in the exemplary embodiment shown here, are each provided with grommets 4, namely a total of ten individual grommets 4. Partition walls 30 with smaller dimensions are also arranged between the pairs of grommets 4 stacked on top of each other, extending parallel to the partition wall 30. However, these are difficult to recognize in the illustration in Fig. 1.

Each grommet 4 has a through-hole 4.2, in which the cables 5 running through the cable leadthrough 100 are accommodated accordingly. Only some of the grommets 4 and cables 5 are marked with reference signs.

The illustration in Fig. 2 shows another structure known from the prior art. Unlike

the structure in Fig. 1, only two of the grommets 4 are shown as examples in the illustration in Fig. 2. Therefore, each of the partition walls 30 is recognizable here. It can also be seen that the grommets 4 each have a through-hole 4.2 to accommodate the cable. In addition, a slot labeled 4.1 can be seen between the through-hole 4 and the outer circumference of the respective grommet 4. This allows the grommet 4 to be opened in such a way that cables 5 with connectors can also be easily and efficiently inserted into the through-hole 4.2 of the grommet 4. In the embodiment variant shown in Fig. 2, the cover 2 as one of the longitudinal strips 2.3 of the frame is not screwed on as in the illustration in Fig. 1, but is clipped on. This structure is also known from the prior art. The running direction L of the cables passing through the cable leadthrough 100 extends vertically in the plane of the sheet in the illustration in Fig. 2.

In the illustration in Fig. 3, a further embodiment variant from the prior art can be seen, which is essentially analogous to that in Fig. 1. In contrast to the illustration there, no cables 5 and grommets 4 are shown here. Instead, a lower frame part 1 is shown, in which the side strips 1.1 and 1.2 essentially form a U with the longitudinal strip 1.3 without taking into account the partition walls 30. The cover 2 is designed in the same way here and also essentially forms an inverted U with its side strips 2.1 and 2.2. In addition, unlike the structure in Fig. 1, an intermediate frame part 20 can be seen in the structure, which, if the partition walls 30 are not taken into account, is essentially an H-shaped component made up of two side strips 20.1, 20.2 and a longitudinal strip 20.3, which could also be described as an intermediate base 11. This structure is also known from the prior art mentioned at the beginning.

In the illustration of Fig. 4, the lower frame part 1 of a cable leadthrough 200 according to the invention is shown. The lower frame part 1 is U-shaped and again has, preferably in one piece, the longitudinal strip 1.3 at the bottom and the side strips 1.1 and 1.2 standing vertically on the sides. A cover 2, not shown here, as the second longitudinal strip 2.3 can, for example, be designed in a similar way to the longitudinal strip 1.3, but without the side strips 1.1 and 1.2. In the exemplary embodiment shown here in Fig. 4, this cover 2 is screwed to the lower frame part 1.

Two separating elements 3, 3' can be seen in the lower frame part 1. One separating element 3 has a greater height than the other separating element 3'.

The separating element 3 with the greater height has insertion strips 3.2 on both end faces 3.3, which are double-T-shaped in cross-section and chamfered on the side facing away from the end face 3.3. Corresponding to these insertion strips 3.2, the longitudinal strip 1.3 of the lower frame part 1 and, without being shown here, also the longitudinal strip 2.3 as cover 2, have recesses 6. As can be seen in the illustration in Fig. 4, a large number of these recesses 6 are arranged next to each other, so that the width of a gap Z, for example between the higher of the separating elements 3 and the side strip 1.2, can be varied accordingly by inserting the separating element 3 into various of the recesses 6.

The shorter separating element 3', which is not yet inserted into the recesses 6 and is shown on the left in Fig. 4, also has the insertion strip 3.2 on its one downward-facing end face 3.3. It is flat on its other end face 3.3, which is facing upwards in the illustration in Fig. 4. For reasons that will be explained in more detail later, this is advantageous for the separating elements 3', which are shorter than the overall height of the interior of the frame.

In the illustration in Fig. 5, the structure can be seen again in a side view, analogous to the illustration in Fig. 4, with the shorter separating element 3' not yet fully inserted. In the illustration in Fig. 6, the same structure can be seen again in a view from above. The individual recesses 6 in the area of the longitudinal strip 1.3 and the side strips 1.1 and 1.2 can also be seen here. The separating elements 3, 3' are each inserted and have the same depth in the running direction L of the cables 5 that are subsequently passed through as the two side strips 1.1 and 1.2. Fig. 7 shows a sectional view in principle through the longitudinal strip 1.3 with the separating element 3 inserted in accordance with line VII-VII in Fig. 5. 5. It can be seen here that the groove, which ultimately forms the recess 6, is designed in such a way that material of the longitudinal strip 1.3 remains around the recess 6 both in the running direction L of the cables 5, which are subsequently fed through, and in the height in the illustration of Fig. 6. This makes sealing easy and the grommets 4 used for strain relief of the cables 5 in the running direction L of the cables, which are ideally positively connected to the waisted profile of the separating elements 3, 3', transmit the forces of the strain relief via the separating elements 3, 3' to the material of the longitudinal strip 1.3 and thus ensure reliable strain relief. In the case of open-edged recesses 6, for example continuous grooves, this would not be possible.

As already mentioned, the insertion strips 3.2 are equipped with an essentially double-T-shaped profile. They are designed so that they sit tightly with their insertion strips 3.2 in the recesses 6 of the longitudinal strip 1.3, so that the separating elements 3, 3' cannot fall out during assembly when the grommets 4 with the cables 5 are inserted. The chamfer on the side of the insertion strips 3.2 facing away from the end face 3.3 enables easy and reliable insertion. The surfaces can be processed accordingly, for example roughened or provided with transverse grooves and/or sealing elements to support this tight fit. A tight fit is to be understood as a press-fit type fit, which is, however, designed in such a way that it can be plugged together by hand. On the other of the longitudinal strips 2.3, i.e. the cover 2 not shown here, a loose fit is preferable, for example in the form of a clearance fit, so that the insertion strips 3.2 are reliably accommodated in the recesses 6, but remain in the other of the insertion strips 1.3 with the tight fit in the event of renewed disassembly and the cover 2 can be removed without the separating elements 3, 3' getting stuck on it. This makes disassembly particularly easy, for example to replace individual grommets 4 and/or cables 5. Subsequent reassembly is then also simple and efficient.

An alternative embodiment, but essentially analogous to the illustration in Fig. 4, is shown in the illustration in Fig. 8. The cable leadthrough 200 can again be seen in a three-dimensional view, here also together with the cover 2 used as the second longitudinal strip 2.3. The first difference is that instead of the recesses 6, holes 7 are provided here, which interact accordingly with corresponding pins 3.1 on the separating elements 3, 3'.

Furthermore, an intermediate base marked 11 can be seen in the illustration in Fig. 8, which interacts positively with the waisted design of the leg 1.2 and one of the separating elements 3, 3' in the running direction L of the cable 5. This is explained and illustrated again later in the details of an assembly in Fig. 14. As shown here, the intermediate base 11 can be designed with smooth surfaces so that it interacts with the separating element 3' and its smooth end face 3.1, as already mentioned. It would be just as conceivable to provide the intermediate base 11 with recesses 6 or holes 7 in the same way as the longitudinal strips 1.3, 2.3, so that the separating elements 3, 3' could also be inserted into the intermediate base 11.

Fig. 9 again shows a sectional view in principle which is essentially analogous to that in Fig. 7, but for the embodiment variant of the cable leadthrough 200

according to Fig. 8. The holes 7 are preferably designed as blind holes, so that the material of the longitudinal strip 1.3 is located around the entire hole 7, thus creating a tight structure that is highly resilient in terms of strain relief, particularly in the running direction L of the inserted cables 5. In order to ensure a reliable seal between the longitudinal strip 1.3 and the separating element 3' - shorter in this case, for example - a seal can optionally be provided in the area of one end face 3.3 or, in the case of a long separating element 3, also in the area of both end faces 3.3. Such a seal is indicated in principle in the illustration in Fig. 9 and provided with the reference sign 8.

In the illustration in Fig. 10, a further embodiment variant can be seen in a section analogous to that in Fig. 6. Instead of the continuous recesses 6 in the form of a double-T-shaped groove, for example in the illustration in Fig. 6, and the holes 7 from the illustrations in Figs. 8 and 9, two recesses are provided here, which are in the form of rectangles with rounded edges, for example. Two separate individual elements 3.4 in the form of beams are inserted into these recesses 6, which together form the separating element 3, 3'. The separating element 3, 3' can therefore consist of two - or even more - parts in the running direction L of the inserted cables 5. The individual elements 3.4 of the separating element 3, which can be seen again in the sectional view in Fig. 11 along line XI-XI in Fig. 10, have neither insertion strips 3.2 nor pins 3.1. Instead, the rods 3.4 are designed so that they fit directly into the recesses 6 and can therefore be inserted with their front end directly into the recesses 6, which correspond to the shape of the individual elements, at least in the area of their front ends. This can also be transferred accordingly to integral separating elements 3 and 3', as shown in the previous figures. This makes the design of the separating elements 3, 3' in particular very simple, as they no longer need to have pins 3.1 or insertion strips 3.2. For example, in the design shown in Figs. 10 and 11, the use of simple, essentially rectangular beams as individual elements 3.4 is sufficient. Since the absence of the end faces 3.3 provided with the insertion strips 3.2 or pins 3.1 means that there is no possibility of a stop, the recesses 6 must all be made to the same depth so that they can form the stop on the end faces of the individual elements 3.4 of the separating element 3, 3' that now rest there.

Figs. 12 and 13 show further alternatives of separating elements 3, 3', which thus come to lie between two of the grommets 4 in each case and interact with them in a form-fit and, due to the elastic material of the grommets 4, in a friction-locking

manner. The grommets 4 largely enclose the entire contour of the separating elements 3, 3' so that they virtually disappear inside the respective grommet 4. This is a decisive advantage, particularly with regard to the different grid dimensions of the individual grommets 4 when equipping a frame with differently sized grommets 4, as with such a structure the width of the frame depends only on the grid dimensions of the grommets 4 and not also on the width and number of separating elements 3, 3'. The design of the separating element 3, 3' in the illustration in Fig. 12 is essentially bulbous, i.e. unlike the waisted design, it uses the same principles, but with a reversal of the shape between the grommet 4 and the separating element 3, 3'. The same applies to the very simply designed separating element 3, 3' in Fig. 13, which is only designed as a round rod and can be placed in a central hole 7 in the longitudinal strip 1.3 in the running direction L of the cable.

The illustration in Fig. 14 shows a first application example with an exemplary loading of the cable leadthrough 200 with a plurality of different grommets 4. The assembly variant shown here, wherein the cables 5 are not shown for reasons of clarity, again shows a U-shaped lower frame part 1 with a longitudinal strip 2.3 as cover 2. The cable leadthrough 200 as a whole is screwed to the wall 12 of an indicated switch cabinet via two lateral mounting holes 10 and screws arranged therein and thus seals an opening in the wall 12 of the switch cabinet, which is not visible here and through which the cables 5 not shown here, again inserted into the grommets 4, are to be routed. The assembled structure in the illustration in Fig. 14 shows a plurality of different types of grommets, including a so-called blind grommet 4', which does not have a through-hole. Two separating elements 3 with the internal height of the frame of the cable leadthrough 200 are inserted between the lower frame part 1 and the cover 2, and two separating elements 3' whose height is shortened to different degrees. One of the intermediate bases 11 is located above each of the shortened separating elements 3' before the next grommet 4 follows, in order to distribute the compressive forces as evenly as possible and to apply the most homogeneous forces possible to all grommets 4. This ensures that the structure of the cable leadthrough 200 is very well sealed.

The illustration in Fig. 15 shows another comparable structure in a pure plan view, here without the wall 12 of the switch cabinet. The structure should essentially use the separating elements 3, 3' as shown in Figs. 12 and 13. The individual grommets 4 are so close together that the separating elements 3, 3' between them are barely

visible, wherein the gap between the individual grommets 4 in the illustration in Fig. 15 is drawn even larger than in reality to improve the representation. These separating elements 3, 3' accommodated within the width of the grommets 4 make it possible to use a different number of separating elements 3, 3' within the cable leadthrough 200 without having to adjust the grid dimensions of the individual grommets 4 measured on the outside. The cover 2 and the lower frame part 1 can be screwed or clipped together, for example.

Fig. 16 shows a structure in which the lower frame part 1 with its two legs 1.1 and 1.2 and the longitudinal strip 1.3 form a U shape. The same applies to the cover 2 with its side strips 2.1 and 2.2 as well as its longitudinal strip 2.3. In between, as in the representation according to Fig. 3 from the prior art, there is an intermediate part 20 with its sides 20.1 and 20.2 as well as a further longitudinal strip 20.3, which is designed in one piece with the legs 20.1 and 20.2, and which has the corresponding possibilities for inserting the separating elements 3, 3' both at the top and at the bottom, or here also in the form of continuous recesses 6 or holes 7.

In the assembly variant of Fig. 16 below, two separating elements 3 are shown, each with a height over the entire height of the frame, as well as a shorter separating element 3', here the leftmost separating element 3' in Fig. 16. From right to left, the assembly is carried out in such a way that first a grommet 4 with the grid dimensions 2:2 is inserted, then a separating element 3, then two grommets 4 with the grid dimensions 1:1 on top of each other, then another separating element 3. In the lower area, there is again a grommet 4 with the grid dimension 1:1, a shortened separating element 3' and a further grommet 4 with the grid dimension 1:1. Above, in contact with the two grommets 4 and the end face 3.3 of the shortened separating element 3', there is a further grommet 4", which is designed to accommodate a flat cable, for example, and which exceptionally deviates from the grid dimension here, as its width also includes the width of one of the separating elements 3. The cable leadthrough 200 can then be screwed together with an optional additional sealing strip to the wall 12, not shown here, via lateral mounting holes 10 around an opening for feeding the cables 5 through, e.g. into the switch cabinet. In the upper half of the cable leadthrough 200 in Fig. 16, the same structure is mirrored again. In contrast to the illustration in Fig. 14, the intermediate bases 11 have been omitted or the further longitudinal strip 20.3 of the intermediate part 20 forms such an intermediate base 11. In the case of the shortened separating elements 3, 3' above and below, there are no

intermediate bases 11 here, which is also conceivable in principle.

Alternatively, the illustration in Fig. 17 shows a structure in which the grommet 4, marked 4" in Fig. 16, also remains within the grid dimension and has a grid dimension of 2:1. The remaining space is compensated for by a further shortened separating element 3', which is inserted into the cover 2 as a longitudinal strip 2.3 and which is positioned directly adjacent to the middle separating element 3. This additional use of a shortened separating element 3 lying directly next to the higher separating element 3' has the advantage that no grommets 4 are necessary, which deviate from the grid dimension, similar to the alternative shown in Fig. 15.

In the illustration in Fig. 17, a frame is also used, which has a U-shaped design for both the lower frame part 1 and the cover 2. In particular, the cover 2 and the lower frame part 1 can be designed as identical components, which are screwed or clipped together from top to bottom on one side and from bottom to top on the other side, for example. This saves further costs in production and toolmaking for the injection-molded lower frame parts 1 and cover 2, for example.

The illustration in Fig. 18 shows a further embodiment variant. This also differs again from the previous embodiment variants with regard to the lower frame part 1 and the cover 2, because both the lower frame part 1 and the cover 2 are essentially L-shaped here and thus the lower frame part carries the longitudinal strip 1.3 and a side strip 1.1, while the upper frame part, i.e. the cover 2, also carries a longitudinal strip 2.3 and a side strip 2.1.

From right to left, the structure is again initially equipped in the same way as the structure in Fig. 17. Then the two grommets 4 arranged one above the other with a 1:1 grid dimension are followed by two of the higher separating elements 3 and a further large grommet 4 with a 2:2 grid dimension, which has four through-holes 4.2 in the example shown here. Here too, it makes sense to place two separating elements 3 next to each other to compensate for the adjustment of the overall width so that no special grommets 4 have to be provided.

In order to ensure adequate sealing of the cable leadthrough 200 even with adjacent separating elements 3, 3', such as those described for the structure in Figs. 17 and 18, it may now be provided that a sealing material 9 is inserted between two adjacent separating elements 3, 3' in order to reliably seal the separating elements 3.3', which are made of a harder plastic than the grommets 4,

when they are adjacent to each other. This can be seen in Fig. 19. If the plastic surfaces of the separating elements 3, 3' were only in contact with each other, such a seal would not be possible or only possible to a limited extent. The elastic sealing material 9 between the separating elements 3, which can be glued in as a sealing strip during assembly, for example, results in a very good seal, so that overall a very tight structure of the cable leadthrough 200 is possible despite its high flexibility, which is a decisive advantage.

It is understood that the different variants of frames, grommets 4 and separating elements 3, 3' can be combined with each other as desired and, in particular, can also be used mixed with each other, provided that they fall within the scope of protection of the appended claims.

PATENTKRAV

1. Kabelgennemføring (200) med

1.1 en delbar ramme, der indeholder mindst to længdelister (1.3., 2.3, 20.3) og mindst to benlister (1.1, 1.2, 2.1, 2.2, 20.1, 20.2), der sammen ligger i et plan vinkelret på de gennemførte kablers (5) løberetning (L),

1.2 mindst én tylle (4), der er forsynet med mindst én boring (4.2) til gennemføring af kablet (5);

1.3 skilleelementer (3, 3'), som befinder sig mellem længdelisterne (1.3., 2.3, 20.3), og af hvilke i det mindste det ene danner et mellemrum (Z) mellem sig selv og et tilstødende skilleelement (3, 3') eller en af benlisterne (1.1, 1.2, 2.1, 2.2, 20.1, 20.2), der er udformet til optagelse af den i det mindste ene tylle (4), der for sit vedkommende er forsynet med mindst én boring (4.2) til gennemføring af kablet (5);

og med følgende træk:

1.4 Hver af længdelisterne (1.3., 2.3, 20.3) er på i det mindste sin side, de vender mod den respektive anden længdeliste (1.3., 2.3, 20.3), forsynet med et stort antal boringer (7) eller udsparinger (6);

1.5 hvert skilleelement (3, 3') korresponderer i det mindste i området ved en af sine endesider med boringerne (7) eller udsparingerne (6) i længdelisterne (1.3., 2.3, 20.3), således at

skilleelementerne (3, 3') kan stikkes ind i boringerne (7) eller udsparingerne (6) på tværs af de gennemførte kablers (5) løberetning (L);

1.5 skilleelementerne (3, 3') er i de indlagte kablers (5) løberetning (L) udformet således, at de er indsnævret med mindst én fordybning, således at der kan etableres en formsluttende kontakt med de enkelte tyller (4).

2. Kabelgennemføring (200) ifølge krav 1, kendetegnet ved, at hvert skilleelement (3, 3') på i det mindste én af sine endesider, der vender mod længdelisterne (1.3., 2.3, 20.3), er forsynet med tapper (3.1) eller indstikslister (3.2), der hver især korresponderer med boringerne (7) eller udsparingerne (6) i længdelisterne (1.3., 2.3, 20.3).

3. Kabelgennemføring (200) ifølge krav 1 eller 2, kendetegnet ved, at boringerne (7) eller udsparingerne (6) i længdelisterne (1.3., 2.3, 20.3) er udført på en sådan måde, at der mellem boringerne (7) eller udsparingerne (6) og begge yderkanter af længdelisten (1.3., 2.3, 20.3) i de gennemførte kablers (5) løberetning (L) bliver materiale tilovers fra længdelisten (1.3., 2.3, 20.3).

4. Kabelgennemføring (200) ifølge krav 1, 2 eller 3, kendetegnet ved, at boringerne (7) er udformet som blindhulsboringer, eller at udsparingerne (6) er udformet som en udsparing, der ikke går igennem længdelistens (1.3., 2.3, 20.3) materiale.

5. Kabelgennemføring (200) ifølge et af kravene 1 til 4, kendetegnet ved, at de geometriske dimensioner eller formgivningen af de respektivt korresponderende endesider af skilleelementerne (3, 3'), tapperne (3.1)

og boringerne (7) eller indstikslisterne (3.2) og udsparingerne (6) er udformet på en sådan måde, at de indstukne skilleelementer (3, 3') i én af længdelisterne (1.3., 2.3, 20.3) har en stram pasning og i den anden af længdelisterne (1.3., 2.3, 20.3) har en løs pasning.

6. Kabelgennemføring (200) ifølge krav 5, kendetegnet ved, at de respektive korresponderende tapper (3.1) og boringer (7) eller indstikslister (3.2) og udsparinger (6) er forsynet med mindst ét tætningselement, således at de indstukne skilleelementer (3, 3') i én af længdelisterne (1.3., 2.3, 20.3) har en stram pasning.

7. Kabelgennemføring (200) ifølge et af kravene 1 til 6, kendetegnet ved, at der mellem benlisterne (1.1, 1.2, 2.1, 2.2, 20.1, 20.2) eller mellem to af skilleelementerne (3, 3') eller mellem en af benlisterne (1.1, 1.2, 2.1, 2.2, 20.1, 20.2) og et af skilleelementerne (3, 3') er tilvejebragt mellembunde.

8. Kabelgennemføring (200) ifølge krav 7, kendetegnet ved, at mellembundene (11) er forsynet med udsparinger (6) eller boringer (7) analogt med længdelisterne (1.3., 2.3, 20.3).

9. Kabelgennemføring (200) ifølge krav 7 eller 8, kendetegnet ved, at mellembundene (11) mellem benlisterne (20.1, 20.2) er forbundet fast med disse og danner en yderligere længdeliste (20.3), der i det mindste ved de to modsatliggende sider, der vender mod de respektive andre længdelister (1.3, 2.3), er forsynet med udsparingerne (6) eller boringerne (7).

10. Kabelgennemføring (200) ifølge krav 7, 8 eller 9, kendetegnet ved, at mellembundene (11) mellem to af skilleelementerne (3, 3') eller mellem en af

benlisterne (1.1, 1.2, 2.1, 2.2, 20.1, 20.2) og et af skilleelementerne (3, 3') er formet på en sådan måde, at de samvirker formsluttende med skilleelementerne (3, 3') eller skilleelementerne (3, 3') og benlisterne (1.1, 1.2, 2.1, 2.2, 20.1, 20.2) i kablernes (5) løberetning (L).

11. Kabelgennemføring (200) ifølge et af kravene 1 til 10, kendetegnet ved, at der ved enden af hver af længdesiderne (1.3, 2.3) er tilvejebragt en benliste (1.1, 2.1), således at længdelisten (1.3, 2.3) og benlisten (1.1, 2.1) danner et L, eller at der ved begge ender af i hvert enkelt tilfælde mindst én respektiv af længdelisterne (1.3, 2.3) er tilvejebragt i hvert enkelt tilfælde én af benlisterne (1.1, 1.2, 2.1, 2.2), således at længdelisten (1.3, 2.3) og benlisterne (1.1, 1.2, 2.1, 2.2) danner et U.

12. Kabelgennemføring (200) ifølge et af kravene 1 til 11, kendetegnet ved, at skilleelementerne (3, 3') er udformet med forskellig højde.

13. Kabelgennemføring (200) ifølge krav 12 og ifølge et af kravene 2 til 9, kendetegnet ved, at skilleelementerne (3) med en højde, der svarer til rammens indvendige højde, på begge endesider (3.3) er forsynet med tapper (3.1) eller indstikslister (3.2), og at skilleelementerne (3') med en kortere højde på én af endesiderne (3.3) er forsynet med tapper (3.1) eller indstikslister (3.2).

14. Kabelgennemføring (200) ifølge krav 1 til 13, kendetegnet ved, at skilleelementerne (3, 3') i mindst én af fordybningerne i deres indsnævring er forsynet med et elastisk tætningsmateriale (9).

15. Kabelgennemføring (200) ifølge et af kravene 1 til 14, kendetegnet ved, at hvert af skilleelementerne (3, 3') i de indlagte kablers (5) løberetning (L) er udformet af mindst to enkeltelementer (3.4).

16. Kabelgennemføring (200) ifølge et af kravene 1 til 15, kendetegnet ved, at udsparingerne (6) strækker sig med en større dimension i de indlagte kablers (5) løberetning (L) end vinkelret på denne og parallelt med længdesiderne (1.3, 2.3, 20.3).

17. Kabelgennemføring (200) ifølge et af kravene 1 til 16, kendetegnet ved, at udsparingerne (6) er udformet i en dobbelt T-form.

18. Kabelgennemføring (200) ifølge et af kravene 1 til 17, kendetegnet ved, at skilleelementerne (3, 3'), tapperne (3.1) og indstikslisterne (3.2) på deres side, der vender mod boringen (7) eller udsparingen (6), er affasede.

19. Kabelgennemføring (200) ifølge et af kravene 2 til 18, kendetegnet ved, at skilleelementerne (3, 3') på deres endeside, der er forsynet med tapperne (3.1) eller indstikslisterne (3.2), indbefatter et tætning (8).

20. Kabelgennemføring (200) ifølge et af kravene 1 til 19, kendetegnet ved, at benlisterne (1.1, 1.2, 2.1, 2.2, 20.1, 20.2) står vinkelret på længdelisterne (1.3, 2.3, 20.3), og skilleelementerne (3, 3') forløber parallelt med benlisterne (1.1, 1.2, 2.1, 2.2, 20.1, 20.2).

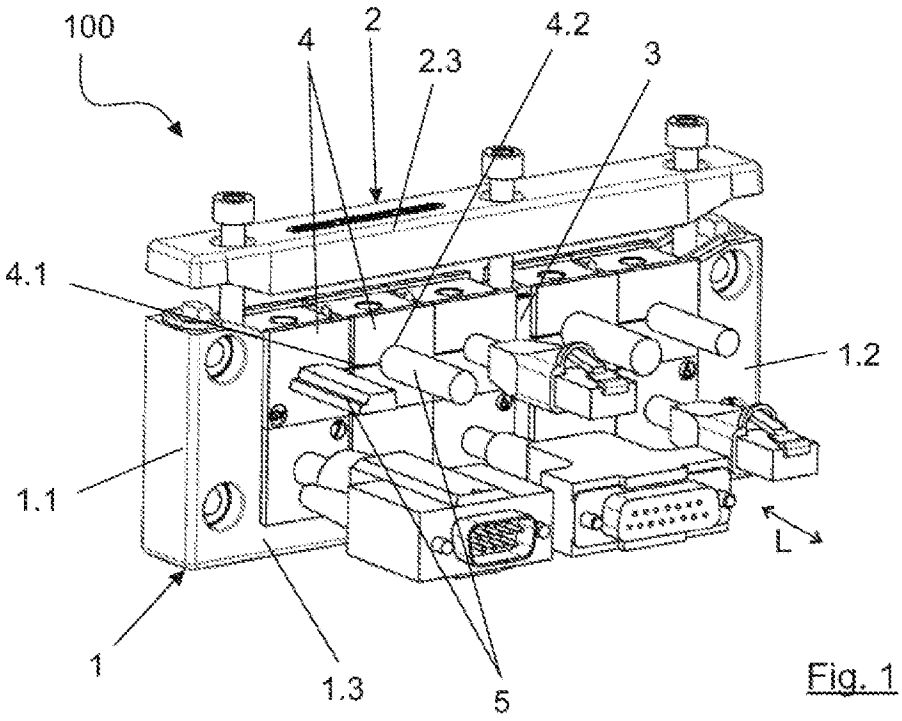


Fig. 1

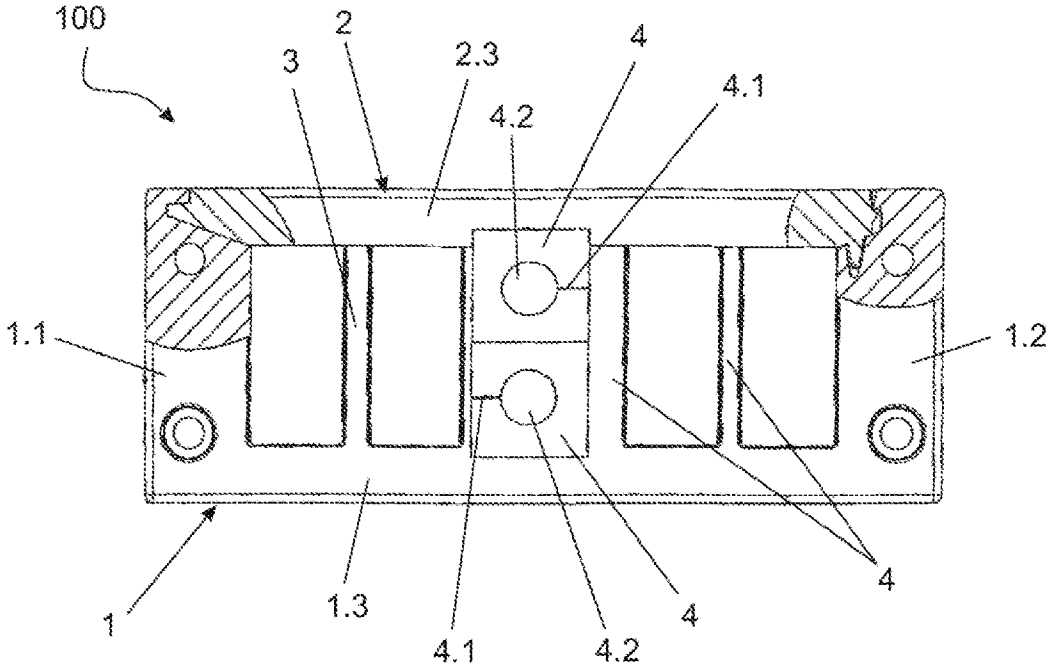
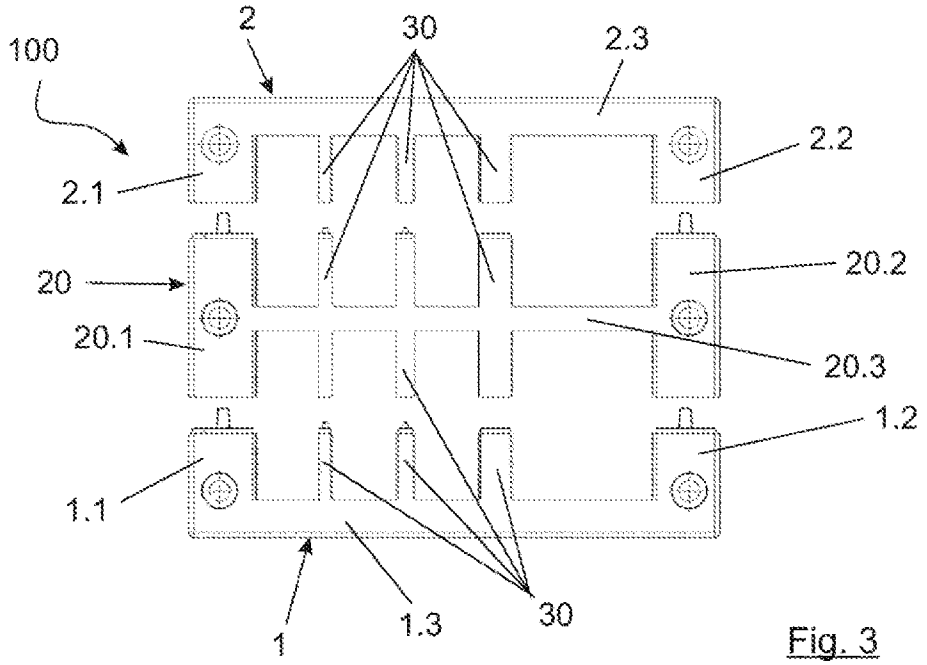


Fig. 2


100
2
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20
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20.1
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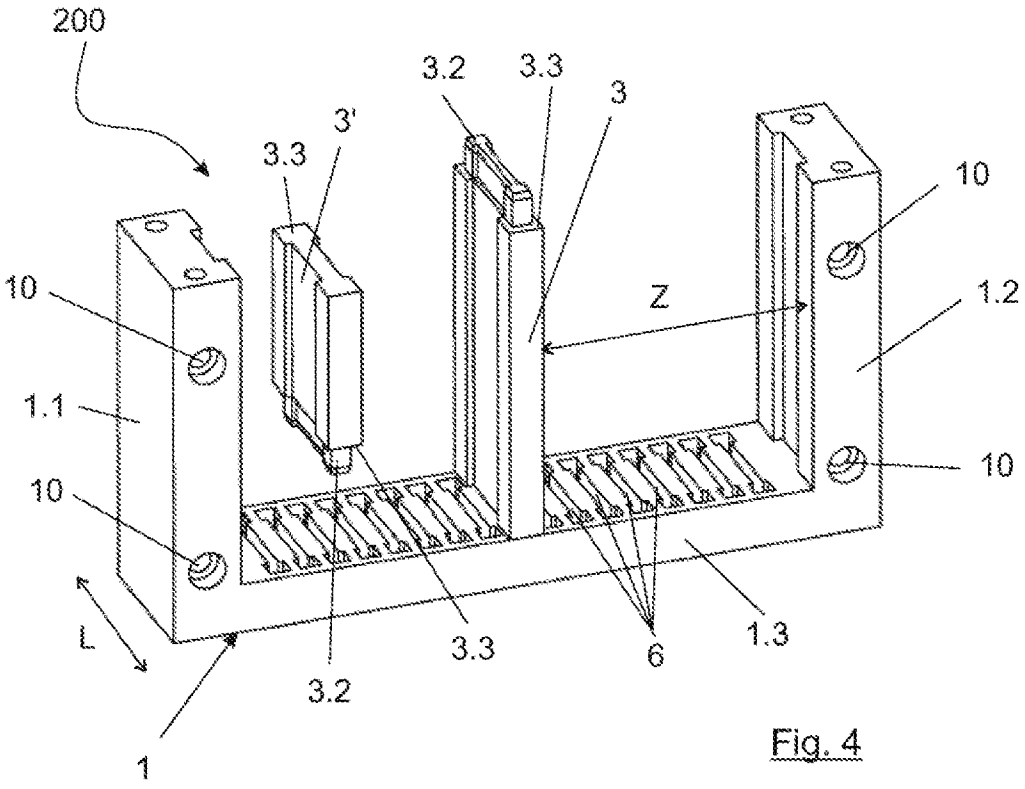
1
1.3
30

Fig. 3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3.2
3.3
3
3'
3.3
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10
Z
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1.1
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L
3.3
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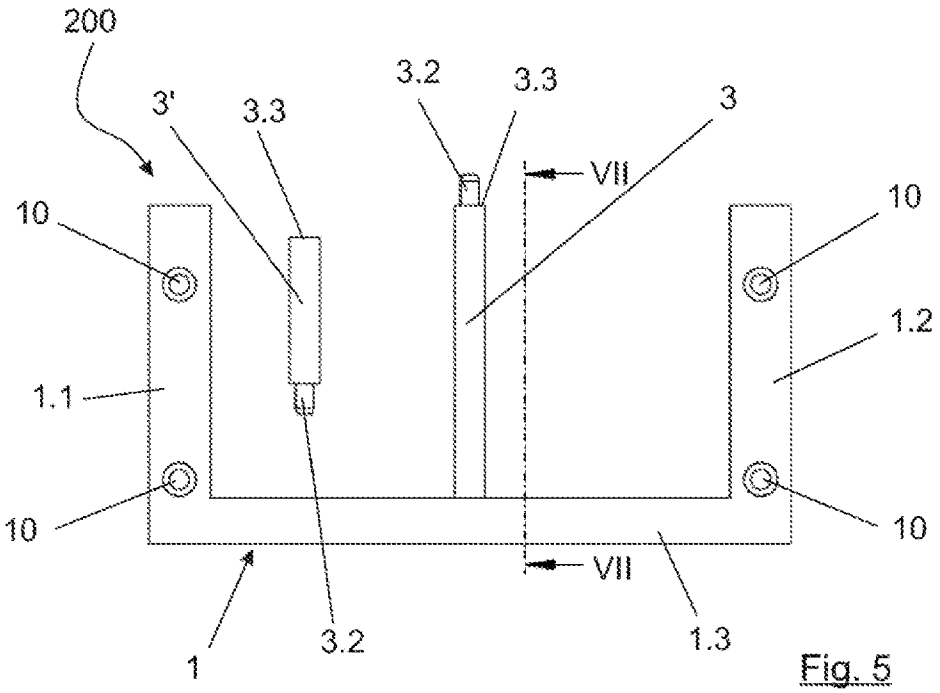
1.3
3.2
1

Fig. 4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3'
3.3
3.2
3.3
3
VII
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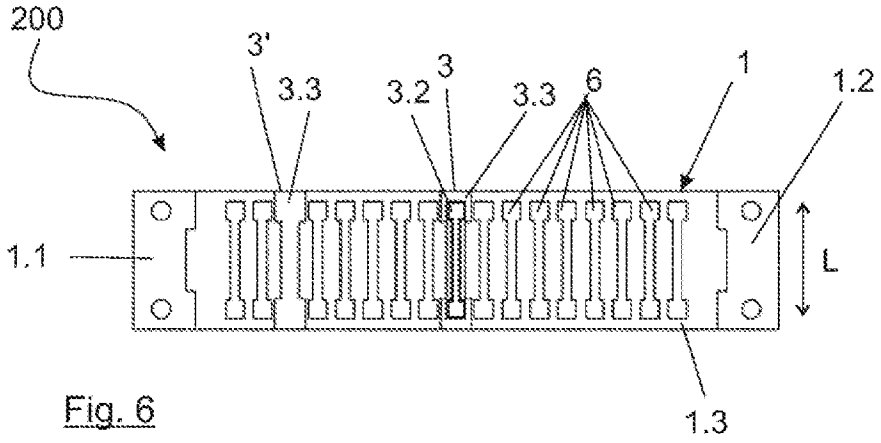
10
1.2
1.1
10
10
VII
1
3.2
1.3

Fig. 5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3
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6
1
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L
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Fig. 6

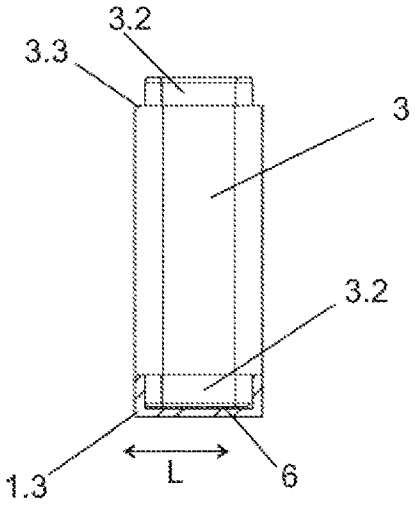


Fig. 7

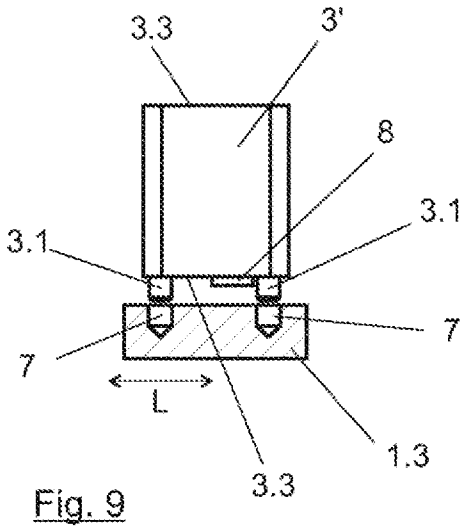


Fig. 9

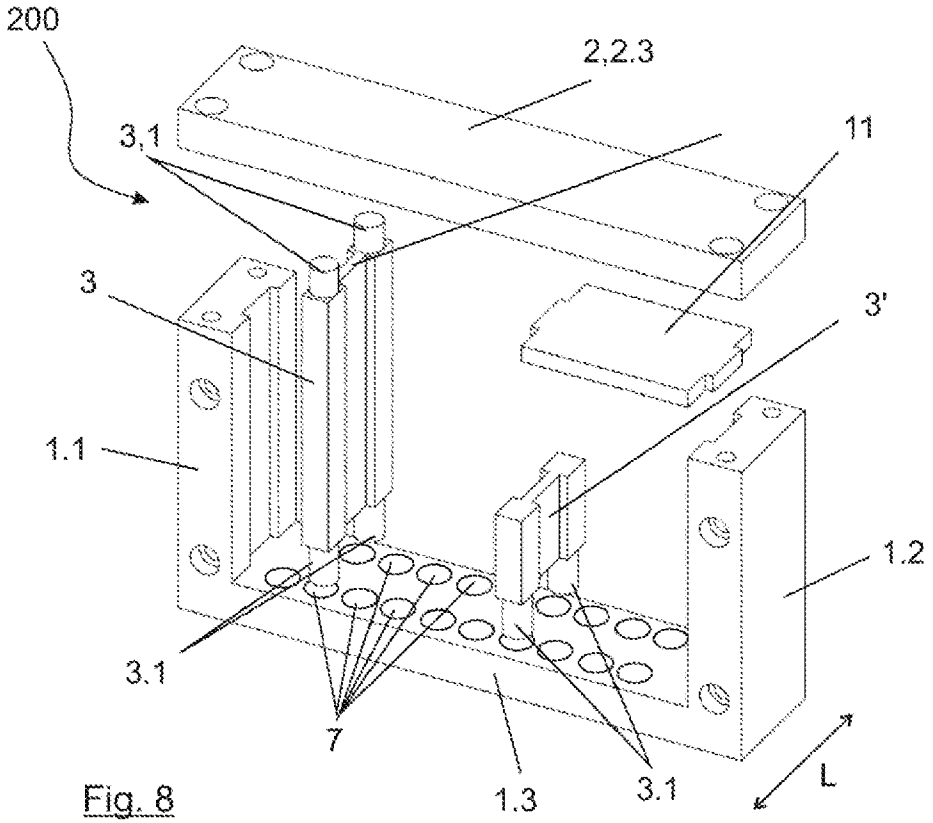


Fig. 8

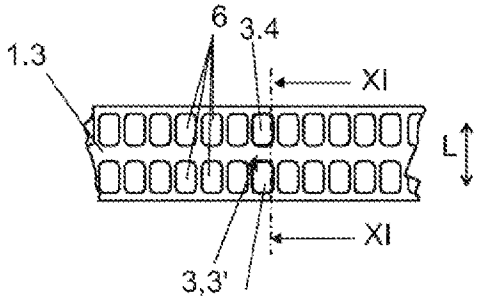


Fig. 10

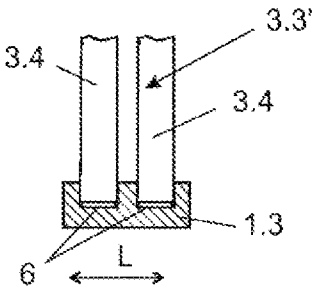


Fig. 11

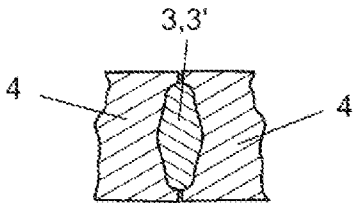


Fig. 12

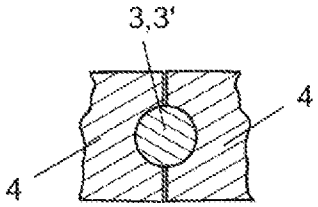


Fig. 13

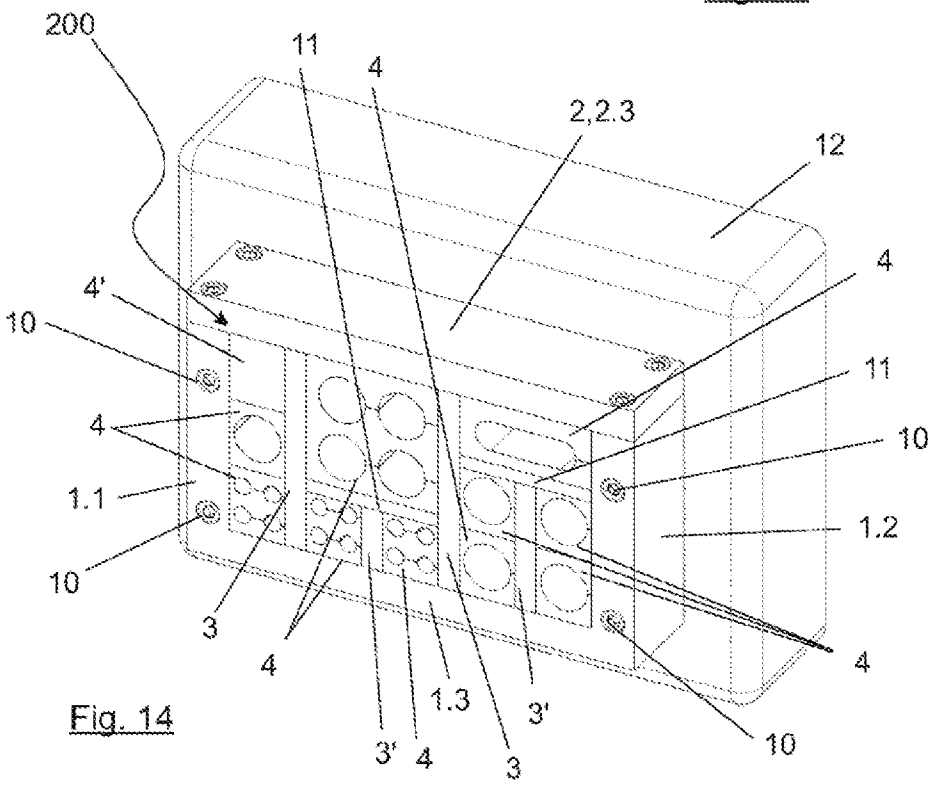
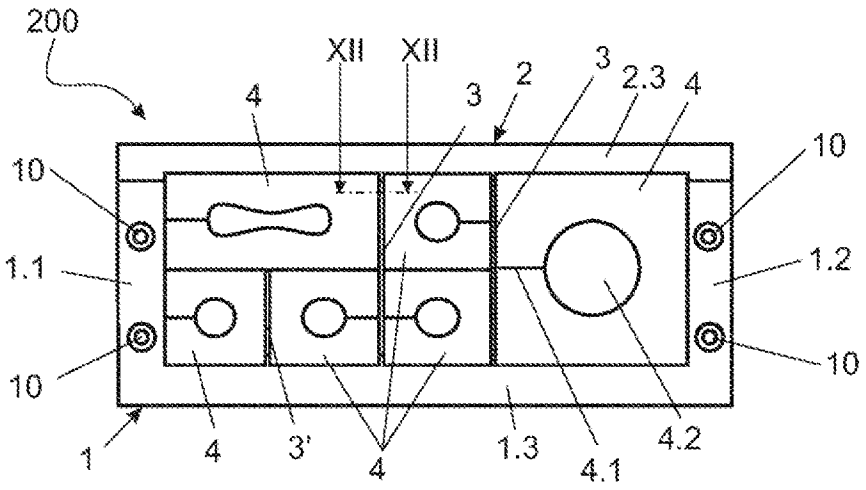


Fig. 14


200
XII
XII
4
3
2
3
2.3
4
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10
1.1
1.2
10
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1
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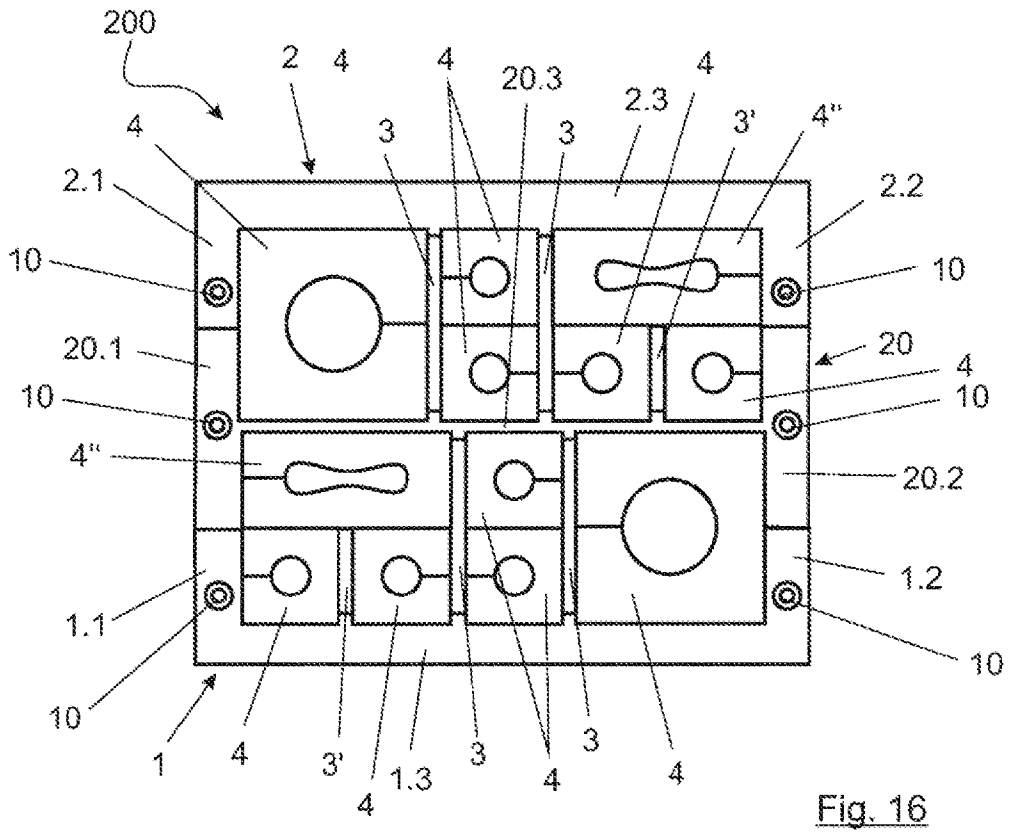
3'
4
1.3
4.1
4.2

Fig. 15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20.3
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4
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3
2.3
3'
4"
2.1
2.2
10
10
20.1
20
4
10
10
4"
20.2
1.2
1.1
10
10
1
4
3'
4
1.3
3
4
3
4

Fig. 16

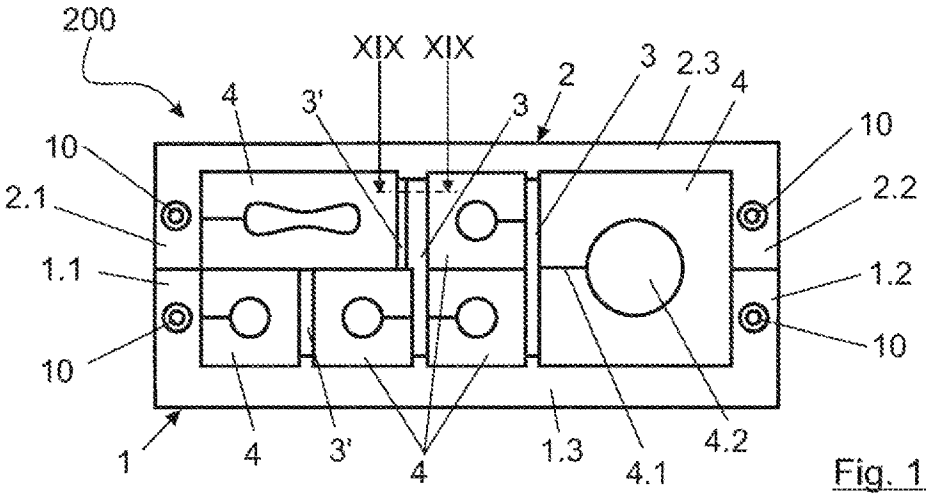

Fig. 17

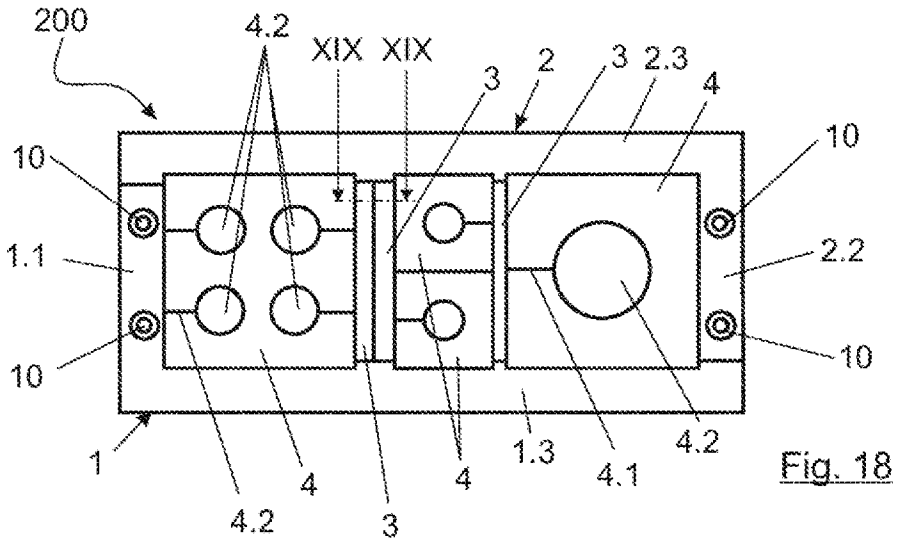

Fig. 18

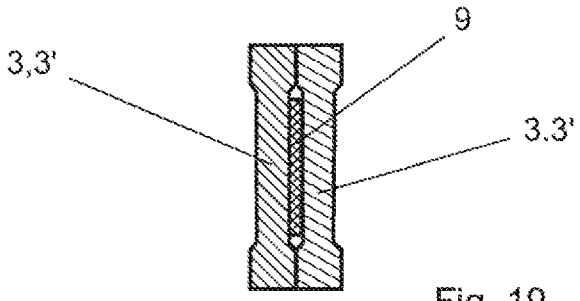

Fig. 19