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(54) **SUPPORT FOR A HOLLOW-CORE SLAB**

(57) A support (1) for a hollow-core slab comprising a horizontal support plate (2) for supporting the end of the hollow-core slab, a back plate (4) extending upwards from the horizontal support plate (2), end plates (5) arranged to the ends of the support (1) for a hollow-core slab and supports (6) protruding from the ends of the support (1) for a hollow-core slab for supporting the support (1) for a hollow-core slab on the hollow-core slabs

(3b). The support (1) for a hollow-core slab comprises a front plate (7) extending upwards from the support plate (2), which front plate (7) is arranged at a distance from the back plate (4), a top plate (8) adjusted between the front plate (7) and the back plate (4), which front plate (7), top plate (8), back plate (4) and support plate (2) form a box-type space (10), into which one or more supporting bars (11a, 11b, 11c) are arranged.

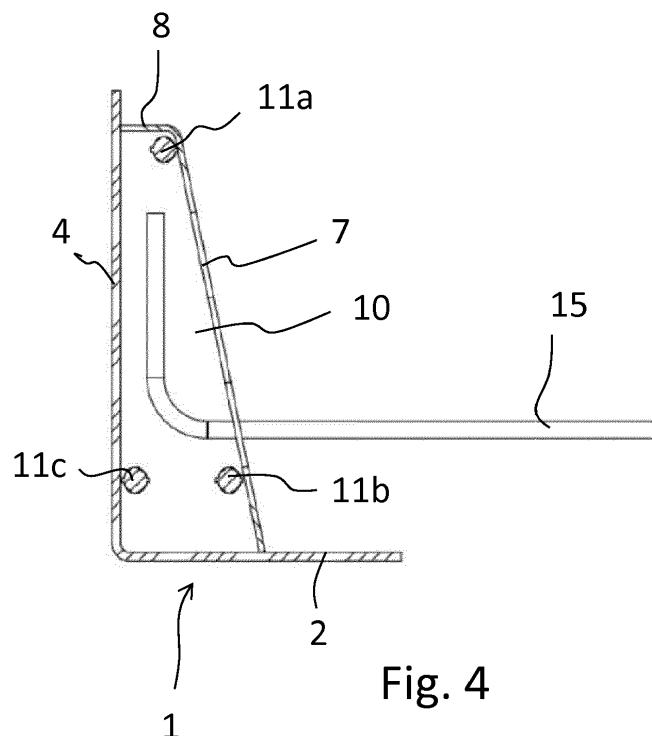


Fig. 4

Description

[0001] The object of the invention is a support for supporting the end of a hollow-core slab according to claim 1.

[0002] The invention relates to a support, typically of steel structure, which bears a concrete hollow-core slab. With the structure according to the invention, the end of the hollow-core slab, which borders on the edge of a floor opening, can be supported and suspended to adjacent hollow-core slabs or to other structures so that the support is completely on the level of the hollow-core slab.

[0003] Prefabricated hollow-core slabs are used in a bearing floor of buildings of concrete element structure, both in roof and in base floor. Hollow-core slabs are generally supported on plane beams and walls. When a hollow-core slab level is provided with large openings for stairs or for other inlets, the end of the hollow-core slab ends on the edge of the opening, in which there is usually no beam or wall to bear and support the end of the hollow-core slab. This is why the end of the hollow-core slab has to be supported with a separate support.

[0004] In utility model FI 4119, it is described a support for a hollow-core slab, which is supported on edges of adjacent hollow-core slabs and on which the end of the hollow-core slab is supported. This support according to the prior art is produced from a steel plate, which is relatively thick (approximately 10-20 mm). The support has to be installed on its place by using a crane because of the weight of the support. The support is produced from an open structure of L-shaped profile, which according to strength theory is a very disadvantageous shape for this purpose. The material of the steel part is according to strength theory very disadvantageous in use, wherein the weight of the steel part is significant and thus it is expensive to produce and the weight of the steel part causes additional costs in installing.

[0005] In utility model FI 7519, it is described a lattice-structured hollow-core slab support, which is lightweight but time-consuming to produce, wherein producing costs increase significantly. Additionally, a problem with this lattice-structured support is that the support does not suit for producing in serial production with variable opening widths of a hollow-core slab level. Openings are not usually multiples of width of a hollow-core slab, but the width of an opening varies arbitrary. Therefore, the support solution has to be suited for variable widths of the opening without problems.

[0006] The aim of this invention is to achieve an improved support for a hollow-core slab by means of which the above mentioned problem can be reduced.

[0007] The aim of the invention is achieved with a support according to claim 1, which support comprises a horizontal support plate for supporting the end of the hollow-core slab, a back plate extending upwards from the horizontal support plate, end plates arranged to the ends of the support for a hollow-core slab and supports protruding from the ends of the support for a hollow-core slab for supporting the support for a hollow-core slab on hol-

low-core slabs. Moreover, the support for a hollow-core slab comprises a front plate extending upwards from the support plate, which front plate is arranged at a distance from the back plate, and a top plate arranged between the front plate and the back plate. The front plate, top plate, back plate and support plate form a case-like space, into which one or more supporting bar is arranged.

[0008] Significant advantages are achieved by the invention.

[0009] With the support for a hollow-core slab according to the invention the problems relating to expensiveness and serial production in manufacturing of the solution of the prior art are reduced. The weight of the support according to one embodiment of the invention is aimed to be minimized, and the manufacturing of the support is made to be simple and thus low-cost. At the same time the structure of the support is made so that it suits well for serial production in a workshop, and the length of the support can be adjusted for variable opening widths without problems. The support is thus cost-effective as it is lightweight and easy to produce, and it enables an easy adjustability of the length of the support.

[0010] The thicknesses of the plates of the support for a hollow-core slab according to one embodiment of the invention are between 4-8 mm due to optimal box-type structure according to strength of materials, which reduces significantly the weight of the structure and brings cost savings. Still the same load bearing capacity of the end of the hollow-core slab is achieved with the invention than with structures according to the prior art. Additionally, with this support, wider floor openings can be supported than with solutions according to the prior art, since a closed box-type structure is the most optimal for this purpose and a corresponding box-type structure is not presented in the prior art solutions for a support for the end of the hollow-core slab.

[0011] A support for a hollow-core slab has to function on hollow-core slab level in three different constructional loading situations. In installing stage the support supports only the own weight of the hollow-core slab so that the hollow-core slab level can be installed without separate installing supports. In the next stage the inside of the box of the support and the space between the hollow-core slab and the support are cast full with concrete. After hardening of the concrete, the support starts to function together with concrete and hollow-core slabs in composite effect, wherein the support transfers the weight of the hollow-core slab and all its effective loads also to adjacent hollow-core slabs. A third operating situation is a fire situation. Then the outer surface of steel of the support is exposed to fire, wherein it is out of use and cannot bear the load. The support has to be able to transfer also in this third design situation the load of the hollow-core slabs to adjacent hollow-core slabs, when a part of the structure of the support is out of use in a fire situation.

[0012] In a solution according to one embodiment of the invention the form of the support for a hollow-core slab is made to be box-like, which is still supplemented

with one or more supporting bars welded to the front plate of the box and with a loose supporting bar, with a corrugated bar, for example, arranged inside of the box. In installing situation the whole outer structure of the box and the supporting bars welded to the box function as a load-bearing structure. Concreting has not yet taken place, and the support is thus a mere steel construction. In the next stage, when the joint groutings of the hollow-core slab will take place, the inside and the outside of the box is cast full with concrete, wherein they function together with the casing as a load-bearing structure for every load of the operating situation. In a fire situation the outer surface and the bottom of the box do not function anymore as a load-bearing structure, since their temperature increases too much. In a fire situation the front plate and the top plate as well as the supporting bar welded to the box and the loose supporting bars function as a load-bearing structure, and the support is capable of transferring the loads of hollow-core slabs to adjacent slabs in a fire situation. Thus the support does not need a separate fire protection, which is also a basic prerequisite for support solutions.

[0013] The support is supported on the adjacent hollow-core slabs or other structures with connection solutions according to the prior art, which can be slightly modified, if necessary.

[0014] According to the strength of materials, the inventiveness of a support for a hollow-core slab according to one embodiment of the invention is formed of a case-type structure produced of relative thin (4-8 mm) steel plates, which structure bears the loads transferred from the hollow-core slab. The advantageousness of the case-type structure is based on its feature and capability to transfer a significant torque according to the strength theory, which is not the case in the solutions according to state of the art. Additionally, the box is strengthened with one or more supporting bars, for example with a corrugating bar, which functions in a fire situation also as a load-bearing structure, when the plates of the visible outer surface of the box are out of use in a fire situation. The concrete to be cast inside the box forms a protective structure for the front plate and for the supporting bar in a fire situation, wherein no separate fire protection is needed. Additionally, concrete functions as a load-bearing composite structure together with steel parts of the support. The support functions in three different design situations according to strength theory.

[0015] Manufacturing technically, the inventiveness of the support for a hollow-core slab according to one embodiment of the invention is based on the solution, in which the plates forming a box can be bent to a form of an angle bar and they will be welded together thereafter. The box can be produced as a long structure, wherein a support of a suitable length needed can be sawn from it and manufacturing is thus simplified, since the length of the support is freely adjustable according to purchase orders. The box also forms a required casting mold and a visible surface for the support. The front plate of the

box is typically set into a slightly inclined position, and concrete feed openings are made into the front plate, with the aid of which concrete feed openings the inside of the box can be cast and the second stage concrete can be made to function together with the box as a composite structure. Additionally, there are air venting openings in the top surface of the box, with the aid of which air venting openings the filling of the box with concrete can be checked reliably.

[0016] With the invention the weight of the support can be made significantly lower compared to a support of the prior art, and the manufacturing costs can be reduced significantly compared to other solution of the prior art.

[0017] In the following, the invention will be described in more detail by the aid of examples with reference to the attached drawings, wherein

Fig. 1 shows a support for a hollow-core slab according to one embodiment of the invention, which support is supported from its ends on hollow-core slabs and on which two hollow-core slabs are supported,

Fig. 2 shows a front view of the support for a hollow-core slab of Fig. 1,

Fig. 3 shows a top view of the support for a hollow-core slab of Fig. 1, and

Fig. 4 shows a cross-section of the support for a hollow-core slab of Fig. 1.

[0018] A support 1 for a hollow-core slab presented in the drawings is used to support the end of the hollow-core slab 3a bordering to the opening or the ends of the hollow-core slabs 3a on adjacent hollow-core slabs 3b or to other supporting structure. The support 1 for a hollow-core slab comprises a horizontal support plate 2 for supporting the end of the hollow-core slab 3a to be supported, and a vertical back plate 4, which extends upwards from the horizontal support plate 2. The vertical back plate 4 extends directly upwards from the horizontal support plate 2. The horizontal support plate 2 and the vertical back plate 4 form a profile of L-shaped cross-section. The horizontal support plate 2 and the vertical back plate 4 are produced from a same plate by bending.

[0019] Moreover, the support 1 for a hollow-core slab comprises a front plate 7 extending inclined upwards from the horizontal support plate 2, which front plate 7 is arranged at a distance from the back plate 4. The front plate 7 is attached from its lower edge to the support plate 2. The front plate 7 slants towards the back plate 4 when going upwards. A top plate 8, which attaches to the back plate 4, is arranged between the upper edge of the front plate 7 and the back plate 4. The top plate 8 is attached to the back plate 4 underneath its upper edge at a distance from the upper edge of the back plate 4. Then the part of the back plate 4, which is above the top plate 8, protrudes upwards from the attachment point of

the top plate 8 and forms a protruding part, which forms a casting mold for concreting. The top plate 8 is horizontal. The front plate 7 and the back plate 4 are connected to each other with the aid of the top plate 8. The top plate 8 and the front plate 7 are produced from a same plate by bending. The front plate 7, top plate 8, back plate 4 and/or support plate 2 form a box-type space 10, which is filled with concrete after the support 1 has been installed. There are concrete feed openings 9 in the front plate 7 for feeding concrete into the space 10. There are air venting openings 13 in the top plate 8 for discharging air from the space 10. Additionally, there is a torsional steel opening 14 in the front plate 7, from which torsional steel opening 14 the torsional steel 15 is placed inside the box 10. The opening 14 is smaller than the concrete feed opening 9. There can be one or more openings 14 and torsional steels 15. The thickness of the front plate 7, top plate 8, back plate 4 and/or support plate 2 is 4-8 mm.

[0020] Furthermore, the support 1 for a hollow-core slab comprises end plates 5 arranged in the ends of the support 1, and supports 6 protruding from the ends of the support 1 for supporting the support 1 on hollow-core slabs 3b in its ends. The supports 6 comprise attachment openings 12, through which screws can be adjusted for attaching the support 1 to the hollow-core slab 3b. The end plate 5 and the support 6 protruding from it are produced from a same plate by bending. The end plates 5 are attached to the support plate 2 and to the back plate 4 by welding.

[0021] One or more supporting bars 11a, 11b, 11c, for example a corrugated bar, is arranged in the space 10, i.e. in the box between the front plate 7 and the back plate 4. The supporting bars are arranged longitudinally between the end plates 5. In an embodiment according to drawings there are three supporting bars. The supporting bar 11a is attached to the corner between the front plate 7 and the top plate 8. The second supporting bar 11b is attached to the lower part of the front plate 7, for example below the concrete feed opening. The third supporting bar 11c is loose inside the box 10. Alternatively, the third supporting bar 11c is attached to the back plate 4, for example at the same height than the other supporting bar 11b.

[0022] Moreover, a torsional steel 15, which in terms of its shape is a deformed bar bent to a form of rectangle, is arranged to the support 1, the aim of which is to transfer the torque coming from the eccentric support of the end of the hollow-core slab 3 to the support 1. The end of the torsional steel 15 is threaded on point of joint of the hollow-core slab 3 through the opening 14 inside the box 10 before casting.

[0023] Support 1 for a hollow-core slab is installed in its place as follows. The support 1 is supported between two hollow-core slabs 3b by fitting the supports 6 against top surfaces of the hollow-core slabs. The support 1 is attached on its place with screws fitted through the attachment openings 12. End of the hollow-core slab to be

supported or the ends of the hollow-core slabs, are set on the horizontal support plate 2 in front of the front plate 7. Thereafter, the space 10 between back plate 4, front plate 7 and top plate 8 is filled with concrete through the concrete feed openings 9. Also the space between the hollow-core slab 3a to be supported and the front plate 7 and the space above the top plate 8 is filled with concrete.

[0024] In a fire situation the support 1 functions so that the support plate 2 and the back plate 4 are not bearing parts for the structure any more. The bearing structure for the support 1 is then formed by the front plate 7 and top plate 8 and by the supporting bar or supporting bars 11a, 11b, 11c as well as by the concrete cast around them inside the box 10 and outside of it. All the structures stay attached to the hollow-core slab 3a with the aid of the torsional steel 15, which attaches to the joint 16 between the hollow-core slabs 3a.

Claims

1. A support (1) for a hollow-core slab comprising a horizontal support plate (2) for supporting an end of the hollow-core slab, a back plate (4) extending upwards from the horizontal support plate (2), end plates (5) arranged to the ends of the support (1) for a hollow-core slab, and supports (6) protruding from the ends of the support (1) for a hollow-core slab for supporting the support (1) for a hollow-core slab on the hollow-core slabs (3b), **characterized in that** the support (1) for a hollow-core slab comprises a front plate (7) extending upwards from the support plate (2), which front plate (7) is arranged at a distance from the back plate (4), and a top plate (8), which front plate (7), top plate (8), back plate (4) and support plate (2) form a box-type space (10), into which one or more supporting bars (11a, 11b, 11c) are arranged.
2. A support (1) for a hollow-core slab according to claim 1, **characterized in that** there are three supporting bars arranged in the box-type space (10), of which a supporting bar (11a) is attached to a corner of the front plate (7) and the top plate (8), the second supporting bar (11b) is attached to the lower part of the front plate (7), and the third supporting bar (11c) is loose in the space (10).
3. A support (1) for a hollow-core slab according to claim 1 or 2, **characterized in that** there are concrete feed openings (9) in the front plate (7) for feeding concrete into the space (10), and there are air venting openings (13) in the top plate (8) for discharging air from the space (10).
4. A support (1) for a hollow-core slab according to any of the preceding claims, **characterized in that** the

top plate (8) is attached to the back plate (4) underneath its upper edge, and the back plate (4) extends upwards from the attachment point of the top plate (8).

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5. A support (1) according to any of the preceding claims, **characterized in that** the support plate (2) and the back plate (4) are produced from a same plate by bending.

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6. A support (1) according to any of the preceding claims, **characterized in that** the front plate (7) and the top plate (8) are produced from a same plate by bending.

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7. A support (1) according to any of the preceding claims, which is designed to function in a fire situation of a building, **characterized in that** the load-bearing structure of the support (1) comprises a structure formed by a front plate (7), top plate (8) and supporting bar or supporting bars (11a, 11b, 11c) arranged in the box-type space (10), which structure is arranged to attach to the concrete joint (16) between hollow-core slabs (3a) to be supported by concrete to be cast in the box-type space (10) and by torsional steel (15).

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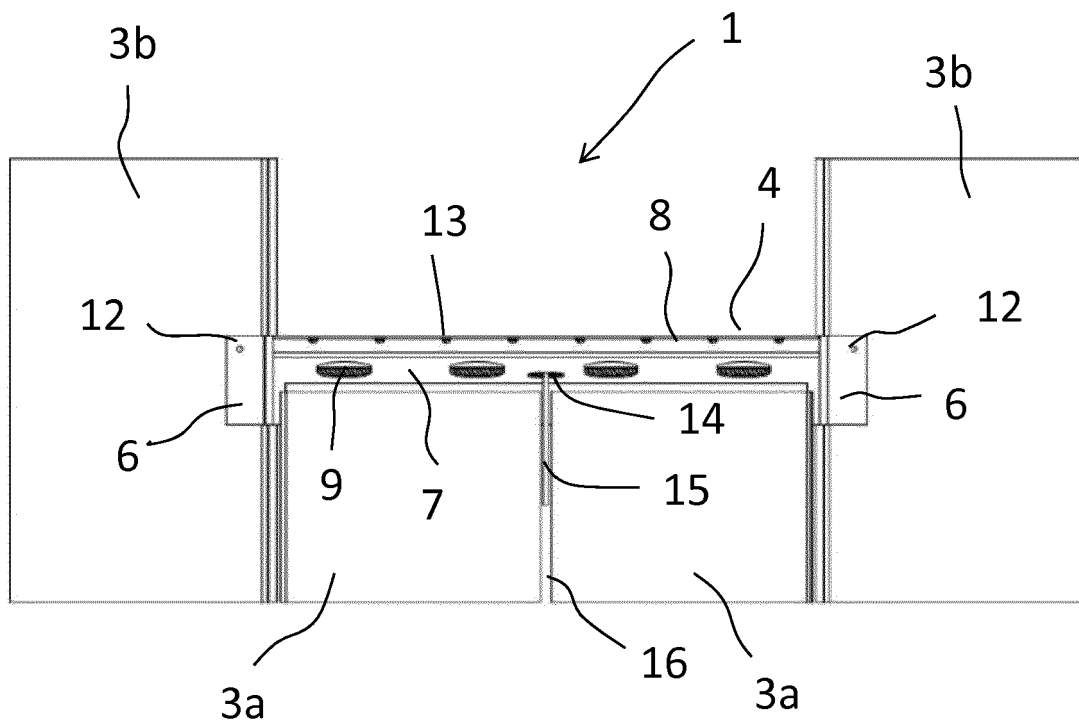


Fig. 1

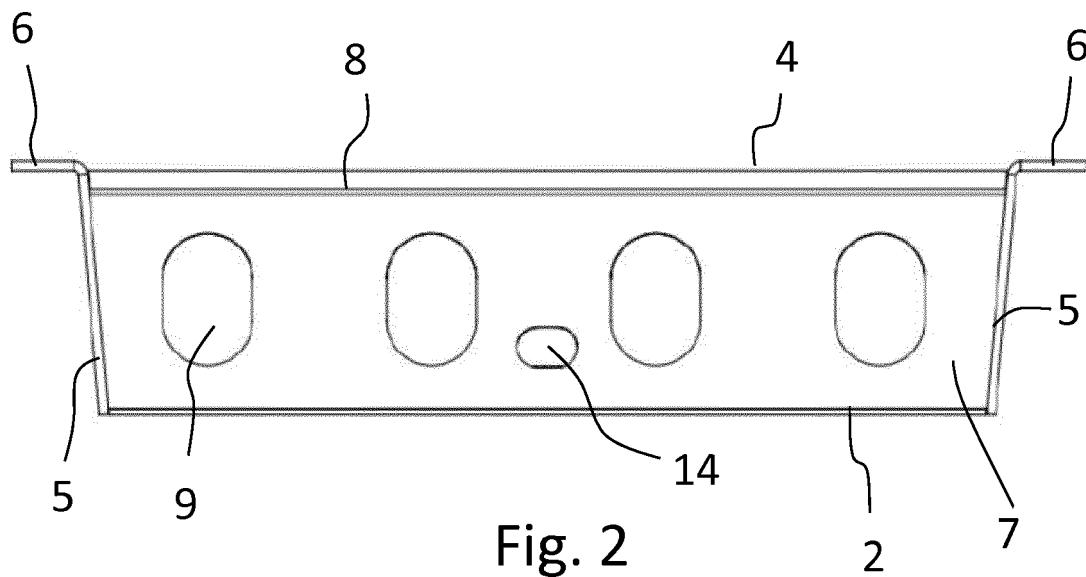


Fig. 2

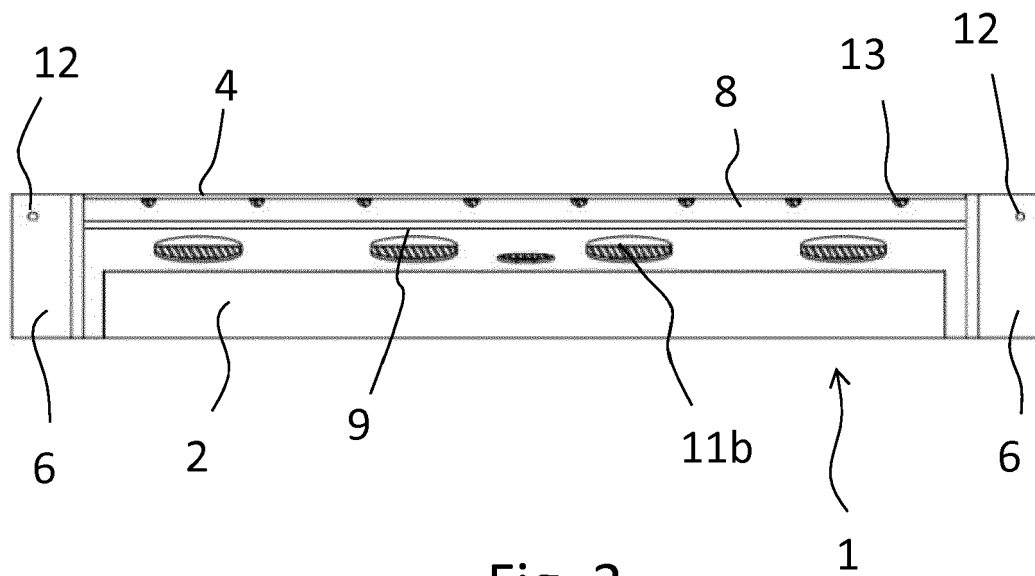


Fig. 3

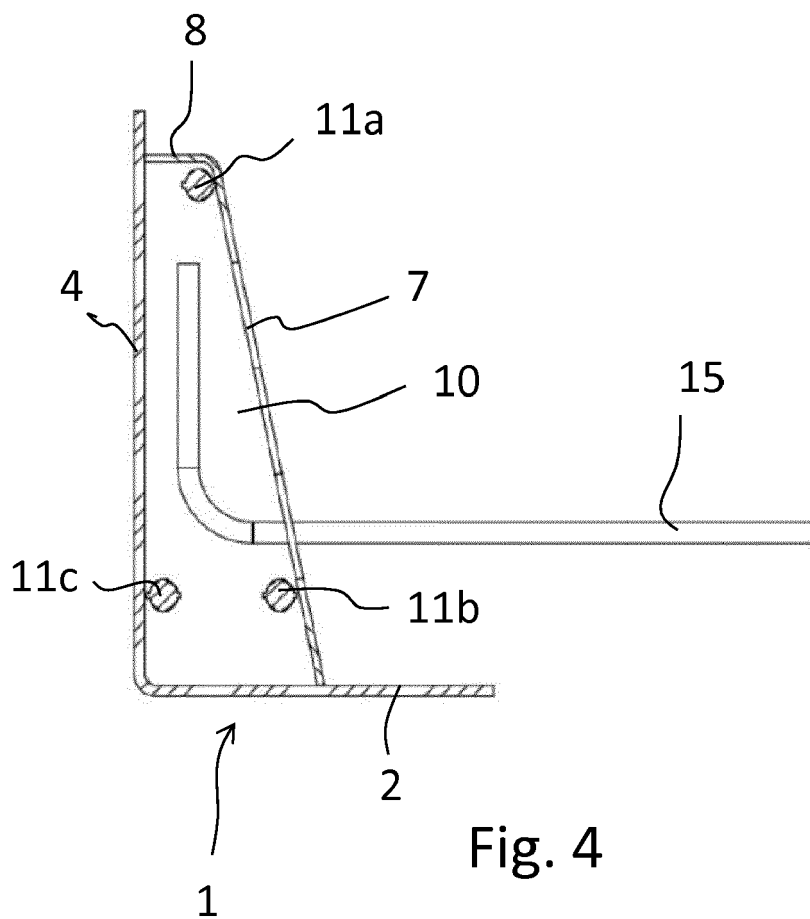


Fig. 4



EUROPEAN SEARCH REPORT

 Application Number
 EP 18 15 0176

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 16 May 2018	Examiner Petrinja, Etjel
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 15 0176

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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16-05-2018

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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