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

TRÄGER FÜR EINE HOHLKERNPLATTE

SUPPORT POUR DALLE À NOYAU CREUX

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## 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 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]** Document WO 2009/156586 A1 discloses a beam for supporting hollow core slabs according to the preamble of claim 1 and a connecting structure between a pillar and a beam. The beam is mounted and supported on the pillar in such a manner that the connectors at the ends of the beam extend inside the pillar at the connecting point of the beam and pillar. Reinforcing steel fittings extending through the pillar at the connecting point are mounted in the area of the end of the beam. The beam and connecting point are concreted, whereby after the concrete has hardened, the reinforcing steel fittings extending through the pillar serve as extension steel fittings and form continuous structures of the beams.

**[0007]** 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.

**[0008]** 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 brackets protruding from the ends of the support for a hollow-core slab for supporting the support for a hollow-core slab on adjacent hollow-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.

**[0009]** Significant advantages are achieved by the invention.

**[0010]** 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.

**[0011]** 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.

**[0012]** 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.

**[0013]** In a solution according to the invention the form of the support for a hollow-core slab is made to be box-like and comprises brackets protruding from the ends of the support for a hollow-core slab for supporting the support for a hollow-core slab on adjacent hollow-core slabs, and that there are three supporting bars arranged in the box-type space, of which a supporting bar is attached to a corner of the front plate and the top plate, the second supporting bar is attached to the lower part of the front plate, and the third supporting bar is loose in the space or attached to the back plate. 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.

**[0014]** The support is supported on the adjacent hollow-core slabs according to the invention.

**[0015]** 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.

**[0016]** 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.

**[0017]** 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.

**[0018]** 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.

**[0019]** 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. 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.

**[0020]** 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.

**[0021]** Furthermore, the support 1 for a hollow-core slab comprises end plates 5 arranged in the ends of the support 1, and brackets 6 protruding from the ends of the support 1 for supporting the support 1 on hollow-core slabs 3b in its ends. The brackets 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 bracket 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.

**[0022]** Three supporting bars 11a, 11b, 11c, for example corrugated bars, are 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. According to the invention 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.

**[0023]** 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.

**[0024]** 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 brackets 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.

**[0025]** 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 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 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, **characterized in that** the support (1) for a hollow-core slab comprises brackets (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 adjacent hollow-core slabs (3b), and 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) or attached to the back plate (4).

2. A support (1) for a hollow-core slab according to claim 1, **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).

3. 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).

4. A support (1) for a hollow-core slab 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.

5. A support (1) for a hollow-core slab 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.

6. A support (1) for a hollow-core slab 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).

**Patentansprüche**

1. Träger (1) für eine Hohlkernplatte, umfassend eine horizontale Trägerplatte (2) zum Tragen eines Endes der Hohlkernplatte, eine sich von der horizontalen Trägerplatte (2) nach oben erstreckende Rückplatte (4), Endplatten (5), die an den Enden des Trägers (1) für eine Hohlkernplatte angeordnet sind, und eine sich von der Trägerplatte (2) nach oben erstreckende Frontplatte (7), wobei die Frontplatte (7) von der Rückplatte (4) beabstandet angeordnet ist, und eine Deckplatte (8), wobei die Frontplatte (7), Deckplatte (8), Rückplatte (4) und Trägerplatte (2) einen kastenartigen Raum (10)bilden, in dem ein oder mehrere Tragstangen (11a, 11b, 11c) angeordnet sind, **dadurch gekennzeichnet, dass** der Träger (1) für eine Hohlkernplatte Konsolen (6) umfasst, die von den Enden des Trägers (1) für eine Hohlkernplatte vorstehen, um den Träger (1) für eine Hohlkernplatte auf benachbarten Hohlkernplatten (3b) zu tragen, und dass im kastenartigen Raum (10) drei Tragstangen angeordnet sind, von denen eine Tragstange (11a) an einer Ecke der Frontplatte (7) und der Deckplatte (8) angebracht ist, die zweite Tragstange (11b) am unteren Teil der Frontplatte (7) angebracht ist, und sich die dritte Tragstange (11c) lose im Raum (10) befindet oder an der Rückplatte (4) angebracht ist.

2. Träger (1) für eine Hohlkernplatte nach Anspruch 1, **dadurch gekennzeichnet, dass** in der Frontplatte (7) zum Zuführen von Beton in den Raum (10) Betonzuführöffnungen (9) vorhanden sind, und in der Deckplatte (8) zum Ablassen von Luft aus dem Raum (10) Entlüftungsöffnungen (13) vorhanden sind.

3. Träger (1) für eine Hohlkernplatte nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Deckplatte (8) an der Rückplatte (4) unterhalb ihrer Oberkante angebracht ist, und sich die Rückplatte (4) von der Befestigungsstelle der Deckplatte (8) nach oben erstreckt.

4. Träger (1) für eine Hohlkernplatte nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Trägerplatte (2) und die Rückplatte (4) durch Biegen aus einer gleichen Platte hergestellt sind.

5. Träger (1) für eine Hohlkernplatte nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Frontplatte (7) und die Deckplatte (8) durch Biegen aus einer gleichen Platte hergestellt sind.

6. Träger (1) für eine Hohlkernplatte nach einem der vorstehenden Ansprüche, der so ausgelegt ist, dass er in einer Brandsituation eines Gebäudes funktioniert, **dadurch gekennzeichnet, dass** die tragende Struktur des Trägers (1) eine Struktur umfasst, die durch eine Frontplatte (7), Deckplatte (8) und Tragstange oder Tragstangen (11a, 11b, 11c) gebildet wird, die in dem kastenartigen Raum (10) angeordnet sind, wobei die Struktur zum Anbringen an der Betonfuge (16) zwischen Hohlkernplatten (3a) angeordnet ist, die von Beton, der in den kastenartigen Raum (10) gegossen werden soll, und von Torsionsstahl (15) getragen werden sollen.

**Revendications**

1. Support (1) pour une dalle à noyau creux comprenant une plaque de support horizontale (2) pour supporter une extrémité de la dalle à noyau creux, une plaque arrière (4) s'étendant vers le haut depuis la plaque de support horizontale (2), des plaques d'extrémité (5) agencées aux extrémités du support (1)

pour une dalle à noyau creux, et une plaque avant (7) s'étendant vers le haut depuis la plaque de support (2), la plaque avant (7) étant agencée à une distance de la plaque arrière (4), et une plaque supérieure (8), les plaque avant (7), plaque supérieure (8), plaque arrière (4) et plaque de support (2) forment un espace de type boîte (10), dans lequel une ou plusieurs barres de support (11a, 11b, 11c) sont agencées, **caractérisé en ce que** le support (1) pour une dalle à noyau creux comprend des équerres de fixation (6) faisant saillie depuis les extrémités du support (1) pour une dalle à noyau creux pour supporter le support (1) pour une dalle à noyau creux sur des dalles à noyau creux adjacentes (3b), et qu'il y a trois barres de support agencées dans l'espace de type boîte (10), dont une barre de support (11a) est attachée à un coin de la plaque avant (7) et de la plaque supérieure (8), la deuxième barre de support (11b) est attachée à la partie inférieure de la plaque avant (7), et la troisième barre de support (11c) est libre dans l'espace (10) or attachée à la plaque arrière (4).

2. Support (1) pour une dalle à noyau creux selon la revendication 1, **caractérisé en ce qu'**il y a des ouvertures de fourniture de béton (9) dans la plaque avant (7) pour fournir du béton dans l'espace (10), et il y a des ouvertures d'évacuation d'air (13) dans la plaque supérieure (8) pour évacuer de l'air depuis l'espace (10).

3. Support (1) pour une dalle à noyau creux selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la plaque supérieure (8) est attachée à la plaque arrière (4) en dessous de son bord supérieur, et la plaque arrière (4) s'étend vers le haut depuis le point d'attache de la plaque supérieure (8).

4. Support (1) pour une dalle à noyau creux selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la plaque de support (2) et la plaque arrière (4) sont produites à partir d'une même plaque par pliage.

5. Support (1) pour une dalle à noyau creux selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la plaque avant (7) et la plaque supérieure (8) sont produites à partir d'une même plaque par pliage.

6. Support (1) pour une dalle à noyau creux selon l'une quelconque des revendications précédentes, qui est conçu pour fonctionner dans une situation d'incendie d'un bâtiment, **caractérisé en ce que** la structure porteuse du support (1) comprend une structure formée par une plaque avant (7), une plaque supérieure (8) et une barre de support ou des barres de support (11a, 11b, 11c) agencées dans l'espace de type boîte (10), la structure étant agencée pour s'attacher au joint en béton (16) entre des dalles à noyau creux (3a) devant être supportées par du béton devant être coulé dans l'espace de type boîte (10) et par de l'acier en torsion (15).

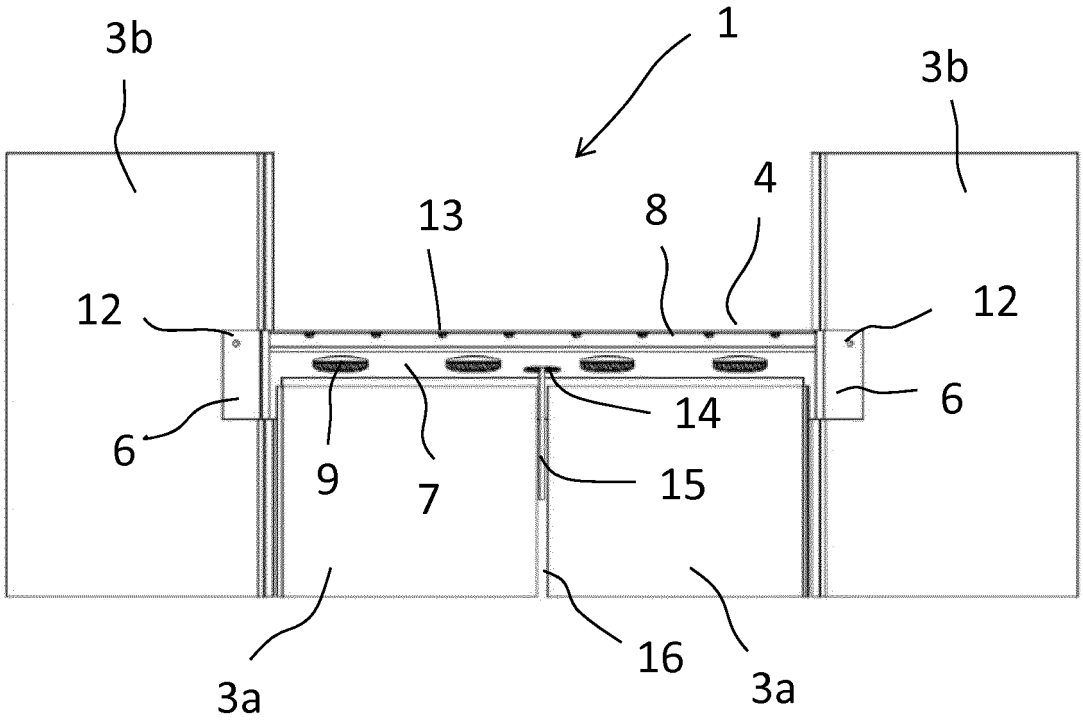


Fig. 1

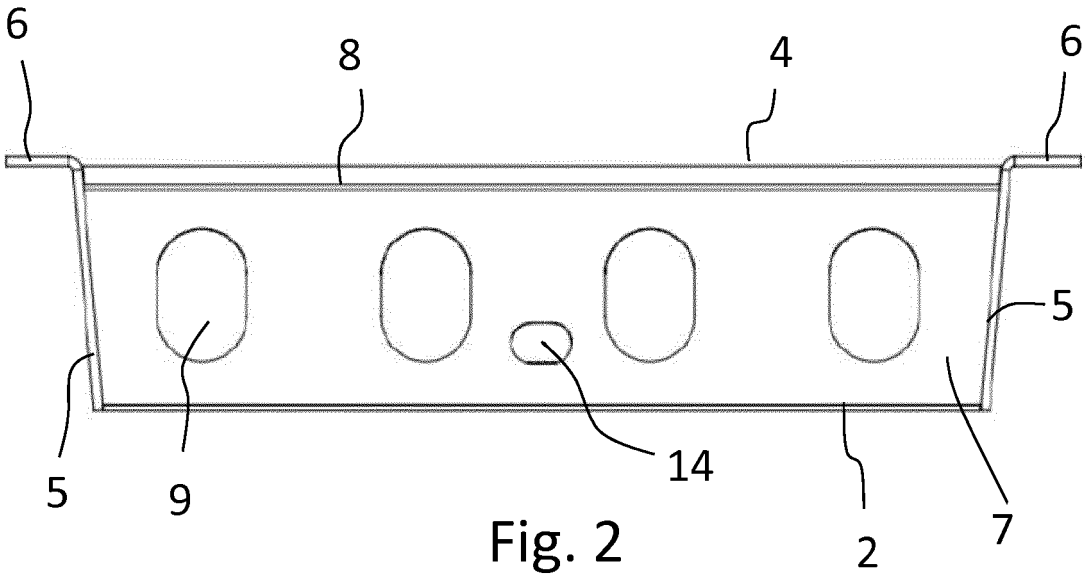


Fig. 2

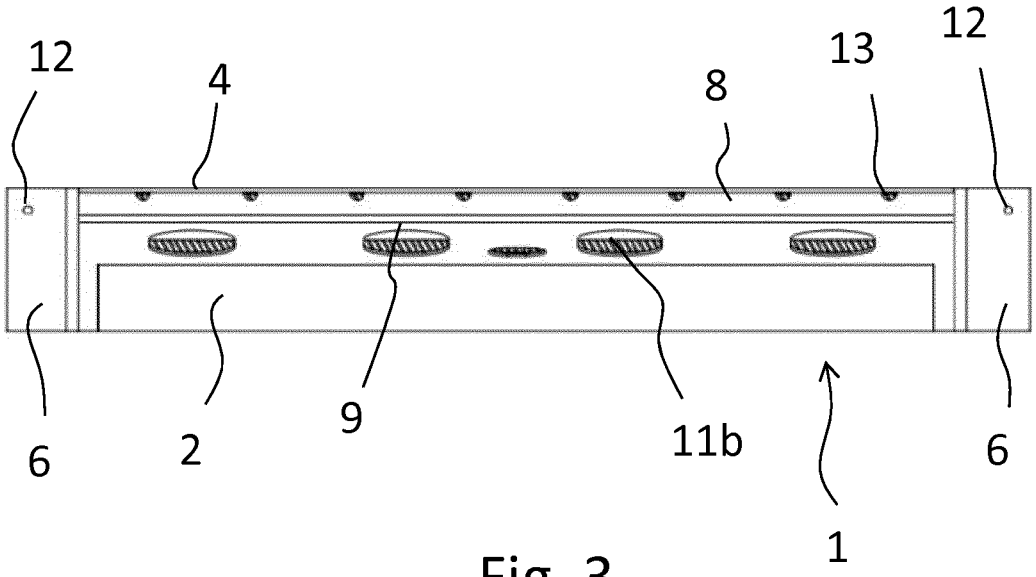


Fig. 3

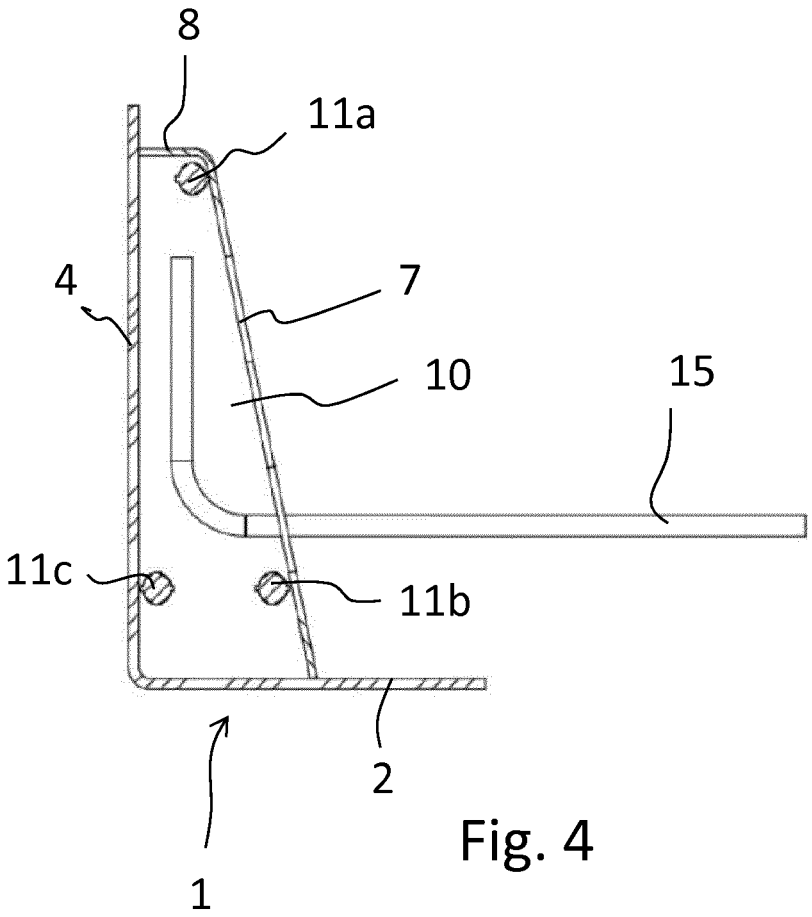


Fig. 4

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- WO 2009156586 A1 **[0006]**