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(54) **ARRANGEMENT IN A FENCE STRUCTURE**

(57) An arrangement in a fence structure, comprising at least of vertical posts (3) at a distance from each other and of wall structures (1) fitted in between the vertical posts (3) and connecting the vertical posts (3). A wall structure (1) fitted in between two sequential vertical posts (3) has been supported at least on one side by fastener elements (4a) on the vertical posts (3) and

aligned in the direction of the vertical posts (3) with the fastener elements being fitted to the vertical posts. Each fastener element (4a) is comprised of a compressive element (4f), which for its part has been arranged to hold one end of a wall structure (1) in connection with one vertical post (3).

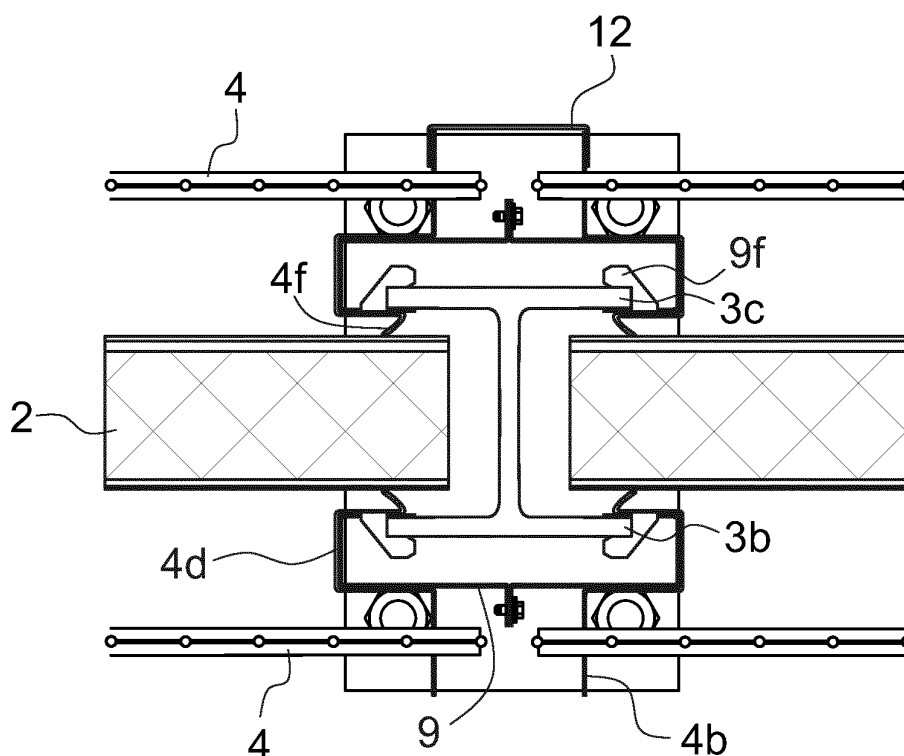


Fig. 7

Description

[0001] The invention is an arrangement in a fence structure presented in the introductory part to the patent claim 1.

[0002] The invented solution is suitable for use in various fence structures, such as modular sound and noise dampening and reducing protective structures. The invented solution is particularly well suited for use in noise barriers for streets, roads, and railroads.

[0003] It is known that various modular fence structures exist, including noise barriers. In some known noise barriers the sound insulating or absorbing modules or similar elements have been fixed in between vertical posts, set at certain intervals. The distance between the posts may be for example approximately two metres, in which case the sound insulating elements fixed in between are likewise approximately two metres in length. According to a known technique, perforated metal sheets have been used as the surface structure for the noise insulating modules on traffic noise barriers, which have been fixed for example in front of sound reducing absorption material. Protective netting or similar protections against vandalism have also often been installed in front of the sound insulating modules. The protective netting is often made of metal, and they also often consist of parts that are approximately as long as the distance between two vertical posts. Some other surface structure apart from perforated metal sheets may also be used in front of the modules.

[0004] The lengths of the sound insulation modules, the perforated metal sheets acting as the module surface structure, and the protective netting vary due to thermal expansion. It is known that sound insulation modules and their surface structures and protective netting are often affixed onto the vertical posts by means of screws, bolts, and nuts, or other similar fasteners. The problem with such solutions is that thermal expansion can cause the fasteners and other structures to break, which is why the insulation elements or protective nets may not stay in place and/or may break. Protective netting and other parts may thus come loose in known solutions due to failing fasteners.

[0005] The purpose of this invention is to remove the faults of the known technique specified above by generating a novel arrangement for fence structures, by means of which arrangement the sound insulation elements or corresponding elements and/or their protective nets or other surface structures fitted in between the vertical posts of the fence structure can be affixed onto the posts firmly, securely, and easily. What has been presented in the characteristics section of patent claim 1 is characteristic of the invented arrangement. What has been presented in other patent claims is characteristic of other applications of the invention.

[0006] The benefit of the invented solution is that the structures fitted in between the vertical posts of the fence structure, such as noise insulation modules / elements,

their protective netting, and/or other surface structures can be attached onto the vertical posts firmly and easily. Another benefit is the absence of screws or similar fasteners in the fixing of the modules and nets, which means that no problems are caused by thermal expansion, due to the fact that the modules and other parts of the fence structure have been affixed in a way which allows their lengths to vary. The various parts of the fence structure will thereby not break easily due to thermal expansion. Another benefit of the screwless fixing is that the noise insulation elements and protective nets can be installed and replaced easily. A further benefit is that the modules and nets will remain securely in place. Yet another benefit is the affordability and simplicity of the arrangement.

[0007] The invention is explained in more detail below by means of application examples and by making reference to the attached drawings, in which

figure 1 presents a simplified frontal view of a part of a fence structure used as a traffic noise barrier, where the invented solution is in use,
 figure 2 presents a simplified end view of a part of a fence structure used as a traffic noise barrier, where the invented solution is in use,
 figure 3a presents an oblique and diagonal view of an adapter part belonging to the invented solution,
 figure 3b presents a top view of an adapter part belonging to the invented solution,
 figure 3c presents a side view of an adapter part belonging to the invented solution,
 figure 3d presents a side view from the other side of an adapter part belonging to the invented solution,
 figure 3e presents a side view from a third side of an adapter part belonging to the invented solution,
 figure 4a presents a top view of a fastener element belonging to the invented solution,
 figure 4b presents an oblique side view of a fastener element belonging to the invented solution,
 figure 4c presents a side view of a part of a fastener element belonging to the invented solution,
 figure 5 presents a side view and a partial cutaway of the fitting of a fastener element belonging to the invented solution onto a vertical fence structure post,
 figure 6 presents a frontal view and a partial cutaway of a fence structure vertical post according to the invented solution with its attached fasteners, protective netting, and covering,
 figure 7 presents a top view of a fence structure fastener solution according to the invention, and
 figure 8 presents a top view of another fence structure fastener solution according to the invention.

[0008] Figure 1 presents a frontal view and figure 2 a top view of a part of a fence structure used as a traffic noise barrier, where the invented solution is applied. In the solution in question, the fence structure with its noise insulation elements 2 has been placed on both sides of a street, road, or railroad, running essentially in the direction of the street, road, or railroad. The fence structure is comprised of essentially vertical posts 3 attached onto the foundations of the fence structure, standing at a distance from each other, and installed sequentially. In the spaces between the sequential vertical posts 3, to join the sequential posts 3, sound insulating elements 2 have been fitted as wall structures 1, one on top of another in a sufficient quantity to achieve the desired barrier height. The vertical posts 3 have been affixed onto the foundations by fasteners 7, for example bolts. The foundations of the fence structure are comprised of a base, for example a concrete sole 6, the stability of which has been further improved by for example underground concrete pillars 5. There is also a plinth in between the sole 6 and the lowest sound insulation element, comprised of for example aluminium plinth elements 8. There are two plinth elements 8 in this application, fitted one on top of the other.

[0009] Outside of the sound insulation elements 2, on both sides of the wall structure 1, there is fitted a protective net 4, which has been arranged to for example prevent graffiti from being painted on the barrier. For clarity, the protective net 4 has been drawn on figure 1 only partially on the wall section in between the vertical posts 3. The protective net 4 and the sound insulation elements 2 have been affixed at their ends in between the vertical posts 3, by means of fastener elements 4a running in the direction of the posts 3 and essentially as long / tall as the posts 3.

[0010] Figure 3a presents an oblique and diagonal view of an adapter part belonging to the invented solution. The adapter part 9 is a support piece cut from metal sheet and bent into shape, which have been arranged for fitting onto the vertical posts 3 belonging to the fence structure and shaped as I-profiles. The end flanges of the I-profiles of the vertical posts 3 are essentially as long as the central flange joining them. The fastener elements 4a have been arranged for fitting on top of the adapter parts 9. The adapter part 9 is comprised of a fastener 9a with its fastening holes 9b, a first support part 9c, a second support part 9d, and a third support part 9e, with a 90 degree angle at the meeting point of all of the said parts. The adapter 9 is also comprised of two support parts 9f.

[0011] In figure 3b the adapter part has been presented from the top, in figure 3c from one side which is the direction of the arrow A in figure 3b, in figure 3d from another side which is the direction of the arrow B in figure 3b, and in figure 3e from a third side which is the direction of the arrow C in figure 3b.

[0012] In figure 4a a top view is presented of the fastener element 4a belonging to the invented solution, which is a suitably bent profile made of a metal sheet.

The fastener element 4a has been bent to form a fastening section 4b, a first supporting section 4c, a second supporting section 4d, a third supporting section 4e, and a compressive element 4f. The fastener element 4a and its different parts are explained in more detail in the explanation section to figure 7.

[0013] In figure 4b the fastener element 4a is presented obliquely from the side. The fastener element 4a is as long as the vertical post 3, or slightly shorter than the vertical post 3, with fastening holes 10 in its fastening section 4b at certain vertical intervals for the fastening of the protective net 4 and a cover element.

[0014] Figure 4c presents a side view of the top end of the fastener element 4a belonging to the invented solution. Figure 4c shows one of the fastening holes 10 of the fastening section 4b of the fastener element. The fastening hole 10 is comprised of a supporting groove 10a and an installation groove 10b. The protective net 4 placed in between each two vertical posts 3 has been arranged to fit securely into the supporting grooves of the fastener holes 10 by its horizontal bars, whereby the protective net 4 will remain firmly attached onto the fence structure fasteners 4a. The protective nets 4 in this application example are such that their horizontal parts are comprised of two parallel metal bars, and their vertical parts of a single metal bar. The protective net 4 has been arranged to be installed into place via the installation grooves 10b. There is an installation groove 10b in the top edge of the fastener element 4a as well, where the topmost horizontal part of the protective net 4 has been arranged to fit.

[0015] Figure 5 presents a side view and a partial cut-away of the fitting of a fastener element 4a belonging to the invented solution onto a vertical fence structure post 3. The vertical post is a metallic I-beam with a central flange 3a, a first end flange 3b, and a second end flange 3c. Figure 5 only presents the top part of the vertical post 3. Onto the first end flange 3b of the I-beam pairs of adapters 9 have been arranged at certain vertical intervals, of which one pair has been fitted close to the top end of the I-beam. There are thus always two adapter parts 9 at the same height of the I-beam, which two adapter parts 9 form a single adapter element. The first adapter part has been fitted around the first edge of the I-beam end flange, and the other adapter part has been fitted around the second edge of the I-beam end flange, whereby the fastener parts 9a of the adapter parts are fitted one against the other. The adapter parts 9 at the same height can be attached one to the other via the fastener holes 9b by means of fastener elements, such as drilling screws. It is usually sufficient to fasten by a screw at each fastener hole 9b, or fastening may not be required at all, because the adapter parts 9 are firmly form locked around the end flange 3b due to their shape. The fastening of the adapter parts onto each other by a screw has been demonstrated in figures 6, 7, and 8. In figure 5 the adapter parts 9 are presented from the same direction as in figure 3d.

[0016] On top of the adapter parts 9 fitted onto both

edges of the end flange 3b a single fastener element 4a has been fitted. Figure 5 only shows the fastener element of the other edge in a partial cutaway. The fastener element 4a has been formed in a way that causes it to form lock firmly around the adapter parts 9. The protective net 4 has been fitted into the fastener holes 10 of the fastener element 4a. Fastener elements 4a can also be attached onto the other end flange 3c of the vertical post 3.

[0017] Figure 6 presents a frontal view and a partial cutaway of the fitting of the fastener elements 4a onto the vertical post 3 of the fence structure and of the fastening of the protective net 4 and the cover element 12 onto the fastener elements 4a. As explained in the explanation section to figure 5, adapter parts 9 have been fitted onto the end flange 3b of the vertical post 3 on both edges of the flange at regular vertical intervals. The adjacent adapter parts 9 have in this application example been fastened to each other by a single drilling screw. Fastener elements 4a have additionally been fitted on top of the adapter parts 9 at both edges of the vertical flange 3b, of which only the upper parts are shown in figure 6. Figure 6 additionally presents a part of a single protective net 4, which has been fitted onto the fastening holes of the first fastener element at its edge.

[0018] Figure 7 presents a magnified and simplified top view of a part of a fence structure used as a traffic noise barrier, where one of the invented arrangement applications is in use. When viewed from the top, each vertical post 3 is for example in the shape of an I-beam and placed into place in a way where the beam centre flange 3a is essentially running in the transverse direction of the longitudinal fence structure, i.e. in relation to the longitudinal direction of the noise insulation elements 2. Thus, a space wider than the noise insulation elements 2 is left in between the I-beam edge flanges 3b and 3c, where one of the ends of the noise insulation elements 2 has been placed. Adapter parts 9 have been fitted onto the vertical post 3 edge flanges at regular intervals. One adapter part 9 has been fitted close to the upper end of the vertical post 3, and one close to the lower end of the vertical post 3. As explained above, the adapter parts 9 are metallic support pieces bent into shape, by which a fastener element 4a has been fitted to both edge flanges 3b and 3c of the vertical post 3. As explained above, the fastener element 4a is a metallic profile as long as or slightly shorter than the vertical post 3 and bent into shape, which has been arranged to centralise and support the ends of the noise insulation element 2 when the end of the noise insulation element 2 has been placed inside the I-beam. In addition, the vertical edge of the protective net 4 has been arranged to be fitted into the fastening holes of the fastener element 4a.

[0019] The fastening section 4b of the fastener element 4a is an essentially vertical flange in relation to the noise insulation elements 2, the first outer edge of which extends slightly beyond the noise insulation elements 2 and out of the I-beam end flange, approximately at the half-way point of the outer edge and centre point of the I-beam

end flange. The other edge of the fastening section 4b of the fastener element 4a joins to the first support section 4c of the fastener element, which has been fitted on top of the adapter parts 9 fitted to the end flange of the I-beam. There is a 90 degree angle in the joint of the fastening section 4b and the first support section 4c of the fastener element 4a, where the first support section 4c has been arranged to align itself towards the outer edge of the I-beam end flange on top of the adapter parts 9. The first support section 4c of the fastener element 4a, as well as the adapter parts 9, have been arranged to align themselves towards the noise insulation elements 2 at the edge of the I-beam end flange, where the following second support section 4d of the fastener element is perpendicular to the noise insulation elements 2 on top of the adapter parts 9. There is a 90 degree angle in the adapter parts 9 and the second support section 4d of the fastener element close to the noise insulation elements 2, after which the third support section 4e of the fastener element 4a begins, which continues in the direction of the I-beam centre flange 3a parallel to the noise insulation elements 2 on top of the adapter parts 9.

[0020] There is an angle greater than 90 degrees, for example approximately 135 degrees, in the fastener element 4a close to the inner edges of the adapter parts 9. The fastener element 4a compressive element 4f begins at this fold, which has been arranged by means of spring force to centralise and support the noise insulation elements 2 in between the end flanges of the I-beam. At the same time, the compressive element 4f keeps the fastener element 4a in place as well with its spring force. The noise insulation elements 2 have room to move in between the end flanges of the I-beam. Because of this and the flexibility of the fastener element 4a compressive element 4f, thermal expansion will not cause problems. Figure 7 also shows a single cover element 12, which has been arranged to cover and protect the structures in between the fastener elements 4a and the fastener parts 4b.

[0021] Figure 8 shows a similar structure to that in figure 7, with the exception that in this application example the vertical post 3, i.e. the I-beam, is larger. Similar adapter parts 9 can however be fitted onto even this larger I-beam. In this case the supporting parts 9f of the adapter parts are supported by the inside of the I-beam end flange, whereas in the application example of figure 7 the supporting parts 9f are supported by the outside of the I-beam end flange.

[0022] It is obvious to the person skilled in the art that the various applications of this invention are not limited to the examples mentioned above, but may vary within the framework set by the following patent claims. Therefore the various parts and structures of for example a fence structure with their lengths, shapes, and locking mechanisms may be very different from what has been presented above.

[0023] It is also obvious to the person skilled in the art that there may be window and door structures in a fence

structure, which animate the surface of the fence structure and provide the opportunity to see through the barrier and/or take a shortcut through it.

[0024] Also, it is obvious to the person skilled in the art that only one side of a fence structure will be equipped with protective netting, meaning that only the vertical posts on the side with the netting will be equipped with the fastener elements described above. The other side of the fence structure may therefore be different.

[0025] It is also obvious to the person skilled in the art that the fastener element and adapter parts for the noise insulation elements and the protective netting may be different from what has been presented above. The fastener element profile for example may be slightly different.

acterised in that the fastener element (4a) profile together with its compressive element (4f) has been formed and dimensioned in a way that causes it to form lock on top of the adapter parts (9) and receive support from the adapter parts (9) and a wall structure (1).

7. An arrangement according to any one of the preceding claims, **characterised in that** the wall structure (1) comprises modular and self-supporting noise insulation elements (2) placed one on top of another.

Claims

1. An arrangement in a fence structure, comprising at least of vertical posts (3) within a distance from each other and of wall structures (1) fitted in between the vertical posts (3) and connecting the vertical posts (3), **characterised in that** the wall structure (1) fitted in between two sequential vertical posts (3) has been attached to vertical posts (3) at least on one side with fastener elements (4a) aligned essentially parallel to the vertical posts (3), which have been fitted together with the vertical posts, and **in that** each fastener element (4a) comprises a compressive element (4f) which for its part has been arranged to support one end of a wall structure (1) in connection with a single vertical post (3).
2. An arrangement according to claim 1, **characterised in that** a protective net (4) has been fitted in front of the wall structure (1), which has been fitted by its vertical edges into fastener elements (4a) fitted in connection to the vertical posts (3).
3. An arrangement according to claim 1 or 2, **characterised in that** at least two adapter parts (9) have been fitted into one vertical post (3) and a fastener element (4a) has been form locked on top of the adapter parts (9).
4. An arrangement according to claim 1, 2, or 3, **characterised in that** the fastener element (4a) comprises a set of fastening holes (10) into which the protective net (4) has been fitted by its horizontal parts.
5. An arrangement according to claim 3 or 4, **characterised in that** the adapter part (9) profile has been formed and dimensioned in a way that causes it to form lock with and receive support from a vertical post (3).
6. An arrangement according to claim 3, 4, or 5, **char-**

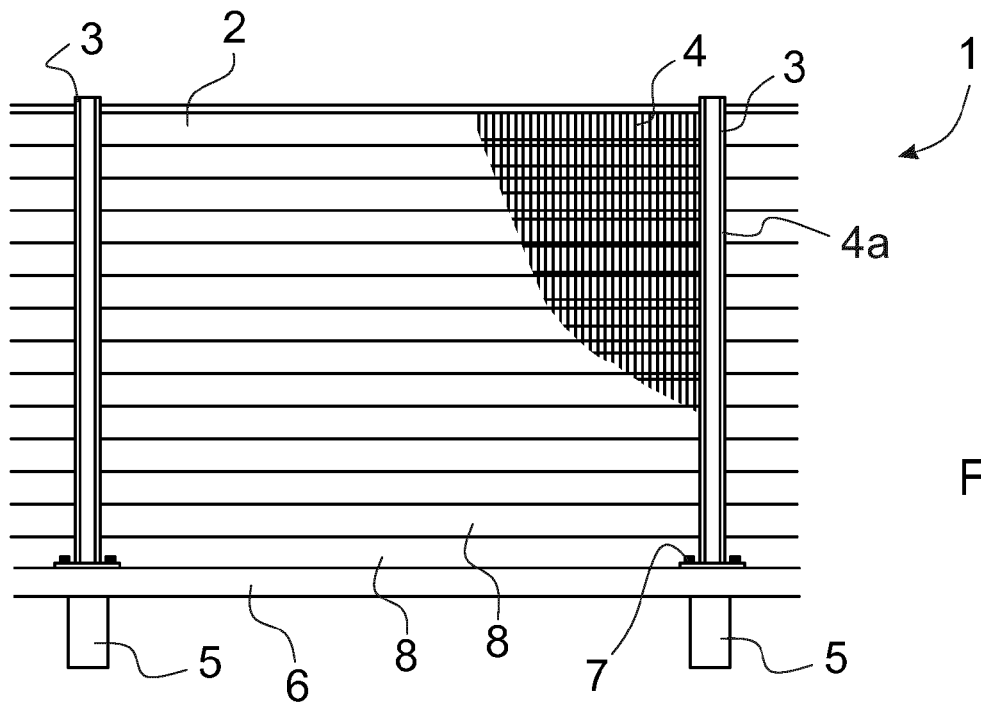


Fig. 1

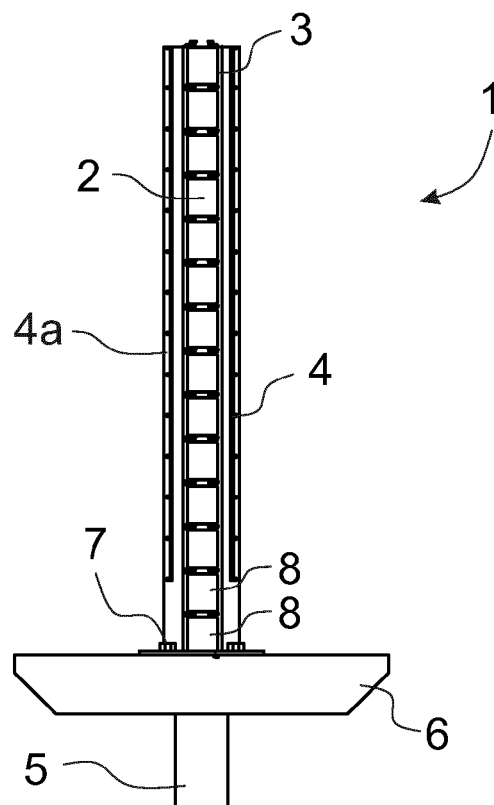


Fig. 2

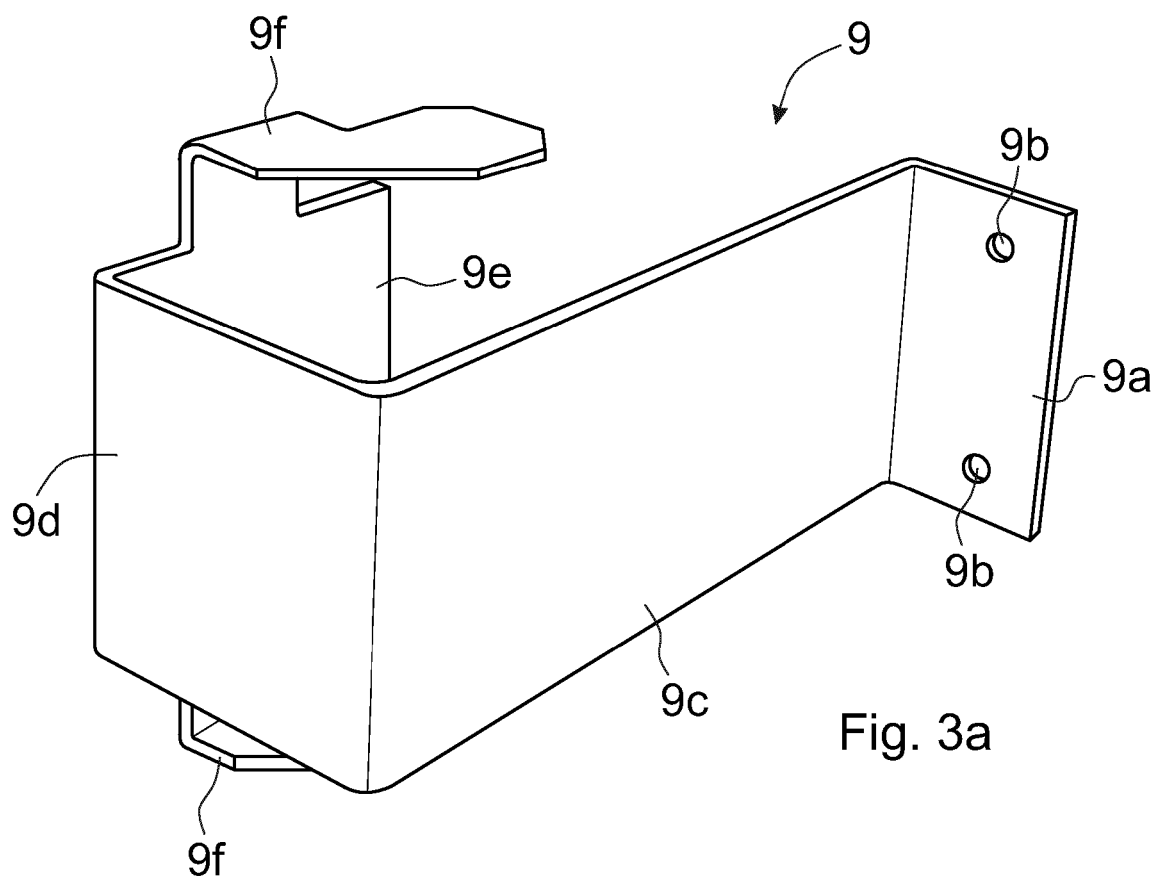


Fig. 3a

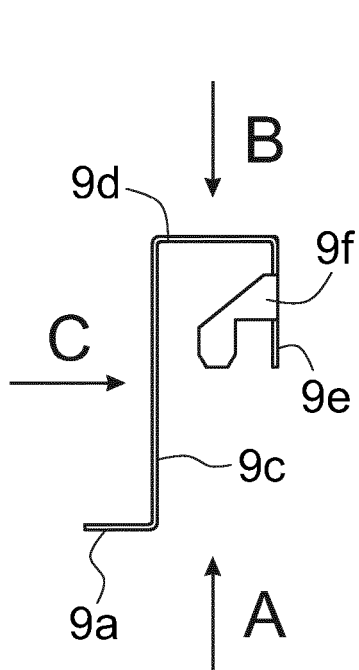


Fig. 3b

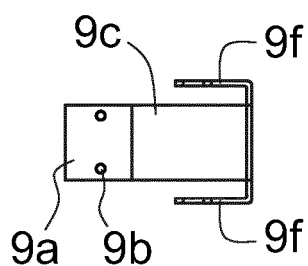


Fig. 3c

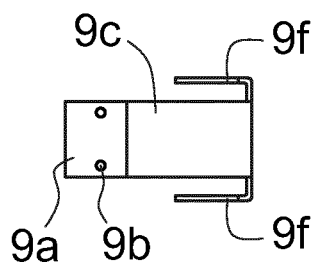


Fig. 3d

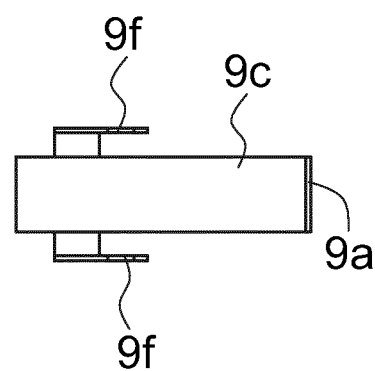


Fig. 3e

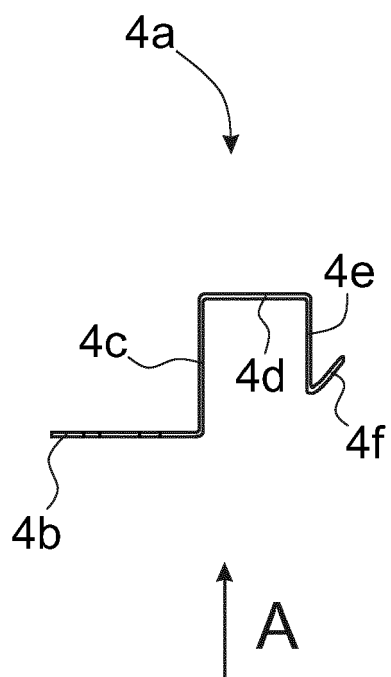


Fig. 4a

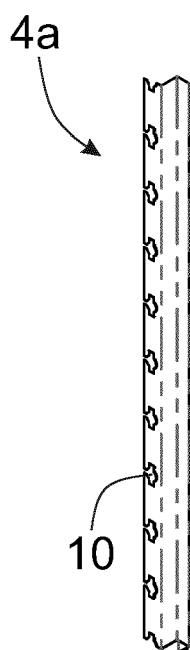


Fig. 4b

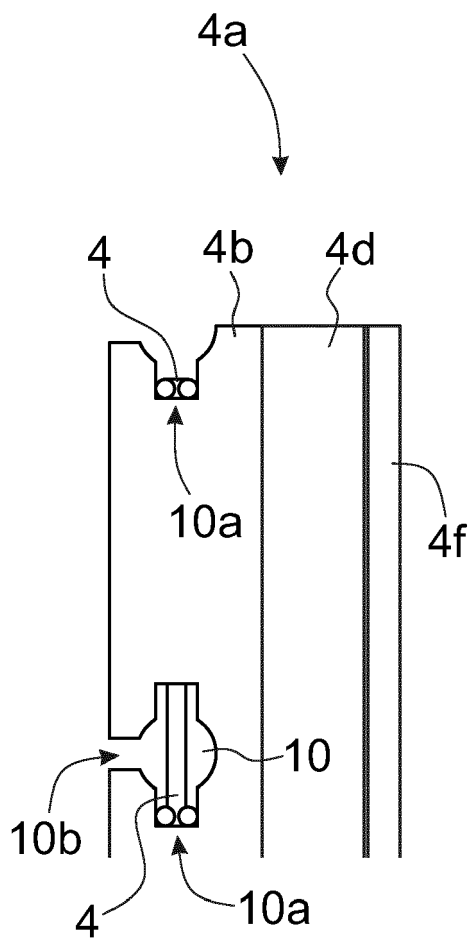


Fig. 4c

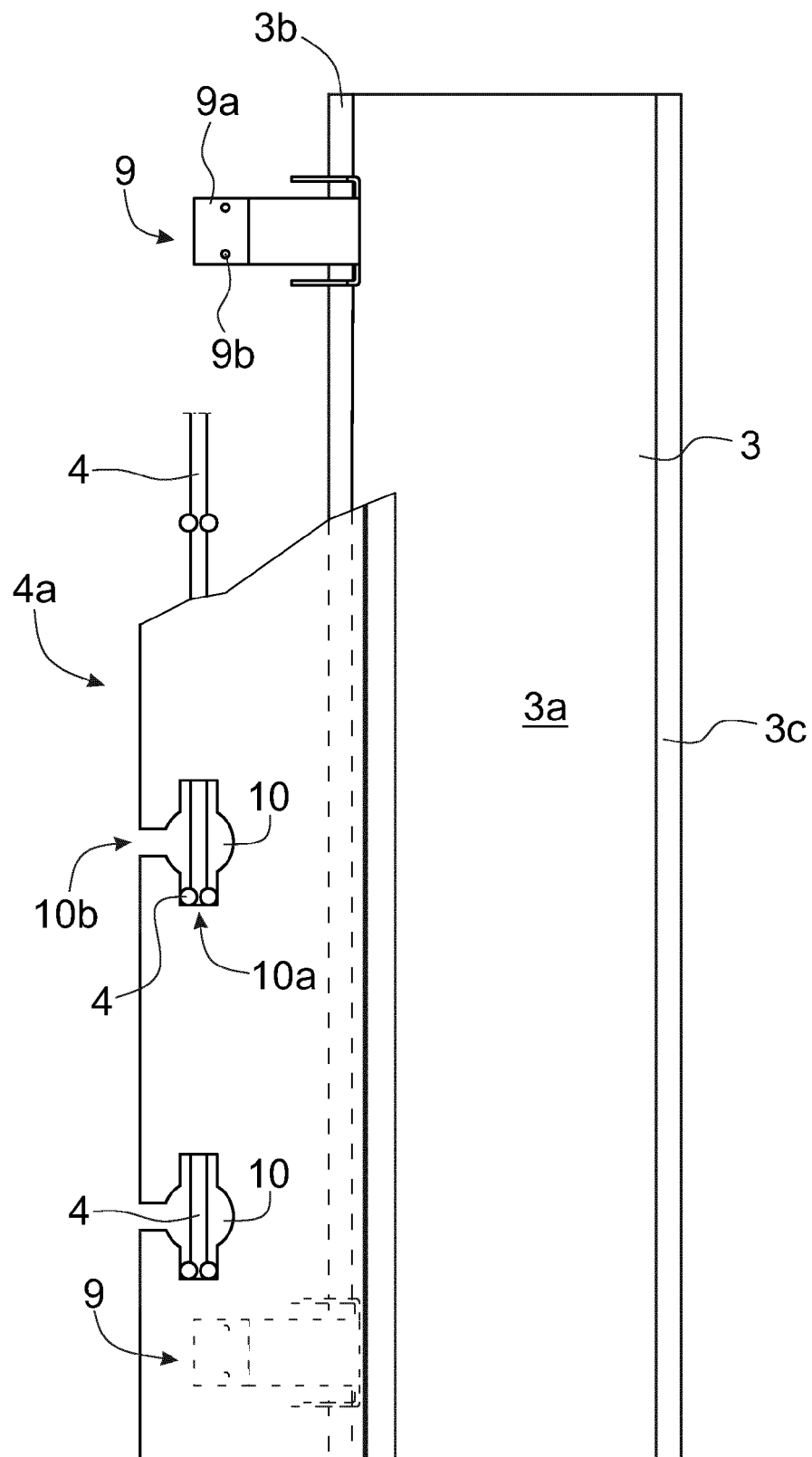


Fig. 5

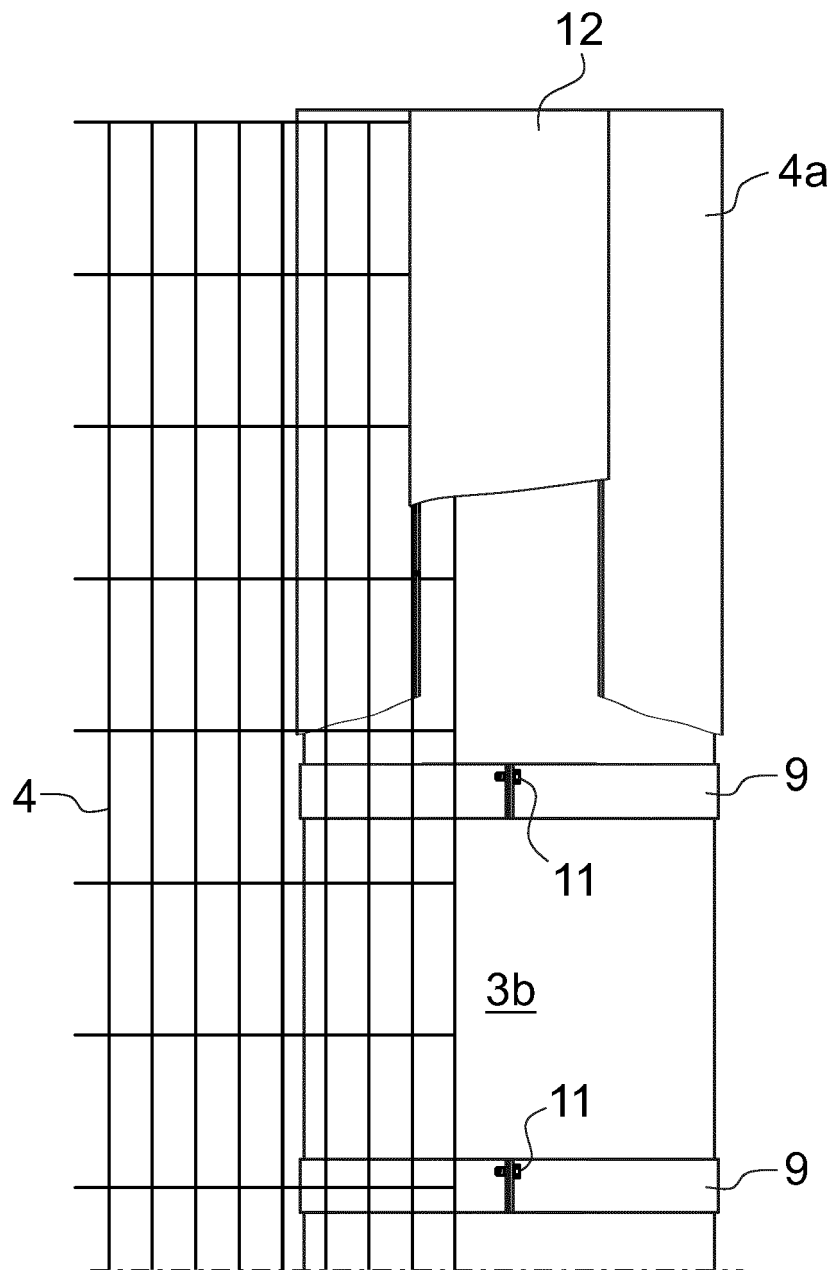


Fig. 6

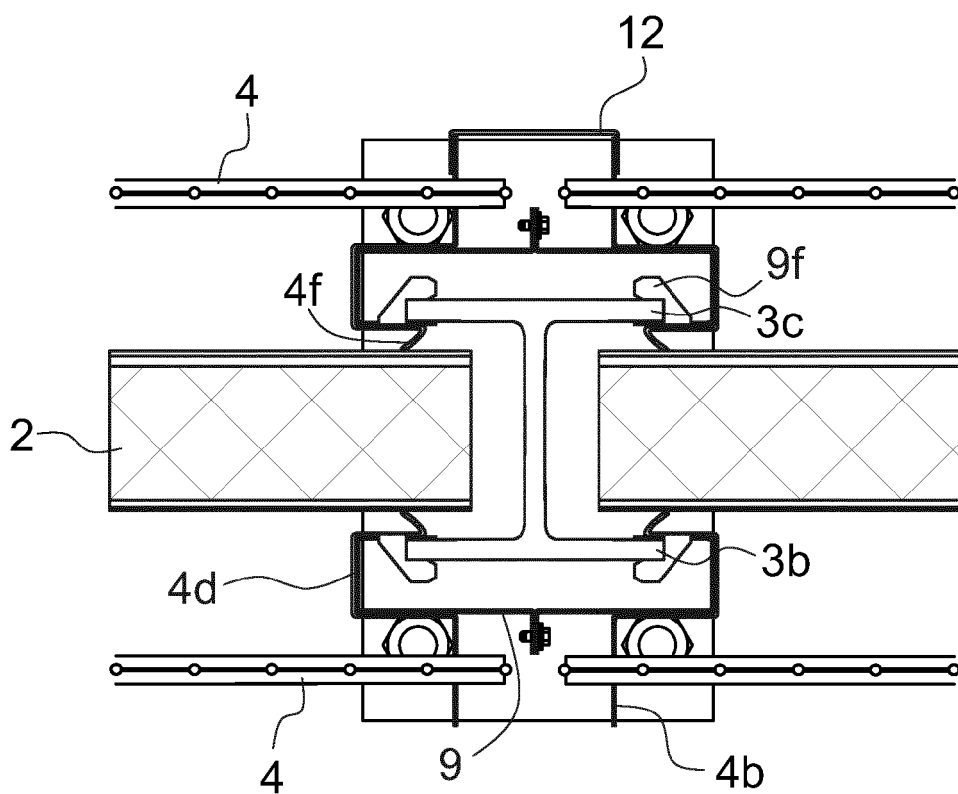


Fig. 7

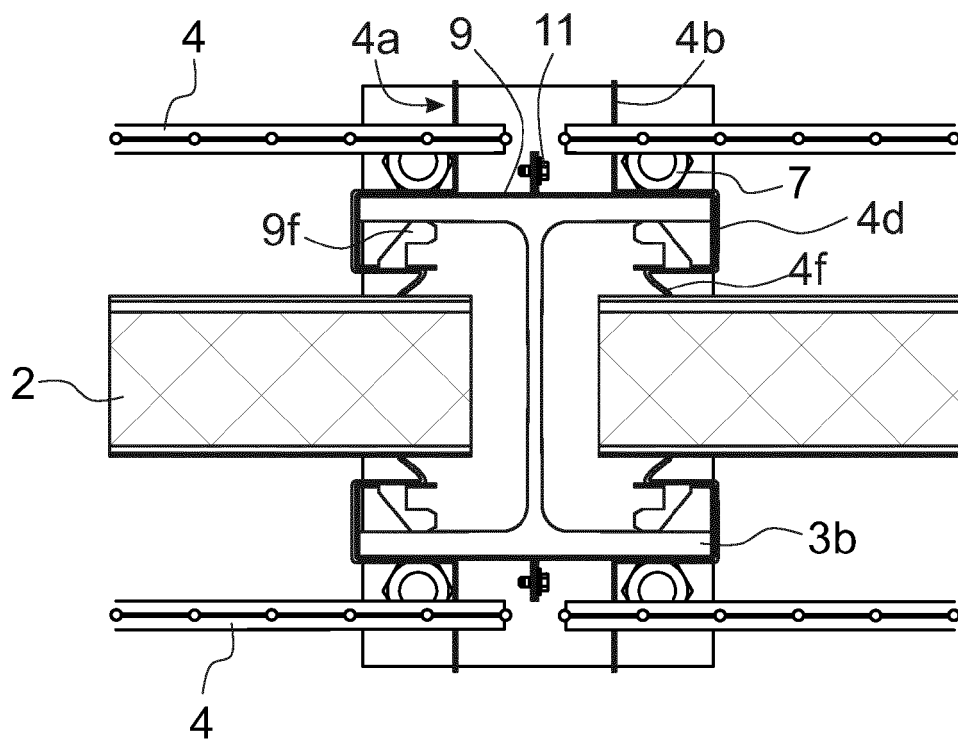


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
EP 19 17 3620

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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			E04H E01F
Place of search		Date of completion of the search	Examiner
Munich		26 September 2019	Brucksch, Carola
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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26-09-2019

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