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(54) CONSTRUCTION OF THE SEGMENTAL FENCE AND METHOD OF ITS ASSEMBLY

(57) The present invention discloses a system and a method of assembling a fence segment of a profiled sheet material (e.g., sheet metal). The fence segment (1) consists of a set of horizontal crossbars (4) made of profiled sheet metal, the folding cross-sectional shape of which is optional. In addition, the fence segment (1) comprises connecting elements (5) for securing the rigid horizontal crossbars (4) between two vertical trough-shaped profiles (6) attached to the vertical poles (3) of the fence. Horizontal crossbars (4) can have different shapes of the sheet metal profile, selected according to the desired fence design and functionality (visibility, sunlight transmission, etc.). The assembled fence segment (1) is resistant to climatic and mechanical effects, such as sudden changes in temperature, humidity, or wind. The method of assembling and disassembling the fence segments is efficient and simple, it does not require special tools and skills during assembly, and the assembly process can be performed by one person.

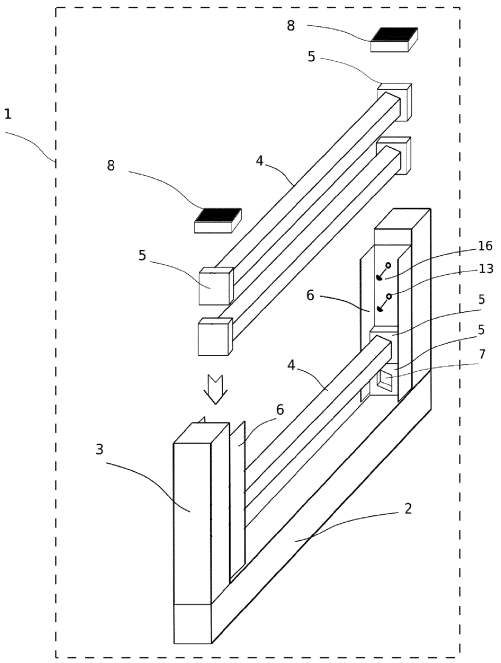

Fig. 2

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to fence structures, in particular having vertical posts with horizontal crossbars, and to their assembly. The invention discloses the structure of the segmental fence comprising rigid crossbars made of sheet material (e.g., profiled sheet metal) and an efficient method of assembling such a fence.

BACKGROUND ART

[0002] The most common structure of fences consists of a series of vertical posts connected by horizontal crossbars or panel elements mounted between the pairs of posts, or other types, design and structure segments installed between the posts of the fence.

[0003] Easy-to-install fence structures are known. U.S. Pat. US3195864A (15-03-1962) describes a fence constructed of posts and crossbars, which is all metal, easy to assemble, solid structure, attractive and pleasing to the eye. Another object of the present invention is to provide factory-made high quality and economical components that can be easily assembled outdoors and thus enabling to assemble a strong metal fence from the crossbars, suitable for a variety of situations and with minimal labor costs.

[0004] Another structure of horizontal tubes and vertical poles is described in the Korean patent KR101910532B1 (18-05-2018). The structure of the fence consists of: the vertical, rectangular cross-section post with at least one engagement groove on the surface; a horizontal tube connected to the post and capable of moving sideways and vertically; a first connecting bracket movably connected to the post engagement groove and movable sideways; a pair of second connecting brackets mounted on the horizontal end of the tube and suspended from the first connecting bracket to move vertically; and a hinge pin for coupling the first and the second connecting brackets.

[0005] Another U.S. patent US7090201B2 describes a fence structure system, consisting of strong and durable polymeric components, provided as an integrated modular kit that is easy to assemble in a DIY way. The modular fence is an integrated system of compatible vinyl components using a unique polycarbonate or ABS-plastic clamp. The fence consists of vertical posts with horizontal elements mounted between them. The horizontal elements have grooves for pressing in and holding the fence panels. Horizontal elements are connected to vertical elements using a new and uniquely configurable connecting element.

[0006] Also, aluminum fences are known similar in structure to those described in KR101910532B1 and US7090201B2, but differ in that the horizontal crossbars of the fence are not round or square aluminum tubes but elements of other cross-sectional shapes, such as flat blind-shaped aluminum profiles.

[0007] Also, there are fence structures made of sheet metal and profiled sheet metal panels. Profiled sheet metal structures, rails and panels are light but durable, they can be galvanized and painted with special durable and resistant paints. Profiled sheet metal improves the strength of the fence structure.

[0008] A fence that completely covers the view is described in U.S. Pat. US20180058092A1, in which the structure consists of interconnected vertical fence panels mounted between horizontal guide rails. In particular, an improved connector of the vertical panel elements is disclosed, which connects the vertical panels into a single fence panel between the horizontal rails, while the vertical panels interlock and are no longer separate, thus enhancing the integrity and stability of the fence.

[0009] Another fence of plinth structure is described in U.S. Pat. US20070221901A1. The fence plinth is made of a sheet material, which in one embodiment is pre-painted galvanized steel, has end edges and is profiled with stiffening formations running along the sheet between the end edges. The plinth is ideal for use in conjunction with a fence consisting of posts connected by horizontal channels in which the edge of the plinth can be inserted. Along with the structure of the plinth fence, the method of forming the plinths is also described.

[0010] Also, there are profiled sheet metal segmental fences assembled using rivets and professional tools. The assembled and riveted profiled sheet metal segments are transported to the destination and installed in the fence line, each segment being installed between the pairs of vertical posts of the fence. However, the production, assembly and transportation of such structure segments is complex, requires professional tools and skills, and can only be serviced by qualified professionals. The structure and method of assembly of such a fence segment comprising horizontal profiled sheet metal crossbars joined by rivets or screws are known and are shown in Fig. 1.

[0011] After the review of the foregoing prior art sources and an assessment of the advantages of different fence structures we can conclude that the fence structures are numerous and differ in functional characteristics, such as contemporary fashion, design and adaptability to customer tastes, safety, durability, resistance to adverse climatic conditions and an efficient delivery and assembly process. Profiled sheet metal fence structures and kits have recently become popular because they have many advantages over other fence structures.

[0012] However, currently known profiled sheet metal fence structures and assembly methods are not efficient enough and require professional technical actions, such as: riveting, special transportation of assembled segments, teams of several qualified specialists to properly install the delivered segment in the fence line. Warranty and post-warranty service is also complicated. For example, in a riveted fence segment, it is difficult to replace

a single crossbar if it has been broken or deformed during the use of the fence. In addition, fence segments assembled by riveting from profiled sheet metal have disadvantages in terms of durability and resistance to climatic factors such as seasonal temperature fluctuations. For example, after a few years, a riveted segment of a fence may come apart due to breakage / rupture of the rivets under influence of climatic thermo-mechanical stress. Delivery of assembled fence segments (Figure 1) to the destination is also problematic, as the assembled / riveted fence segments can be 1.8-4 meters long and up to 2 meters high. In addition, a team of at least 3 persons is required to deliver the assembled fence segments of this size to the destination (loading and unloading) and to install them in the fence line.

SUMMARY OF THE INVENTION

[0013] The present invention discloses the structure and assembly method of a segmental fence made of profiled lamellas. The segment of the fence consists of horizontal crossbars, or lamellas, made of profiled sheet metal or metal sheets folded in cross-sectional profiles of the chosen shape. The cross-sectional shape of the lamellas is chosen by taking into account the design and functional factors of the fence, such as visibility through the fence or transmission of sunlight. The fence segment consists of two vertical trough-shaped metal rails attached to the fence posts. Furthermore, the structure uses special connecting elements to ensure firm stacking of the horizontal lamellas on top of each other and rigid connection within the segment; also, the base structure, the top cover (covers for posts and / or covers for the whole segments), and the protective and fixing elements. The horizontal bars (lamellas) of the fence segment are bent from high-quality sheet metal or other sheet and / or metal material. The sheet metal can be galvanized and coated with special paints, which give the lamella a good appearance and resistance to the environmental factors.

[0014] The assembly process of this segmental fence is efficient, starting with preparation of the structural elements (the vertical rails, the horizontal lamellas, the connecting elements, the base, the covers and the protective fastening elements). The fence segment kit is provided in a compact package that can be conveniently delivered to the destination by one person. The assembly of the fence segments is performed according to a simple instruction that does not require professional tools or operations (such as bending, painting, drilling or riveting). Sufficient tools are a standard electric screwdriver and a level measuring tool (spirit level). According to these instructions, the fence installation technician or the customer himself, who has minimal technical skills, can independently install any segment of such structure.

[0015] The assembled and installed fence segment is resistant to adverse climatic conditions, such as sudden changes in temperature, humidity, and wind. The segment is rigid and resistant to deformations due to short-term mechanical impact, such as the impact of a children's play ball. The vertical sheet metal rails and horizontal lamellas are coated with special anti-corrosion materials that protect the surfaces and ensure a long-term service life of the components.

[0016] The structure of the segment and the method of assembly allow for a variety of fence shapes and designs. This variety is characterized by the different shapes of the horizontal lamella profile, which allows the implementation of different fence configurations, such as roofs, blinds, with clear acrylic inserts (boxes) and the like.

[0017] The fence of this structure is disassembled as easily as it is assembled, so it can be moved and reinstalled in another location. As with the assembly, disassembly does not require professional tools and skills.

DESCRIPTION OF DRAWINGS

[0018] The accompanying diagrams and drawings comprise an integral part of the description of the invention and are provided as a reference to a possible embodiment of the invention, but are not intended to limit the scope of the invention. The drawings and diagrams do not necessarily correspond to the scale of the components of the invention. Components that are not necessary to explain the operation of the invention and have no relation are not provided.

Fig. 1	Known example of the prior art, where a set of horizontal bars (lamellas) of profiled sheet metal is connected into a segment of a fence by means of rivets, screws or bolts;
Fig. 2	Prefabricated structure and elements of a fence segment in accordance with the present invention;
Fig. 3	Example of a connecting element for stacking horizontal crossbars (lamellas) of a fence and connecting them into a segment of the fence;
Fig. 4	Fragment of the fence made of the two assembled segments;
Fig. 5 (a-k)	Cross-sectional shapes of the horizontal lamellas of the fence segment, practical and selected according to the desired fence design: (a)-(d) - "blind" shape; (e) - "roof" shape; (g)-(i) - "herringbone" shape; (f), (k) - tightly covering horizontal crossbars.
Fig. 6	Longitudinal vertical cross-section of the fence segment showing how the segment is assembled; the horizontal lamellas have a clearance allowing the lamella to thermally shrink or expand in the longitudinal direction between the two connecting elements; the vertical rails of the

segment have bottom supports for supporting and holding a stack made of horizontal lamellas and connecting elements;

Fig. 7 Segment of the fence, ready (that is, compactly packaged) to be transported to the destination (the location of the fence installation);

Fig. 8 (a-c) Examples of vertical rail cross-sectional profile (top view): (a) cross-section with straight edges; (b) with folded edges; (c) with double outer and inner rails and compensating spring steel plates between the two rails;

Fig. 9 (a-b) Versions of fastening the assembled fence segment by: a) closing (locking) the stack of lamellas and connecting elements with lids at the top of the vertical rails; (b) covering and securing (locking) the segment with an upper continuous beam or top;

Fig. 10 (a-c) Double vertical rail structure with spring plates: (a) side view; (b) side view when the fence posts are not perfectly vertical;

Fig. 11 (a-b) Protective cover structure (cross-section) of the connecting elements of the fence post and the segment: (a) two fence segments in the same line; (b) two fence segments connected at an angle;

Fig. 12 (a-c) Embodiments of lamella connecting elements of the same shape: (a) a connecting element holding part of one lamella and part of another; (b) two connecting elements holding a single lamella; (c) one connecting element completely holding one lamella.

DRAWINGS - description of highlighted items

[0019]

1 Fence segment;
2 Base (foundation) of the fence segment;
3 Posts (poles) of the fence segment;
4 Horizontal crossbar (profiled lamella) of the fence segment;
5 Connecting element for aligning (stacking) of horizontal crossbars (lamellas) into the fence segment;
6 Vertical rail attached to the fence post (3) by bolts, screws, wood screws or nails;
6.1 Outer vertical rail;
6.2 Inner vertical rail;
6.3 Compensating / damping spring steel plates between outer and inner vertical rails;
7 Grooves (notches) of the connecting element (5) for inserting a profile of the horizontal crossbar (4) therein;
8 Top lock or lid for securing (locking) a stack of horizontal lamellas and connecting elements in vertical rails;
9 Thermal displacement ("freedom") clearance for expansion and contraction of horizontal lamellas in connecting elements due to temperature changes;
10 Vertical rail lower support for supporting and holding the horizontal lamellas stacked in the stack together with the connecting elements;
11 Holes in horizontal and vertical crossbars for riveting the assembled fence segment;
12 Rivets or bolts connecting the vertical rail of the fence segment to the horizontal crossbars;
13 Holes for attaching the vertical rails of the segment to the fence poles (posts);
14 Upper beam securing (locking) the assembled fence segment;
15 The rear vertical groove of the connecting element, which provides space for the head of the vertical rail fastening screw;
16 A bolt, a screw, or a nail for attaching a vertical rail to a fence post;
17 Outer cover of vertical post and vertical rails with protective and design improvement function;
18 Additional embodiments and forms of the connecting element (5).

DETAILED DESCRIPTION OF THE INVENTION AND ITS EMBODIMENTS

[0020] Fence segment structure. The fence consists of a series of vertical posts or poles (3) spaced at a predetermined distance from each other. Posts (3) can be made or built of brick, concrete, wood, metal or other suitable structures and materials. In the present invention, the material and structure of the vertical posts (3) is not essential for the installation of the fence segment (1), since the fence segment (1) is assembled (arranged) into two vertical rails (6) belonging to the segment, which are previously attached to said vertical posts (3).

[0021] The fence may also have a base or foundation (2). The base / foundation (2) is usually cast of concrete and can also be constructed or formed of wood, metal, brick or other suitable materials. The foundation (2) may be useful / suitable as a base for placing (arranging) on it the horizontal crossbars / lamellas (4) of the fence segment together with the connecting elements (5). In this case, an important feature of the fence base (2) is its smooth and horizontal upper surface, so that the crossbars / lamellas (4) of the fence segment, laid and stacked on the surface of the base (2), are exactly horizontal. Otherwise, if the foundation of the fence is not horizontal and level, then the horizontality of the crossbars / lamellas (4) must be ensured by other means.

[0022] The vertical rails (6) of the fence segment (1) are designed to make a stack of horizontal crossbars / lamellas (4) and their connecting elements (5). The vertical rail (6) is U-shaped and its width corresponds to the width of the horizontal crossbar / lamella (4) and the con-

necting element (5). The profile of the vertical rail (6) may have the cross-sections shown in Figures 8 a-b. The vertical rails (6) can be made of thick (for example, 1.5 to 2 millimeters thick) sheet metal, which is preferably galvanized and painted with paint for durability. Alternatively, the vertical rail (6) may have a lower support (10) for supporting and holding the stack of horizontal crossbars / lamellas (4) with connecting elements (5). The support (10) is required if there is no cast fence foundation (2), or if the cast foundation (2) is uneven, or if the top surface is not horizontal enough to support and put horizontal crossbars / lamellas (4). The vertical rail (6) is attached to the vertical post (3) of the fence with bolts, screws, nails or other suitable means. Accurate alignment of the two vertical rails (6) is required when the vertical rails (6) are used not only to place the horizontal crossbars / lamellas (4) in the stack, but also to ensure the horizontal alignment of said stack using the lower supports (10) of the vertical rails (6).

[0023] The set of horizontal crossbars / lamellas (4) are arranged in two vertical rails (6) by means of connecting elements (5). The choice of design and shape of the fence segment (1) and the horizontal lamella (4) can take into account the direct visibility through the fence and the transmission of sunlight at different times of the year. The connecting elements (5) are one of the essential elements of the present invention. These elements ensure easy assembly of the segment (1), as well as give the horizontal crossbars / lamellas (4) a "freedom" clearance (9) for thermal expansion and contraction. The connecting elements (5) are made or cast or 3D-printed from polyvinyl, polyethylene, polypropylene plastics or their composites or other suitable materials. In one suitable embodiment, the plastic composite comprises a mixture of 80% polyethylene and 20% polychlorovinyl.

[0024] After that, the assembled stack of horizontal crossbars / lamellas (4) is fastened from above with lids (8) or with the upper beam or cover (14) of the segment. The fastening lid (8) is fixed above the connecting element (5), and no longer allows the elements (5) below the vertical rail (6) to move, and at the same time no longer allows the fence segment (1) to be dismantled.

[0025] **Horizontal crossbars (lamellas).** The fence segment (1) comprises horizontal crossbars / lamellas (4). These are the components that perform the essential function of the fence segment (1). Where appropriate, they are made (folded) of profiled sheet metal, but can be cast from aluminum, made of sheet metal, of glued moisture-resistant wood, plastic and other suitable materials. In the present invention, the main feature of the element / lamella (4) is the use of a three-dimensional thin-walled profile, which allows to obtain a large covering area, lamella strength and stiffness, low weight and various functional shapes with a small amount of raw material.

[0026] The thickness of the sheet metal suitable for the production of horizontal lamellae profiles (4) can be selected from 0.4 to 1.00 millimeters. The outer surface of the tin profile is covered with paint: polyester, imitation of wood or other. The sheet metal can be galvanized, in which case the surface is extremely resistant to environmental influences, such as rain, wind and temperature changes. In addition, the segment of the profiled sheet metal fence is rigid and light. It is resistant to many typical mechanical impacts (for example, impacts when children play with the ball, strong winds, etc.). The length of the horizontal crossbars / lamellas and fence segment using sheet metal profiling technology can reach 3-4 meters. Proper coating, painting and element materials ensure the longevity of the fence up to 30 years.

[0027] The horizontal crossbar / lamella (4) is made by folding the sheet metal into the selected cross-sectional profile. There may be various and different cross-sectional shapes of the profile, as shown in Figure 4. Each particular cross-sectional shape can also perform a specific function. For example, a fence with horizontal crossbars / lamellas (4), the profiles of which are shown in Figures 5a, 5b, 5c, can be used:

- To provide visibility from the yard side to the street, but block visibility in the opposite direction. Visibility through the fence can be selected in the range of 90% to 0%;
- To pass direct sunlight into a neighbor's yard if the fence is high enough and becomes a barrier to sunlight entering the neighbor's yard. The angle of sunlight depends on the latitude and the orientation of the fence line to the south; therefore, the angles of the blind-type lamellas can be selected differently.

[0028] The shape of the horizontal crossbar / lamella (4) is selectable. This means that the lamella (4) and its connecting elements (5) can be designed and manufactured according to individual shapes desired by the customer. Practical versions of profiles are presented in Figure 5. (a-k). Some profiles can be reinforced and stiffer in structure. For example, Figure 5c shows a reinforced modification of profile depicted in Figure 5b. Figures 5 i, k show the changes for strengthening the profile structure depicted in Figure 5g. In the fence segments, any of the profile versions shown can be used for horizontal crossbars (4) with a standard length (1800 millimeters) or less. For crossbars / lamellas (4) with a selected length exceeding 1800 millimeters, only reinforced versions are recommended (Fig. 5 (c, k, i). Furthermore, it is to be understood within the scope of the present invention that only a few examples of different profile shapes are given in Figures 5 (a-k). However, they are not intended to limit the use of other selected or designed horizontal lamella (4) profile shapes within the scope of the present invention.

[0029] **Connecting element.** The connecting element (5) is essential in the present invention and is shown in Figure 3. It ensures the assembly and vertical alignment of the horizontal crossbars / lamellas (4) into the fence segment (1), and there is also a connection between the

vertical rails (6) and the horizontal crossbars / lamellas (4). The connecting element (5) can be molded or 3D printed from polyvinyl, polyethylene, polypropylene plastics or their composites, or other suitable materials. In the most preferred embodiment, this element (5) has a rectangular parallelepiped shape and has dimensions that ensure its sliding along the vertical rail (6) and is adapted to the horizontal crossbar / lamella (4) cross-sectional profile, as shown in Figure 2. Also, the element (5) has notches / grooves (7) corresponding to the cross-sectional shape of the horizontal crossbar / lamella (4). For example, the horizontal crossbar / lamella (4), the cross-sectional profile of which is shown in Figure 5, coincides with notches / grooves (7) of the connecting element (5) shown in Figure 3. Also, the element (5) has a vertical groove (15) on the back side for the head of the bolt (16) to pass, when the vertical rail (6) is attached by bolts (16) to the post (3) and the connecting elements (5) with lamellas (4) are inserted one after another into the rail (6). In most cases, the notch / groove (7) coincides with the profile of the horizontal rail (4). However, it is possible for the connecting element (5) to have a cavity / groove (7) corresponding to horizontal rails of several different shapes. For example, Figures 5 (g, h) show lamella profiles that can coincide with a notch / groove (7) of a single connecting element. The dimensions of the connecting element (5) may differ in each case. As a practical example, when the connecting element (5) has a thickness of T_{SE} = 20 mm, the depth of the back side groove is D_{RG} = 5 mm and the depth of the notches / grooves (7) is D_{CG} = 15 mm. The thermal gap DTSG (9) of the horizontal crossbar / lamella (4) is selected from 3 to 5 millimeters at each end of the horizontal crossbar / lamella (4), depending on the length of the lamella (4), which in most embodiments can be from 1.5 to 3.2 m. These specific dimensions are one practical example, and in the embodiments of the invention the connecting elements (5) may have different numerical dimensions.

[0030] In some embodiments of the invention, the connecting element (5) may be not only a rectangular parallelepiped, but, for example, a rhomboidal parallelepiped or a trapezoidal parallelepiped. Also, the single lamella connecting element (5) can be cast not in one piece, but in more than one piece (18), as shown in Figure 12. Various versions and shapes of this element (5) are possible as long as they ensure the functions and characteristics of joining and reinforcing the elements of the fence segment described above.

[0031] In addition to the essential elements described above, additional technical solutions can be applied to the structure of the fence segment (1) to improve the structure characteristics of the fence segment, the external design features, and the fence assembly efficiency, and are essential objects of the present invention.

[0032] One such additional technical solution (shown in Figure 10) is to use not a single vertical rail (6) in the fence segment (1), but a special sliding double vertical rail structure consisting of:

- An outer rail (6.1), which is attached to the fence post (3);
- An inner rail (6.2), which is placed inside the outer rail (6.1), and the horizontal crossbars / lamellas (4) are introduced into the two inner rails (6.2) together with the connecting elements (5);
- The third element of this double rail (6) structure is at least two curved spring steel plates (6.3) performing the function of mutual damping and longitudinal compensation between the outer rail (6.1) and the inner rail (6.2).

[0033] This solution of double vertical rail (6, 6.1, 6.2, 6.3) gives the structure of the fence segment (1) several essential advantages:

- The length of the lamellas (4) of the segment (1) may not be calculated with great precision, for example in tenths of a millimeter, but with a sufficient accuracy, for example, within 1 millimeter;
- Thermal displacement clearance D (9) is no longer required, as the thermal expansion-contraction of the lamella (4) is compensated by the gap between the outer (6.1) and inner (6.2) rails and the spring-loaded steel plates (6.3);
- The fence posts (3) may or may not be perfectly vertical, i.e., certain difference in distance between the tops and the bottoms of the two posts (3) is tolerated. In practice, this difference can be up to 5 millimeters, but the double and spring-loaded vertical rail structure will keep the lamellas (4) of the same length firmly tightened in the fence segment (1).

[0034] Another technical solution is an external design and protection element - an external protective cover of the vertical posts (3) and vertical rails (6) of the fence, which gives a better look to the whole fence and protects the essential connecting elements of the structure from external natural or intentional factors. Possible versions of such an outer cover (17) are shown in Figure 11 (a-b). This cover is installed by lowering it from above and fixing its edges behind the edges of the two vertical rails (6). Thereafter, the rails (6) together with the post (3) are covered with an upper protective lid (8) or a continuous beam or cover (14), thus preventing the removal of the side covers (17) or the dismantling of the fence segments (1).

[0035] **Assembly of the fence segment.** If the fence foundation (2) has already been cast and the vertical posts (3) have been erected, then the fence segment (1) is assembled in the following steps:

- The two vertical rails (6) are mounted / fastened opposite each other, to the adjacent fence poles (3). Fastening is done with, for example, a screwdriver and screws. The lower supports (10) of the two vertical rails (6) must be leveled with spirit level at the same level so that the crossbars / lamellas (4) then

lied on the rails (6) lie exactly horizontally. The distance between the installed vertical rails (6) must correspond to the total length of the horizontal crossbar (4), the two connecting elements (5) and the thermal expansion "freedom" clearance D (9), as shown in Figure 6;

- One horizontal crossbar (4) is assembled with two connecting elements (5) and this set is pushed into the vertical rails (6) until it abuts at the bottom. This step is repeated with the other lamellas (4) and connecting elements (5) until the fence segment (1) is assembled;
- The assembled segment (1) is fastened / locked by attaching lids (8) or a continuous beam or cover (14) on top of the vertical rails (6) on top of the entire fence segment (1).

[0036] Disassembly of the segment. Disassembly of the fence segment (1) is performed in reverse order:

- The assembled fence segment (1) is unlocked: the upper fixing lids (8) or the upper beam or cover (14) are removed from the vertical rails (6) from the top of the segment (1);
- The horizontal crossbars / lamellas (4) with connecting elements (5) are pushed one after the other out of the vertical rails (6) until the fence segment (1) is emptied;
- The vertical rails (6) are released from the vertical poles (3) of the fence.

[0037] Transportation of the fence segment. The fence segments can be conveniently transported in compact packages, as shown in Figure 7.

[0038] The assembly and disassembly of the segments described above can be carried out quickly by one person, such as fence technician or by the customer himself, who has minimal technical skills.

[0039] After assembling the fence, its further maintenance is quite simple. In general, it is sufficient to periodically wash the fence with a jet of water. If the need arises to replace one segment crossbar, it is sufficient to use the assembly and disassembly instructions described above.

[0040] Installation options for the fence segment. In the most p[referable installation version, the fence consists of standard 180 cm wide fence segments (1). The top of the fence foundation (2) is exactly flat and horizontal. The connecting element (5) is molded from a plastic composite consisting of 80% polypropylene and 20% polyethylene. The thickness of the connecting element (5) is T_{SE} = 20mm, the depth of the rear groove (15) is D_{RG} = 5mm, the depth of the notch / groove (7) for the horizontal crossbar (4) is D_{CG} = 15mm. The horizontal crossbars / lamellas (4) are cut to a fixed length of 1800 millimeters. The fence post (3) is a metal or wooden beam of square cross-section with a side length of 100 millimeters. The posts (3) are installed on the fence foundation (2) at predetermined distances, according to the length of the horizontal crossbars / lamellas (4) (1800 mm), also according to the thickness of the vertical rails (6) (2 mm), according to the thickness of the connecting element (5) 5 mm and a thermal clearance (9) at each end of the lamella DT_{SG} = 3 mm. Therefore, the predetermined distance between the central symmetry axes of the fence poles (3) is calculated: 1800 mm + 2x5 mm + 2x3 mm + 2x2 mm + 2x50 mm = 1920 mm. Next, all fence segments (1) are assembled according to the assembly instructions described above.

[0041] In another installation version, the fence segment (1) is adapted to the constraints already present on the construction site. The distance between adjacent fence posts (3) is fixed at 3100 millimeters. The fence foundation (2) is not flat and / or insufficiently horizontal. The sheet metal of the vertical rails (6) is 2 millimeters thick, and the dimensions of the connecting element (5) are the same as in the previous installation version. Therefore, the length of the horizontal crossbar (4) is calculated: 3100mm -2x5mm -3x3mm -2x2mm = 3080mm, so in this case 3080 millimeter long lamellas (4) are cut. In addition, reinforced profile versions (e.g., Fig. 5 (c, h, i)) are used for this lamella length in excess of the standard 1800 mm length. The vertical rails (6) are made with a lower support (10) and fastened to the posts (3) by leveling the heights of both supports (10) with a spirit level so that the horizontal crossbars (4) then lie exactly horizontally on the supports (10). Next, all fence segments (1) are assembled according to the assembly instruction described above.

Claims

1. Fence construction system comprising:

- a fence foundation (2),
- fence posts (3),
- a fence segment (1) comprising two vertical rails (6) attached to the posts (3), into which one or more horizontal crossbars (4) are inserted from above together with pairs of connecting elements (5) at the ends of each crossbar (4),
- upper locks (8) or upper beams (14) securing and / or locking the stack of horizontal crossbars (4),

characterized in that

- the horizontal crossbar (4) is a rigid lamella formed of a sheet material and having a three-dimensional profile,
- the connecting element (5) corresponds to the shape of the vertical rail (6) on the rear side and has notches and / or grooves (7) on the front side, the shape of which corresponds to the shape of the horizontal crossbar (4) profile for

inserting the profile into the cut-outs / grooves.

2. The system according to claim 1, **characterized in that** the notch / groove (7) of the connecting element (5) is so deep that the horizontal crossbar (4) is provided with a sufficient clearance of its longitudinal thermal displacement between the connecting elements (5) inserted into the vertical rails (6).

3. The system according to claim 1, **characterized in that** the connecting element (5) is made of polyvinyl, polyethylene, polypropylene plastics or composites thereof, or other suitable materials.

4. The system according to claim 1, **characterized in that** the connecting element (5) may have configurations in which

- the connecting element (5) holds part of one lamella (4) and part of another;
- two connecting elements (18) hold one lamella (4);
- one connecting element holds one lamella (4);

5. The system according to claim 1, **characterized in that** the spatial profiles of the horizontal crossbar (4) are reinforced by using additional internal profile-reinforcing partitions and elements.

6. The system according to claim 1, **characterized in that** the profile of the horizontal crossbar (4) is made of galvanized sheet metal and covered with polyester, wood imitation or other outdoor paints.

7. The system according to claim 1, **characterized in that** the profile of the horizontal crossbar (4) is made of sheet metal, of glued moisture-resistant wood, plastic or other materials suitable for outdoor conditions.

8. System according to claim 1, **characterized in that** the vertical rail (6) comprises

- an outer rail (6.1) attached to the fence post (3);
- an inner rail (6.2), which is placed inside the outer rail (6.1), and horizontal crossbars / lamellas (4) are inserted into the inner rail (6.2) together with the connecting elements (5);
- two or more curved spring steel plates (6.3) compensating for longitudinal displacements of the fence segment (1), thermal changes in the length of the lamellas (4), and deviations of the fence posts (3) from the vertical axis.

9. System according to claim 1, **characterized in that** the vertical rail (6) and the vertical outer rail (6.1) have a lower support (10) of the fence segment (1) for supporting and holding the horizontal fence crossbars (4) together with their connecting elements (5).

10. System according to claims 1-9, **characterized in that** the vertical rails (6) of the mounted fence segments (1) together with the fence posts (3) are covered from the sides by protective covers (17), which

- have curved edges for hooking behind the edges of the vertical rails (6);
- are arranged by lowering them from above so that the folded edges of the cover (17) engage behind the edges of the vertical rails (6);
- the installed covers (17) are fastened / locked with upper locks (8) or upper beam (14), together with the entire structure of the fence segment (1).

11. Method of assembling a fence segment (1) having structure according to claims 1-10, wherein a fence foundation (2) and at least two adjacent fence posts (3) are provided, **characterized in that** the method comprises the following steps:

- fastening two vertical rails (6) to the fence posts (3) with bolts, screws or nails;
- introducing a horizontal crossbar (4) with two connecting elements (5) into said two vertical rails (6), repeating the step with a predetermined number of horizontal crossbars (4), or until the fence segment (1) is filled;
- securing the assembled fence segment (1) by mounting lids (8) on the vertical rails (6) or by attaching an upper beam or cover (14) to the top of the segment (1).

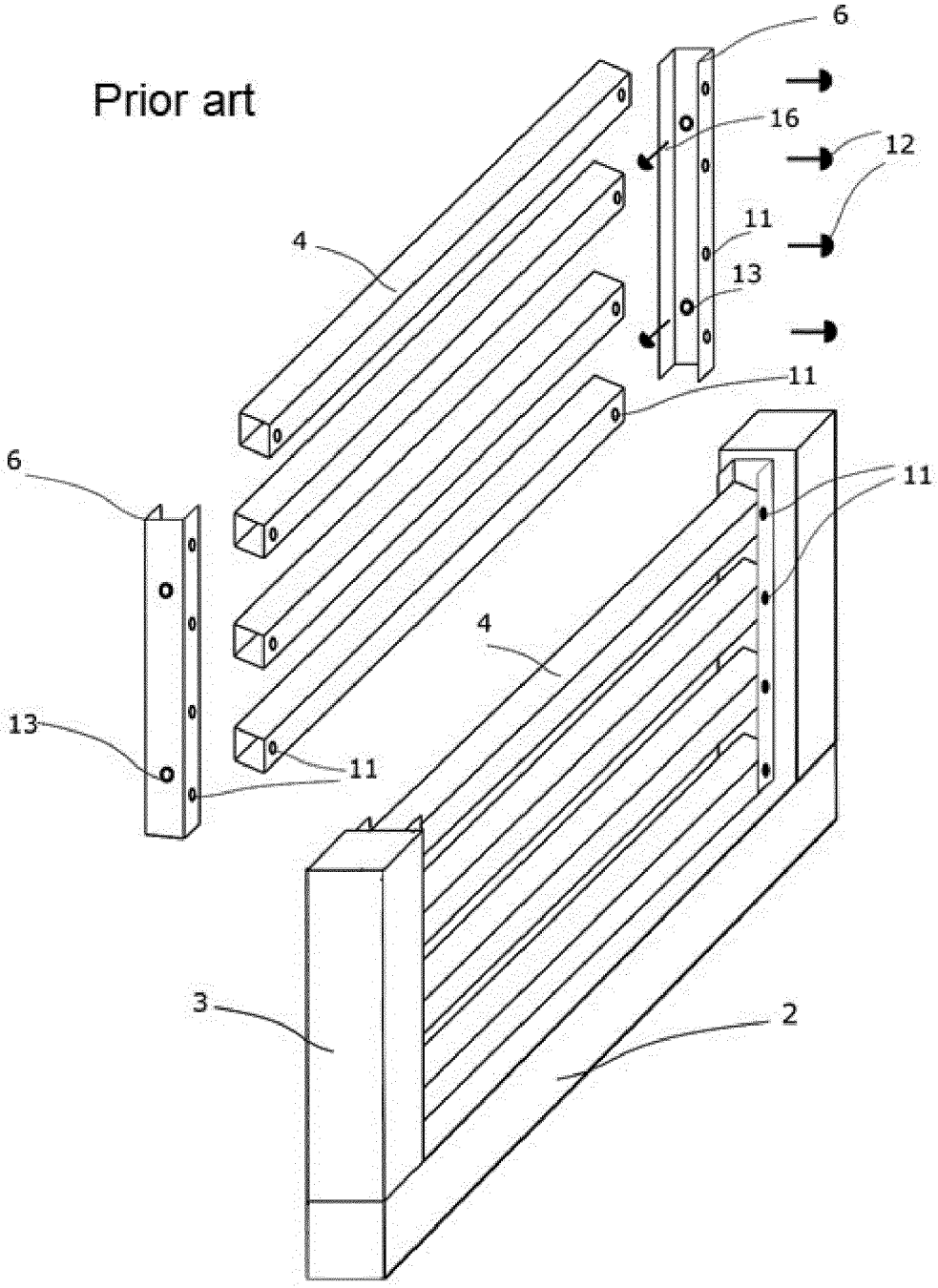


Fig. 1

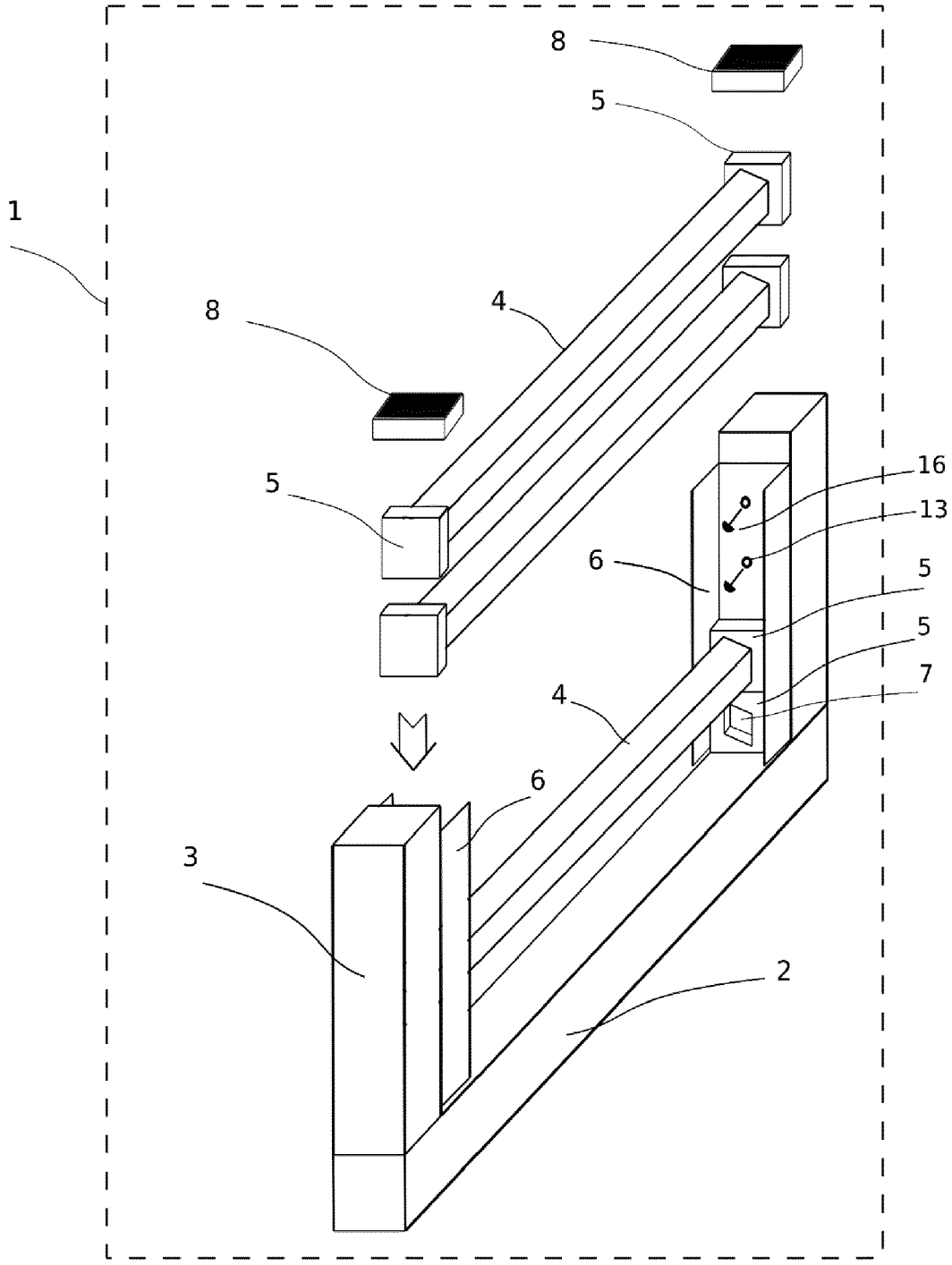


Fig. 2

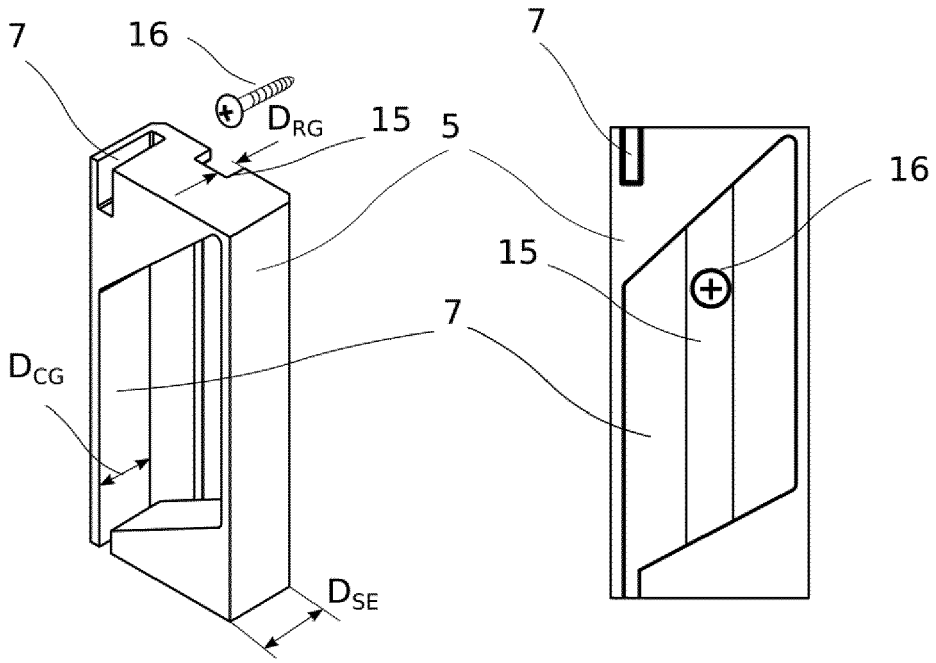


Fig. 3

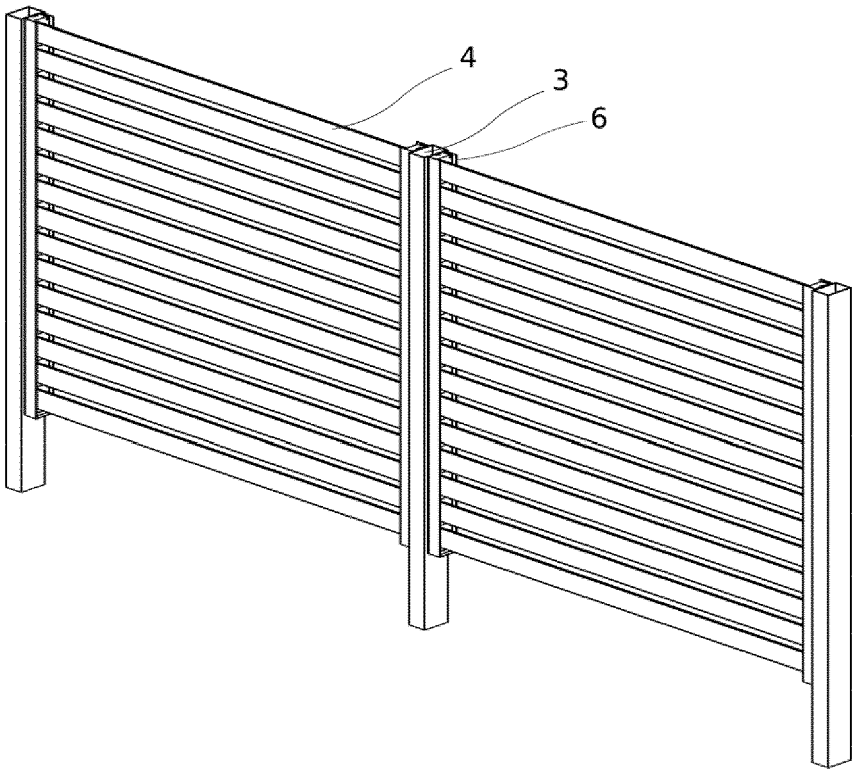


Fig. 4

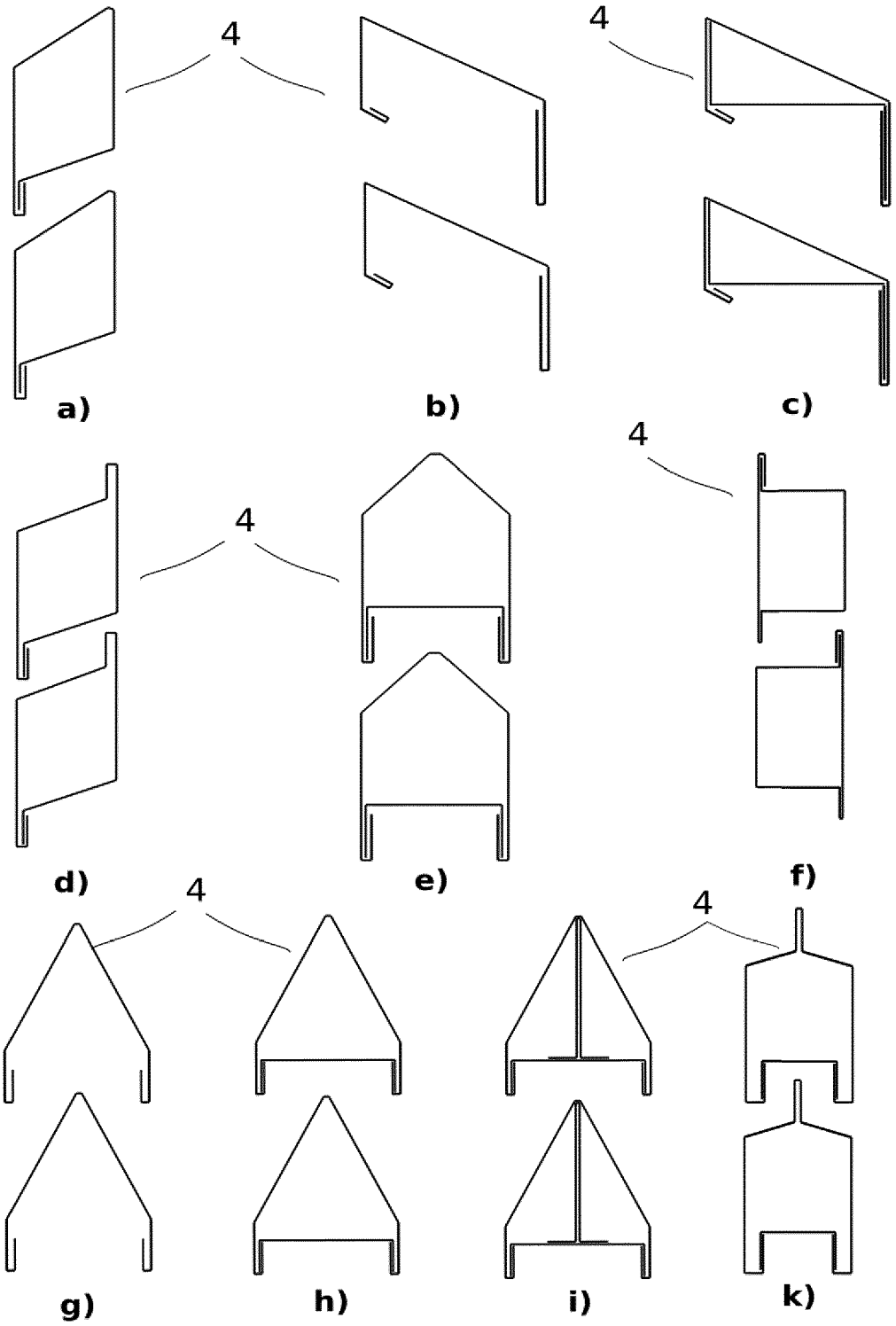


Fig. 5

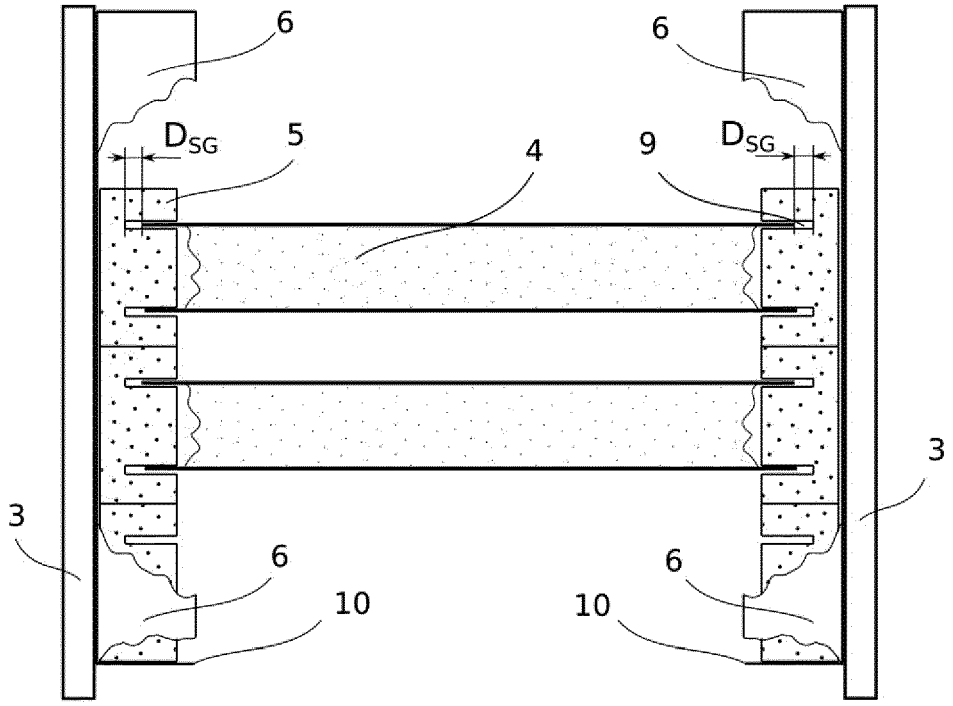


Fig. 6

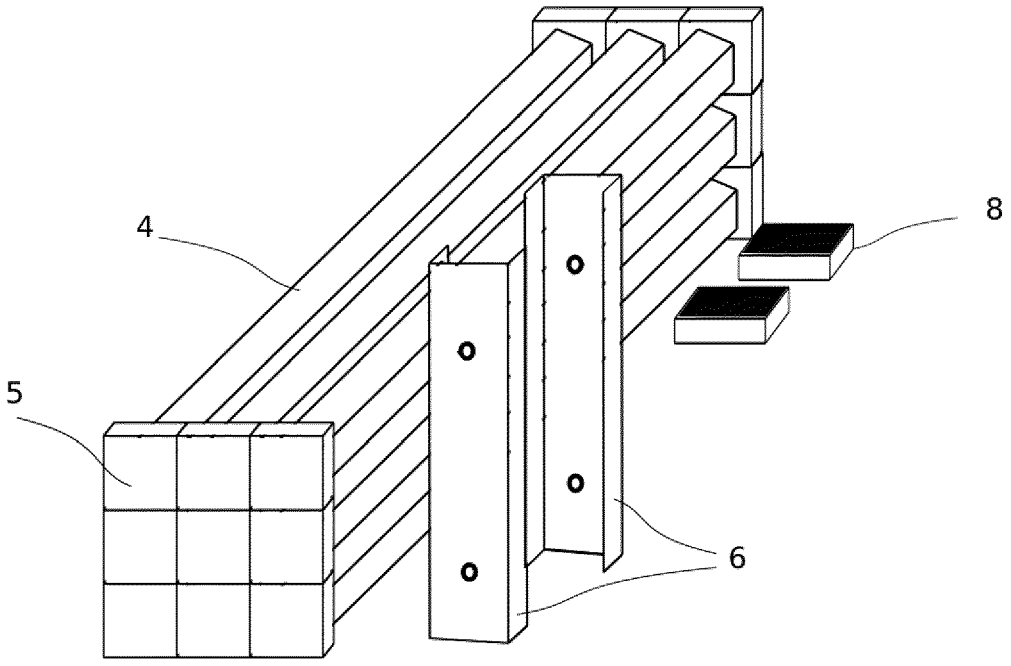


Fig. 7

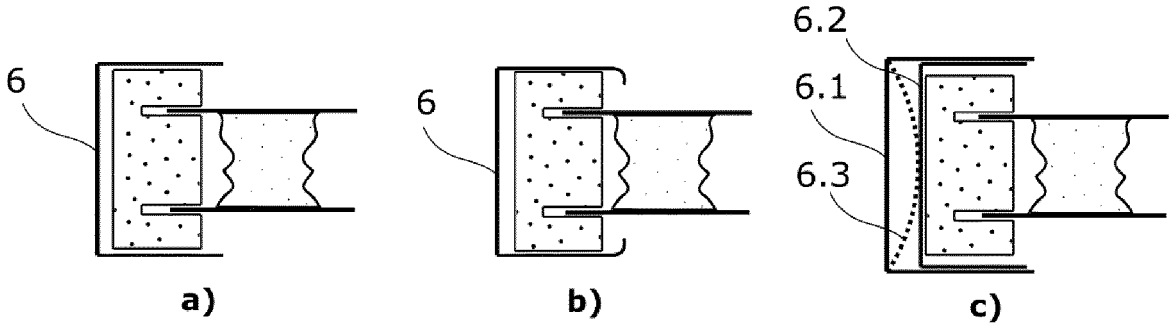
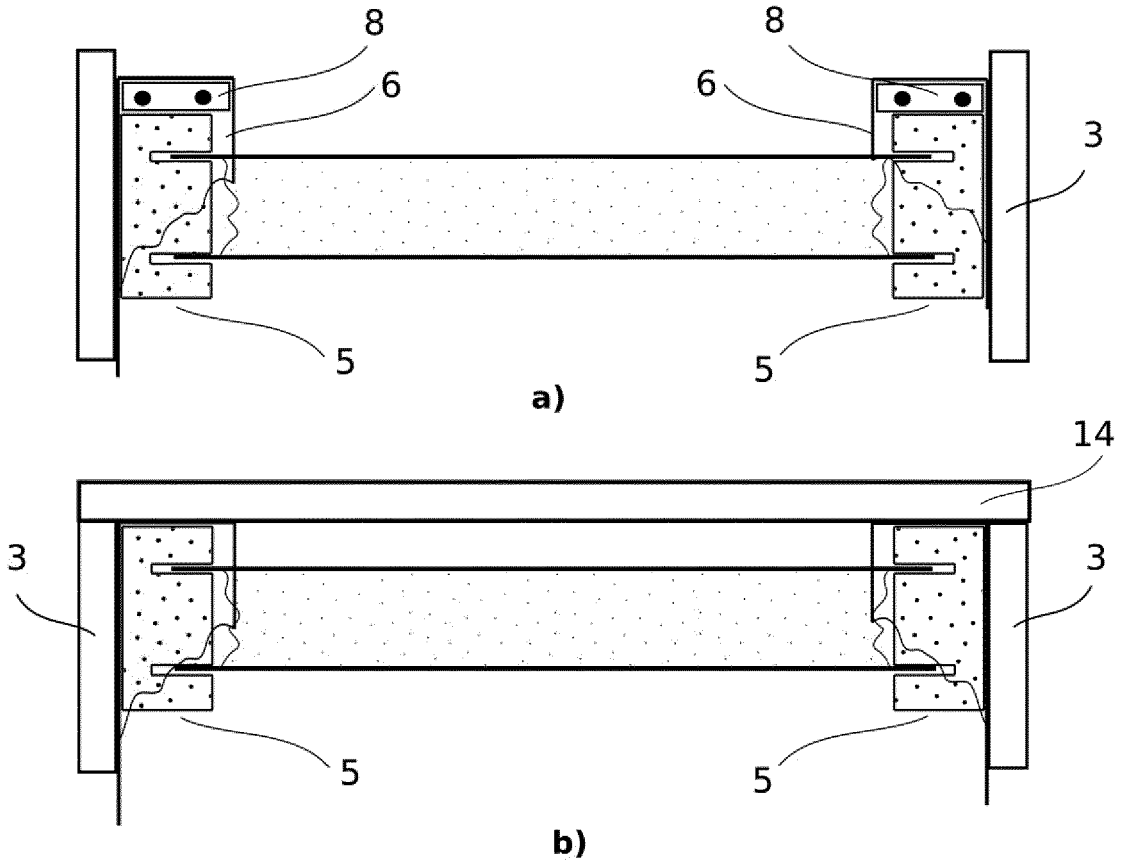


Fig. 8



9 pav.

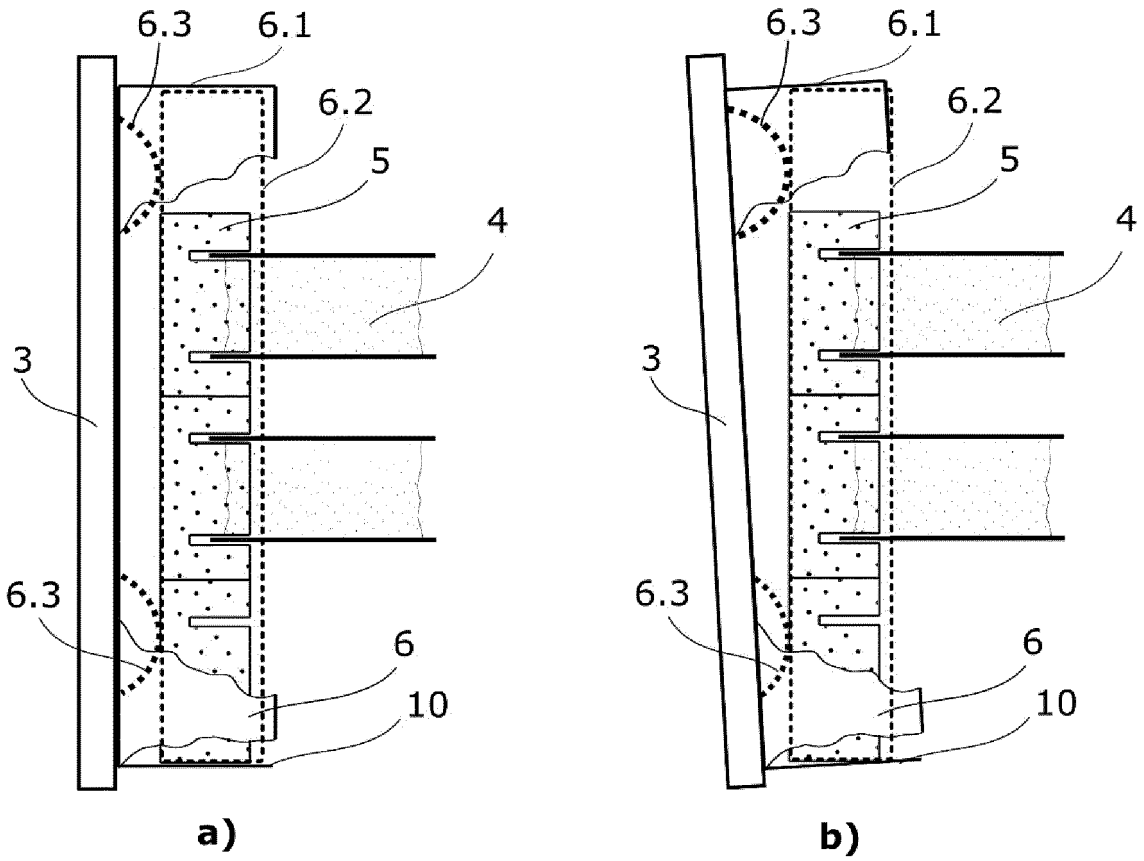

6.3
6.1
6.2
5
4
3
6.3
6
10
a)
6.3
6.1
6.2
5
4
3
6.3
6
10
b)

Fig. 10

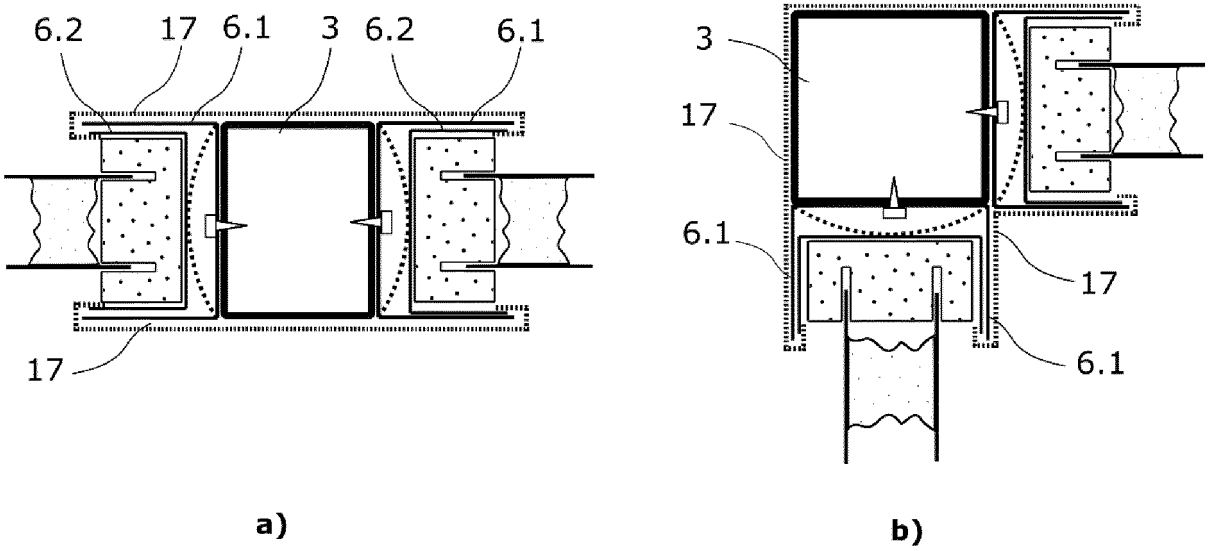

6.2
17
6.1
3
6.2
6.1
17
a)
3
17
6.1
17
6.1
b)

Fig. 11

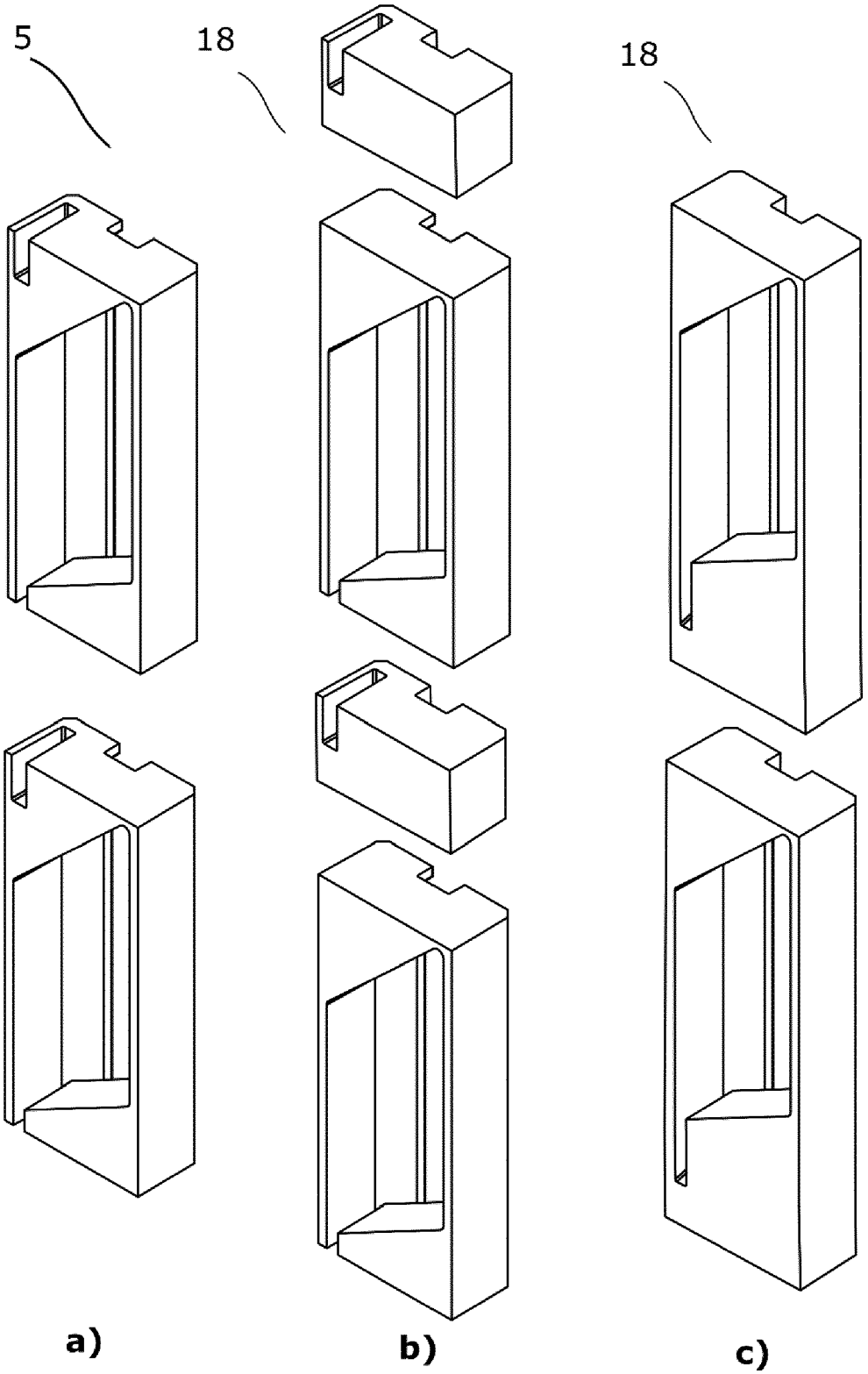


Fig. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 21 18 0339

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 655 428 B1 (AGORESPACE [FR]) 28 July 2010 (2010-07-28) * column 3, line 44 - column 7, line 58; figure 1 *	1,2,4,5, 7,10,11	INV. E04H17/14
A	FR 2 651 523 A1 (CECEGE STE CIVILE RECH [FR]) 8 March 1991 (1991-03-08) * page 3, line 17 - page 6, line 16; figure 1 *	1-7,10, 11	
A	US 9 347 191 B2 (ROSS TECHNOLOGY CORP [US]) 24 May 2016 (2016-05-24) * column 3, line 9 - column 5, line 23; figures 1-4 *	1-7,10, 11	
A	EP 3 399 123 B1 (ZHEJIANG YOTRIO GROUP CO LTD [CN]) 4 December 2019 (2019-12-04) * column 6, line 12 - column 10, line 31; figures 1-6 *	1,6,10	
A	US 5 702 090 A (EDGMAN THOMAS J [US]) 30 December 1997 (1997-12-30) * abstract; figures 1-3 *	1,8,9	TECHNICAL FIELDS SEARCHED (IPC) E04H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 December 2021	Stefanescu, Radu

CATEGORY OF CITED DOCUMENTS

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06-12-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1655428 B1	28-07-2010	AT 475762 T	15-08-2010
		EP 1655428 A1	10-05-2006
		FR 2877364 A1	05-05-2006
FR 2651523 A1	08-03-1991	NONE	
US 9347191 B2	24-05-2016	US 2016017555 A1	21-01-2016
		US 2016230358 A1	11-08-2016
EP 3399123 B1	04-12-2019	AU 2018203124 A1	22-11-2018
		DK 3399123 T3	09-03-2020
		EP 3399123 A1	07-11-2018
		ES 2769300 T3	25-06-2020
		FR 3065979 A1	09-11-2018
		HR P20200360 T1	12-06-2020
		HU E048696 T2	28-09-2020
		PL 3399123 T3	18-05-2020
US 5702090 A	30-12-1997	NONE	

EPO FORM P0459

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

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Patent documents cited in the description

- US 3195864 A **[0003]**
- KR 101910532 B1 **[0004] [0006]**
- US 7090201 B2 **[0005] [0006]**
- US 20180058092 A1 **[0008]**
- US 20070221901 A1 **[0009]**