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(54) **ACOUSTIC SCREEN MODULE**

(57) The module comprises a first panel (1a), which is preferably perforated, and a second panel (1b), said panels defining two main surfaces, trapezoidally corrugated surfaces (3) or smooth surfaces (2), and comprise, at two opposite ends, means for coupling same together, the two panels (1a, 1b) delimiting an interior cavity suitable for the placing of a noise-absorbent material (8). Both panels (1a, 1b) have identical profiles, each panel having, at opposite ends, complementary guide means (4, 7) of suitable configuration to allow the coupling and uncoupling of the two panels, in the manner of a runner, in the longitudinal direction, and to prevent the relative movement thereof, except in said longitudinal direction. The complementary means of each panel comprise a longitudinal guide (4) with an interior cavity (5) open at the ends thereof, and a lateral opening (6), and a complementary configuration (7) suitable for insertion in the longitudinal guide (4) of the other panel (1 b, 1 a).

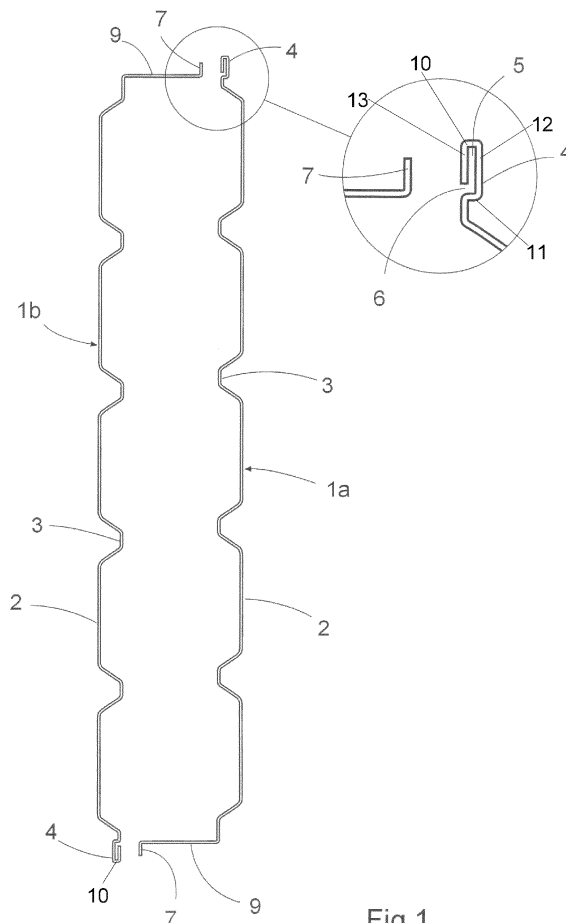


Fig.1

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Description

OBJECT OF THE INVENTION

[0001] The invention relates to an acoustic screen module comprising a first perforated plate, that can be used to form a side exposed to a noise source, and a second plate that can be used to form a side protected from said noise. These plates define two main surfaces, corrugated or smooth, and comprise on two opposite ends means for coupling to each other. The two plates define an inner cavity that can be used to place a noise absorbing material.

[0002] This acoustic screen module presents constructive features meant to reduce manufacturing costs for the plates that form the module; allow compact stacking thereof, reducing the space and costs related to storage and transport; facilitate assembly in a quick, simple, safe manner without the need for external attachment elements; and providing for the coupling means of the plates an arrangement and configuration allowing to define assembly stops and break the acoustic bridge at the areas of contact with other modules or with any lower support bases.

BACKGROUND OF THE INVENTION

[0003] Noise screens are also known as acoustic shields or barriers. Their function is to prevent the transmission of noise from one side to the other of their physical location. These screens are installed next to communication routes with high noise levels, such as roads, railroads, or airports, and are an effective measure for reducing or eliminating the noise from said emitting source in the area to protect, efficiently reducing the harmful effects and inconveniences resulting from the noise.

[0004] The screen behaves as an enclosure that defines an obstacle for transmission of the noise between the source and the area to protect, which is an inhabited area. The screen acts as an acoustic insulation against fixed noise sources or traffic by absorbing sound waves.

[0005] The screens are formed from modules joined to one another to configure a screen with the desired height to fulfil its function.

[0006] Screens are known that are formed from modules where each module consists of two metal plates or sheets of galvanized steel or aluminium representing the two faces of the acoustic panel. On the sheet meant to be installed facing the noise source a plurality of orifices are made by punching. The sheet meant to be on the side to be protected is smooth, without orifices. In addition, the configuration of the two sheets is often wavy or corrugated.

[0007] The sheets or plates have a configuration allowing them to be joined to one another, leaving a space in the middle in which a core of synthetic material, generally rockwool, is placed, as a block placed in the central

part of the module that does not cover the spaces defined by the corrugation.

[0008] Thus, the perforated sheet is placed facing the noise source so that the acoustic waves penetrate the screen modules through the orifices of the plate. This is aided by the grooves, waves or corrugation of the plate surface. The synthetic material on the inside, rockwool, absorbs the acoustic waves, which are prevented from exiting out of the walls of the module by the smooth, non-perforated plate placed on the side of the area to protect from the noise.

[0009] The metal screens are made of galvanised steel or aluminium and can have various plate thicknesses and rockwool densities to adapt to the absorption and insulation levels.

[0010] Along the screen lines there are vertical profiles providing support between modules, these profiles sized according to the height of the barrier and the expected wind pressure at the area where the screen will be installed.

[0011] Each module has closing side covers made of polypropylene that prevent a direct contact between the plates and the support profile.

[0012] The screen is placed on a support base built as a separation between the modules and the ground on which the acoustic screen rests.

[0013] Acoustic screens are known in the prior art where each module is made from two different plates, which requires the use of different forming machines for manufacturing them.

[0014] The two plates are joined at the factory or workshop or at the work site by elements for attaching the plates, screws or rivets, and using tools. This method of attachment means that the bending stress due to wind pressure causes plasticising in the steel/aluminium and consequently deformations in the plates of the areas of union made by said rivets or screws.

[0015] In known screens it is necessary to assemble the plates at the factory, transporting the modules to the place of installation of the noise screen, which has the drawback of occupying considerable space in the transport means. If they are transported disassembled for assembly on site by workers, the configuration of existing plates prevents stacking the same such that there are no gaps between them.

[0016] Specifically, Italian patent 2008000049 discloses a module meant for factory assembly of the two plates that it comprises, for which it is not possible to optimise the space in the transport means if the two plates are carried disassembled for installation on-site, since their specific shape does not allow a correct stacking with a uniform pressure exerted on the surface of one plate against the other; instead, pressure is exerted only on some contact points, such that the weight of the stack will deform the plates arranged on the bottom at these areas.

[0017] In this prior art the plates are placed opposite each other and coupled at their ends in a U-piece of the

other plate. This U-piece is pressed to fold it against the end of the complementary plate, establishing the complementary attachment. This pressing and folding task must be carried out to bend one end of the plates against the other end of the complementary plate. Another drawback of this prior art document is that the top and bottom parts of the module are corrugated, such that when the screen is formed by joining the modules there are spaces left between them that result in lower stability and lower noise absorbency, since neither these gaps nor the space forming the corrugation contain noise-insulating material as this material is installed as a block in the central part of the module.

[0018] Another drawback of the modules of which these known acoustic screens is the closure of the acoustic bridge between the base and the first module, since the top surface of the concrete base is flat and, although the modules have a tongue and groove connection between them to prevent acoustic leaks, this union of the first module and the baseboard leaves spaces through which acoustic leaks can occur.

DESCRIPTION OF THE INVENTION

[0019] The subject matter of the invention is an acoustic screen module of the type discussed above, comprising a first plate, preferably perforated, that can be used to form a side exposed to a noise source, and a second plate that can be used to form a side protected from said noise; these plates define two main surfaces, corrugated or smooth, and comprise on two opposite ends means for coupling to each other; the two plates define an inner cavity that can be used to place a noise absorbing material.

[0020] A first objective of this acoustic screen module is to have constructive features meant to allow a compact stacking of the plates that form the modules, where the pressure exerted on the plates in the stack is uniform in its entire surface, reducing the space and costs of storage and transport without risk of deformation of the plates in this position. In turn, said features allow reducing the manufacturing costs of the plates.

[0021] Another objective of the invention is to provide the plates with a configuration that allows facilitating assembly and, no less importantly, disassembling the module for subsequent recycling in a quick, simple, safe manner without the need to use external attachment elements or subsequent additional folding work after the plates are assembled.

[0022] Another objective of the invention is to provide the coupling means for the plates that form the module with an arrangement and configuration allowing the creation of assembly stops in the formation of the screen by joining successive modules with the features of the invention, or in the assembly position of an initial module on a masonry baseboard.

[0023] For this purpose and according to the invention, a first feature of the module of the invention is that the

first and second plate have profiles with a shape allowing a compact and safe stacking, reducing by up to 600% the space needed to store and transport the plates used in the construction of other known modules, which implies a considerable savings in storage and transport.

[0024] Another feature is that the plates have identical profiles and this shape coincidence reduces manufacturing costs, as the two plates of the module can be manufactured with the same set of rollers or tools in the same forming machine.

[0025] Another feature of the invention is that the plates forming the module are provided on opposite ends with complementary guiding means with a configuration allowing coupling and separation of the two plates, in a sliding manner, simply by sliding along a longitudinal direction and preventing the relative displacement thereof except in said longitudinal direction.

[0026] These complementary guide means allow coupling and separating the two plates that form the module without any additional work (folding, riveting, etc.) nor using external attachment means, which simplifies and reduces the cost of handling and assembly.

[0027] The complementary guiding means comprise in a first end of each plate a longitudinal guide with an inner cavity open at its ends and provided with a lateral opening and, in a second end of each plate a complementary configuration that can be inserted in one of the ends of the inner cavity of the longitudinal guide of the other plate and displaced along the same in a sliding manner, between the coupling and separation positions thereof.

[0028] It should be noted that with this feature the complementary guide means can adopt different shapes without affecting the essence of the invention.

[0029] The shape coincidence of the plates and the definition on opposite ends thereof of said complementary guiding means in a longitudinal direction allows, when placing a plate in a position and rotating the other 180°, coupling the plates by a longitudinal displacement of one plate with respect to the other, such that the two plates are assembled without requiring additional attachment elements, tools, or tasks for folding complementary ends.

[0030] Once the plates have been coupled the rock-wool or selected insulator is placed inside the module.

[0031] In an embodiment of the invention the longitudinal guide and the complementary configuration meant to be coupled therein are arranged with one next to the main surface of the corresponding plate and the other laterally displaced from said main surface and joined to the same by a portion of plate substantially perpendicular to the main flat surface, forming a wall that closes the corresponding end of the module in the coupling position of the plates.

[0032] In one embodiment the longitudinal guide initially has an area substantially perpendicular to the main flat surface, continuing from this area to configure the longitudinal guide in an inner cavity that is related in

shape and size with the shape and size of the complementary configuration. This configuration includes the circular shape that the longitudinal guide may have.

[0033] In this way, in the assembly position of the module the longitudinal guides and complementary configurations are in a position jutting out of the closure walls of the opposite ends of the module and a side of said closure walls, forming means to break the acoustic bridge between the module and any support element or stack thereof.

[0034] When stacking successive modules to define an acoustic barrier with the desired height, the complementary guide means overlap laterally with the adjacent modules, defining a tongue and groove union that laterally closes the effective support area formed by the end walls of said modules and breaks the acoustic bridge, preventing sound waves from passing between said modules.

[0035] Similarly, unlike other known modules, said complementary guide means also ensure the closing of the acoustic bridge between the end wall or base of the first module and a support base of the acoustic screen.

[0036] The specific shape of the module is such that the block of insulating material, generally rockwool, is placed covering the entire height of the module to form an acoustic barrier in the union of the modules without gaps through which sound waves can pass from one side of the barrier to the other.

[0037] The screen created with the modules of the invention is also characterised by its bending mechanical strength against wind pressure, which prevents plasticising of the plates by presenting a continuous coupling between the plates lacking coupling areas with attachment elements that can be deformed by said pressure.

[0038] To summarise, the characteristics of the screen formed with the modules that are the subject matter of the invention simultaneously fulfils the following functions: allowing the use of two plates with identical shape to form the module, saving manufacturing costs; allowing the configuration of a tongue and groove union between modules or between the first module and the support base; allowing the lack of gaps or spaces without insulating material in the screen through which sound waves can pass the barrier; allowing a continuous closure between the module plates, not requiring for a correct assembly rivets, screws or subsequent folding after inserting a plate in its complementary plate; and most importantly, the specific shape of the plates allows stacking them in a compact and safe manner saving space in the transport means.

[0039] It should be noted that the module plates can present on their surface a variable number of corrugations of different depth, or have different shapes, which in no way affects the invention disclosed herein.

DESCRIPTION OF THE FIGURES

[0040] To complete the description being made and to

provide a better understanding of the characteristics of the invention, the present specification is accompanied by a set of drawings where, by way of illustration only and in a non-limiting sense, the following is represented:

- Figure 1 shows a profile view of an example of an embodiment of the acoustic screen module according to the invention which represents the two plates thereof in a disassembled position and an enlarged view of two opposite ends of said plates.
- Figure 2 shows a profile view of the module with the two plates coupled to each other and a noise absorbing material in the interior, as well as an enlarged view of the coupling of the plates.
- Figure 3 shows a perspective view of the two plates of figure 1 while being coupled by sliding them relatively to each other in a longitudinal sense.
- Figure 4 shows a profile view of several plates for making the module, stacked in a compact position.
- Figure 5 shows a profile view of an acoustic screen formed by two modules of the invention stacked and resting on a lower base.
- Figure 6 shows a profile view of different embodiments of the module of the invention where the plates have different corrugations.

PREFERRED EMBODIMENT OF THE INVENTION

[0041] In the example of embodiment shown in figures 1 to 3, the acoustic screen module comprises two plates ((1a, 1b) with identical profiles, each one of which has a main flat surface (2) and reinforcement waves or corrugations (3).

[0042] Each one of the plates (1 a, 1 b) has on one of its ends a longitudinal guide (4) with an inner cavity (5) open at the ends and provided with a lateral opening (6), as shown in figure 1. On the opposite end there is a complementary configuration (7) to the inner cavity (5) of the longitudinal guide, in this case consisting of an end tab, parallel to the main surface (2) of the corresponding plate (1a, 1b).

[0043] In the example shown, the inner cavity (5) represents a considerably rectangular configuration to receive the cross-section of the complementary configuration (7) of the opposite end.

[0044] In one embodiment the longitudinal guide (4) begins in an area substantially perpendicular to the main flat surface (2) which is located on one end of the plate, as a continuation of the end of the main flat surface (2), after the last corrugation (3) or in the middle thereof, as shown in Figure 1, the longitudinal guide extending from this area to configure an inner cavity (5) that has a shape and size allowing to receive the complementary config-

uration (7). One of the possible shapes of the longitudinal guide (4) described in this embodiment is circular.

[0045] However, it should be noted that the cross-sections of said inner cavity (5) and said complementary configuration (7) can be any that allow coupling the plates (1 a and 1 b) only by longitudinal displacement thereof, preventing any other relative movement between them.

[0046] As shown in figure 2, the plates (1 a, 1 b) couple to each other to form the outer surface of the module, by inserting the complementary configurations (7) of each plate (1 a, 1 b) in one of the ends of the longitudinal guides (4) of the opposite plate (1b, 1a); such that simply moving or sliding said plates (1a, 1b) in the longitudinal direction allows coupling them as shown in figure 3.

[0047] After coupling the plates, a block of noise absorbing material such as rockwool is placed inside the module, covering from the top end to the bottom end of each module.

[0048] As mentioned above, one of the plates (1 a, 1 b), specifically that meant to form in the module a side exposed to a noise source, is made from perforated plate.

[0049] In the example shown, the complementary configuration (7) is separated from the main surface (2) of the corresponding plate and joined to the same by a portion of flat plate (9), without corrugations, which after coupling the plates (1a,1b) forms a closing wall in the corresponding end of the module.

[0050] This implies that in the assembly position of module 1, represented for example in figure 3, the longitudinal guide (4) and the complementary configuration (7) housed inside it jut out of the closure wall formed by the plate segment (9) in the corresponding end of the module.

[0051] The fact that the complementary guide means jut out and are displaced towards one of the sides of the complementary guide means allows the successive stacked modules forming a sound barrier, as shown in figure 5, to be coupled by tongue and groove unions and said guide means to overlap with the adjoining modules or with a lower support base (14), breaking the acoustic bridge in said support or contact areas; the plate segment (9) acting as a support for settling in the upper area of the base (14) or between adjoining modules.

[0052] In the preferred embodiment shown in the drawings, the longitudinal guide (4) forms an inner cavity (5) which is related to the dimensions of the complementary configuration (7), where said longitudinal guide (4) is substantially rectangular, forming the walls with two minor sides, one outer side (10) and one inner side (11), and two major sides (12, 13), one of the major sides (12) having a lateral opening (6). The largest (12, 13) in the example shown are perpendicular to the plate segment (9). With this arrangement, the longitudinal guide (4) houses the complementary configuration (7) defined in the example of the embodiment in a tab that is an extension of the plate portion (9). This tab is parallel to the flat and perpendicular main surface (2), and therefore to the plate portion (9). The insertion of the complementary con-

figuration (7) in the longitudinal guide (4) and the perfect coupling thereof is made possible by the participation of the minor sides (10, 11) of the longitudinal guide (4), the minor outer side (10) on the lower part of the module acting as a support for the tab that defines the complementary configuration (7), and the inner minor side (11) on the top part of the module acting as a support of the end of the plate portion (9), these supports acting together to provide a suitable attachment of the plates (1 a, 1 b) when the slide on each other and in their coupling.

[0053] As shown in figure 4, the coincidence of the profiles of plates (1 a, 1 b) and their specific shape described allows a compact stacking thereof with supports on the entire surface of one plate on the other, minimising the storage and transport space.

[0054] As shown in figure 6, the plates (1 a, 1 b) can have on their main surface a different number of corrugations of different depth or amplitude, as this does not affect the essence of the invention.

[0055] Having described the nature of the invention sufficiently, as well as an example of a preferred embodiment, it should be stated for all applicable purposes that the materials, shape, size and arrangement of the described elements can be modified, provided this does not imply an alteration of the essential characteristics of the invention as claimed below.

Claims

1. Acoustic screen module comprising a first plate (1a), preferably perforated, adequate to form a side exposed to a noise source, and a second plate (1 b) adequate to form a side protected from said noise, where said plates (1 a, 1 b) define two main surfaces, corrugated (3 or smooth (2), and comprise on two opposite ends mutual coupling means, the two plates (1 a, 1 b) delimiting an inner cavity in which a noise absorbing material (8) can be placed; **characterised in that** the first and second plate (1a,1b) have identical profiles, each plate comprising on opposite ends complementary guide means (4, 7) with a shape appropriate for allowing coupling and separating the two plates, in a sliding manner along a longitudinal direction, and preventing the relative displacement thereof except in said longitudinal direction.
2. Module according to claim 1, **characterised in that** the complementary guide means comprise in a first end of each plate (1a,1b) a longitudinal guide (4) with an inner cavity (5) open at its ends and provided with a lateral opening (6) and, in a second end of each plate a complementary configuration (7) that can be inserted in one of the ends of the inner cavity (5) of the longitudinal guide (4) of the other plate (1b, 1 a) and displaced along the same in a sliding manner, between the coupling and separation positions thereof.

3. Module according to the preceding claims, **characterised in that** the longitudinal guide (4) and the complementary configuration (7) are arranged with one next to the main surface (2) of the corresponding plate (1 a, 1 b) and the other laterally displaced from said main surface (2) and joined to the same by a plate portion (9) substantially perpendicular to said main flat surface (2), forming a wall that closes the corresponding end of the module in the coupling position of the plates (1 a, 1 b).

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4. Module according to claim 3, **characterised in that** in the assembled position of the module, the longitudinal guides (4) and the complementary configurations (7) are arranged in a position such that they jut out of a side of the plate portions (9) that define the closure walls of opposite ends of the module, additionally defining means for breaking the acoustic bridge between the module and any support element or between adjoining modules.

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5. Module according to claim 3, **characterised in that** the plate portion (9) is flat, defining a support on which rests a base (14) or for settling between adjoining modules.

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6. Module according to claims 1 and 2, **characterised in that** the longitudinal guide (4) begins at an area substantially perpendicular to the main flat surface (2), which area is placed immediately after the end of the main flat surface (2) after the last corrugation (3) or in the middle thereof, the longitudinal guide (4) extending from this area to form an inner cavity (5) that is related in shape and size with the shape and size of the complementary configuration (7).

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7. Module according to claims 1 and 2, **characterised in that** the longitudinal guide (4) has a substantially rectangular shape with two minor sides (10 and 11) and two major sides (12, 13), one of the major sides (12) having a lateral opening (6).

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8. Module according to the preceding claim, **characterised in that** the major sides (12, 13) are arranged perpendicular to the plate portion (9).

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9. Module according to claims 1 to 3 **characterised in that** the complementary configuration (7) is a tab that is an extension of the plate portion (9) and is perpendicular to the same.

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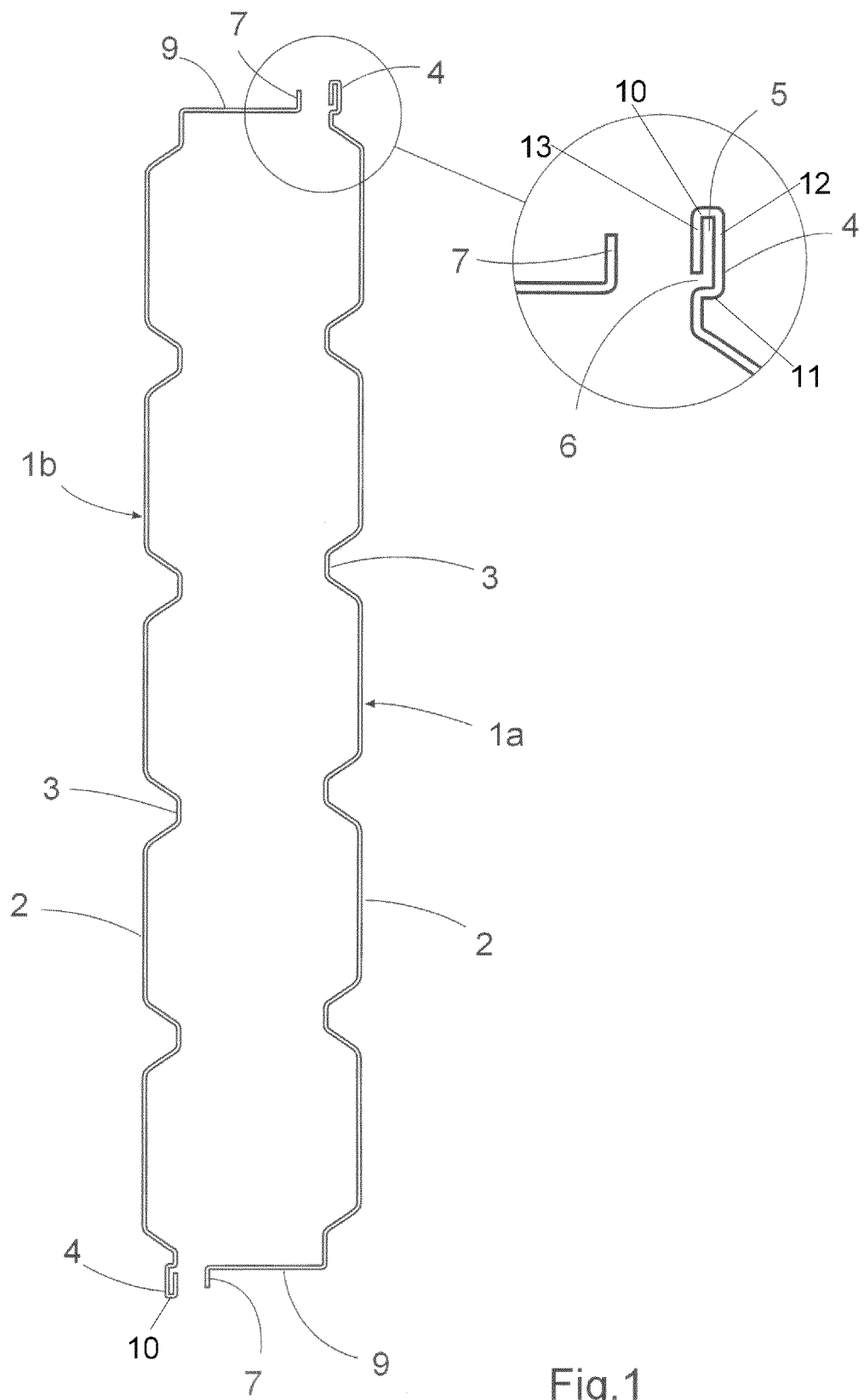


Fig.1

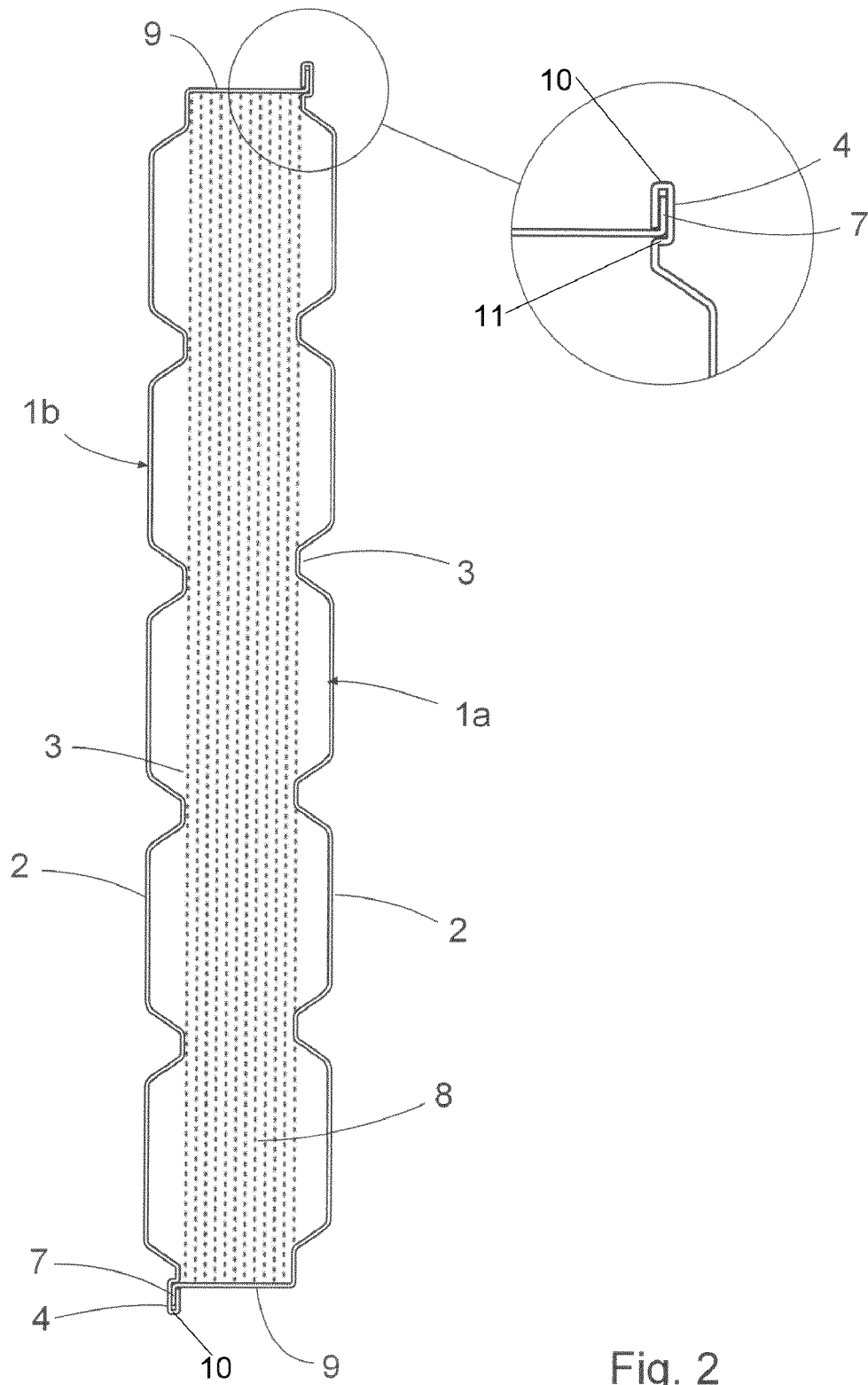


Fig. 2

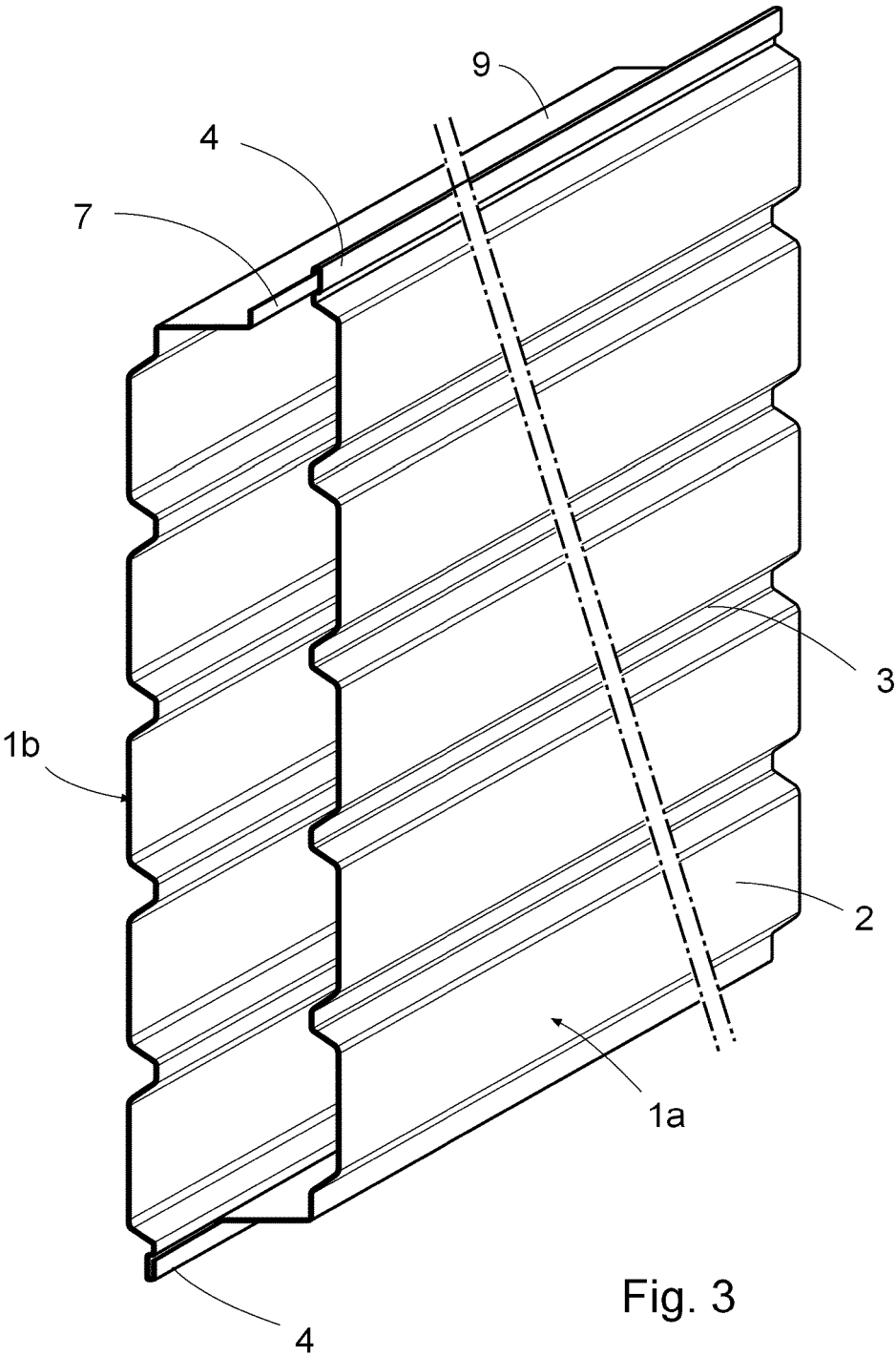


Fig. 3

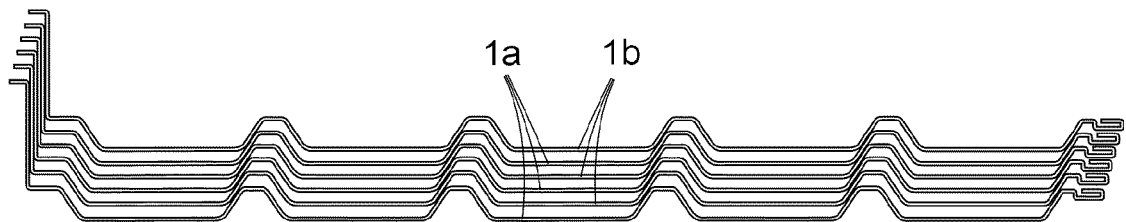


Fig. 4

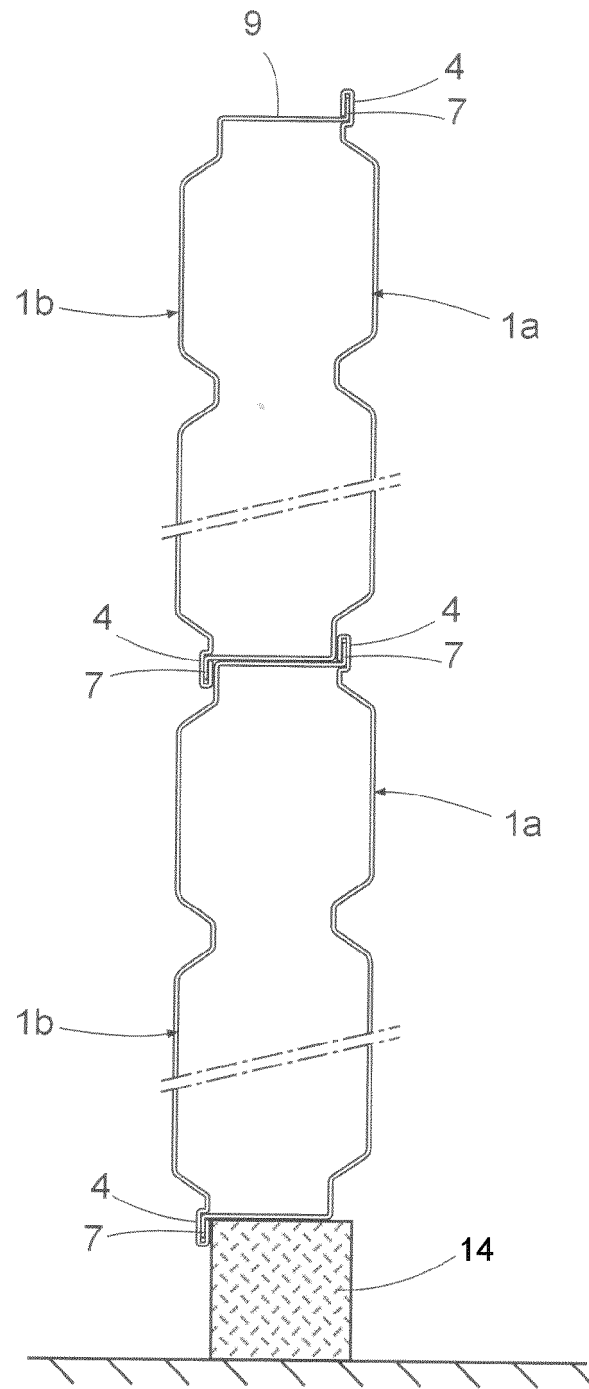


Fig. 5

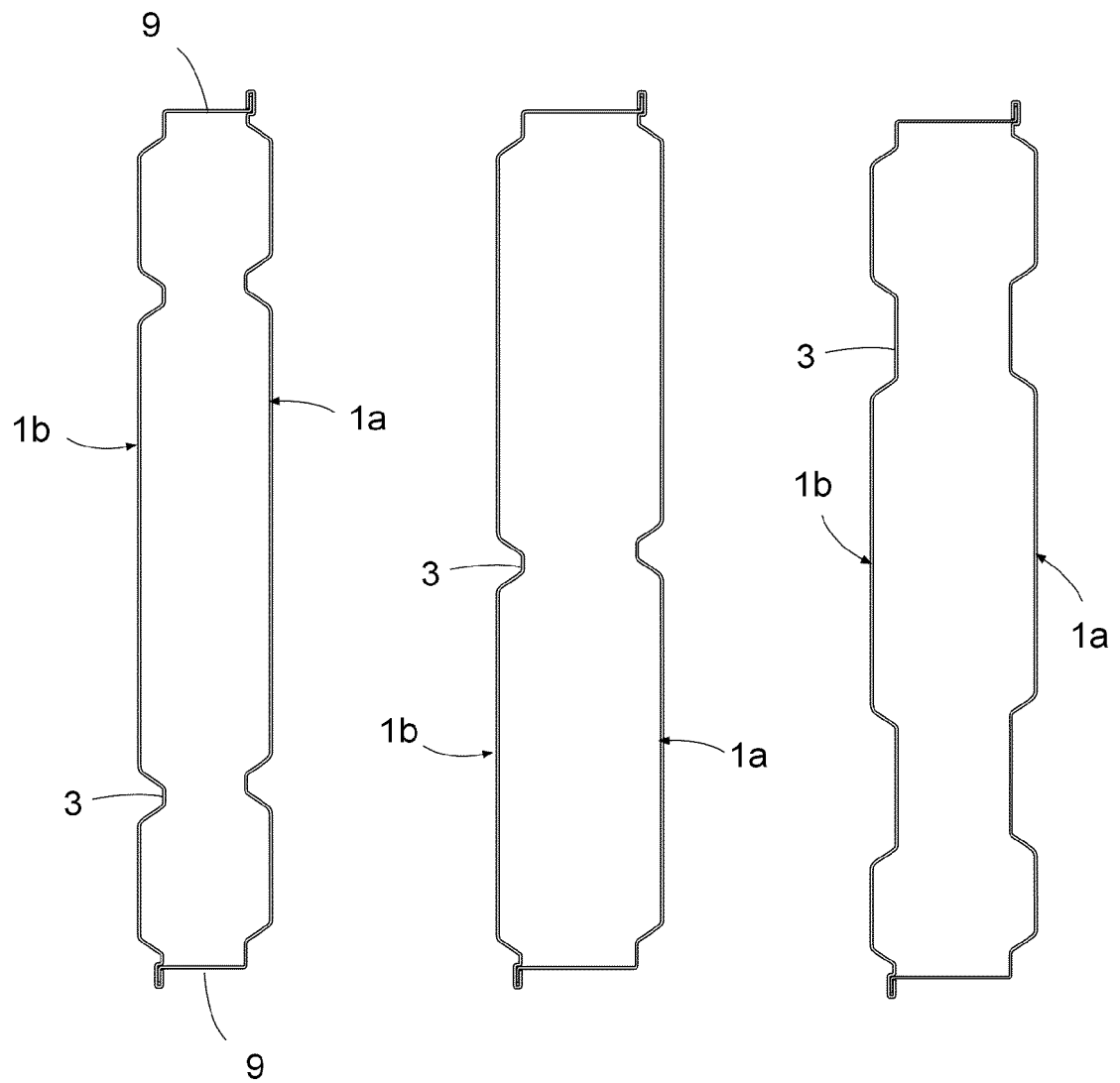


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2014/070650

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E04B, E01F, E04C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, INVENES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 663897 A (DETROIT STEEL PRODUCTS CO) 27/12/1951, page 1, lines 12 - 25; page 1, line 40 - page 2, line 7; figure 1.	1-9
X	US 3267626 A (DALY EDWIN A) 23/08/1966, column 2, line 5 - column 5, line 16; figures 2, 3, 8.	1, 2, 6-9
X	DE 2929853 A1 (RHEINHOLD & MAHLA GMBH) 19/02/1981, & Abstract from DataBase WPI. Retrieved of EPOQUE; AN 1981-B7100D; figures 1, 3.	1
A		2-6, 9
A	US 5285609 A (GOAD GARY N) 15/02/1994, column 2, line 7 - column 3, line 19; figures 1 - 3.	1-9

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search
03/11/2014

Date of mailing of the international search report
(04/11/2014)

Name and mailing address of the ISA/

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Telephone No. 91 3495437

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2014/070650

C (continuation).	DOCUMENTS CONSIDERED TO BE RELEVANT	
Category *	Citation of documents, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1840270 A1 (TECANT ENGINEERING SRL) 03/10/2007, paragraphs[0038 - 0059]; figures 2 - 4.	1, 2, 6-9

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2014/070650

Information on patent family members

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
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US3267626 A	23.08.1966	NONE	
DE2929853 A1	19.02.1981	NONE	
US5285609 A	15.02.1994	NONE	
EP1840270 A1	03.10.2007	AT431463T T ITUD20060078 A1	15.05.2009 30.09.2007

Form PCT/ISA/210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2014/070650

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CLASSIFICATION OF SUBJECT MATTER

E04B1/86 (2006.01)

E01F8/00 (2006.01)

E04C2/292 (2006.01)

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REFERENCES CITED IN THE DESCRIPTION

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