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(54) A BUILDING PART WITH HIGH SOUND INSULATION PERFORMANCE

(57) The present invention relates to a building part comprising a floating floor (6) resting on a support structure (1). The floating floor (6) comprises an upper floor (7) and a plurality of floor elements (8) arranged spaced apart from each other and attached to the upper floor (7). The support structure (1) comprises a plurality of floor support members (4) arranged spaced apart from the floor elements (8). The building part comprises a plurality of elastic tension straps (10) extending between the floating floor (6) and the support structure (1) such that the floor elements (8) rest on the tension straps (10) and the tension straps bear on the floor support members, wherein floor elements (8) and the floor support members (4) are elongated, the floor support members are arranged in parallel with the floor elements, and the tension straps (10) extend transversally with respect to the floor elements (8) and the floor support members (4) along the support structure (1).

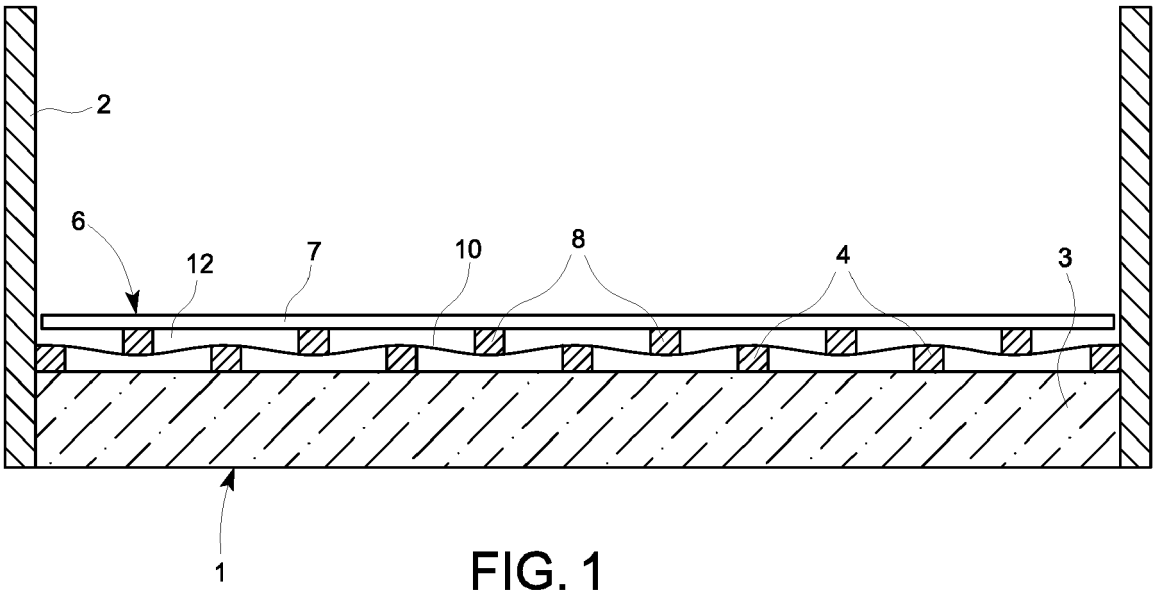

FIG. 1

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Description

Field of the invention

[0001] The present invention relates to a building part comprising a floating floor resting on a support structure, wherein the floating floor comprises an upper floor and a plurality of elongated floor elements arranged spaced apart from each other and attached to the upper floor.

Background of the invention

[0002] Intrusive sounds that penetrate walls and separating floor structures are a problem for the inhabitants and users of buildings. A reduction in the sound level in a building improves the comfort and quality for the inhabitants living in the building.

[0003] There are two types of sound transmission. Airborne sound is produced by active systems, speech and loud music, and is a series of pressure waves carried through the air. Impact sound results from objects striking a surface, which then causes vibration in other objects attached to or resting on that surface. In buildings, sound energy can be transmitted directly or indirectly from one side of a wall or floor to the other. Indirect transmission is where the sound waves travels through the walls or floors of the building.

[0004] One approach for improving sound insulation is to simply increase the thickness of the walls and floors. However, this method is expensive and will increase the weight and size of the walls and the floors. Alternatively, the sound insulation performance can be improved by introducing an insulating material into the support structure. The infill is, for example, an inert silicate cotton material, such as glass wool. Another solution is to provide a resilient layer that is isolated from and not fixed to the base structural floor, and which incorporates a sound and shock absorbing material such as rubber composite or cellular foam.

[0005] A floating floor will improve both airborne and impact sound insulation qualities. A standard timber floating floor would comprise an upper floor, which rests on a resilient quilt placed over a support structure. A problem associated with all floating floor systems, however, is that they can raise the finished floor level significantly, resulting in the need to then raise skirting boards and to trim the base of doors and architraves. Sound insulation measures may also increase the floor loads significantly.

[0006] JPH0666015 discloses a sound insulating floor including vacuum panels laid down without clearance on an underfloor for supporting floor load. An upper floor is laid down on the underfloor. To insulate impact noise on floor, an elastic material is installed on the front surface of the under floor or rear surface of the upper floor at the same time when the vacuum panels are laid down.

[0007] SE1450219 discloses a building element comprising upper and lower beams arranged at a distance from each other and connected by tilted slats. A tension strap is arranged between upper and lower beams at a distance from the tilted slats in order to reduce sound noise and prevent sound propagation in a building. The tension strap forms an undulating pattern.

Object and summary of the invention

[0008] It is an object of the present invention to further prevent sound propagation in buildings and by that further reduce sound noise in the building.

[0009] This object is achieved by a building part as defined in claim 1.

[0010] The building part comprises a floating floor resting on a support structure. The floating floor comprises an upper floor and a plurality of floor elements arranged spaced apart from each other and attached to the upper floor. The invention is characterized in that the support structure comprises a plurality of floor support members arranged spaced apart from the floor elements, the building part comprises a plurality of elastic tension straps extending between the floating floor and the support structure such that the floor elements rest on the tension straps and the tension straps bear on the floor support members.

[0011] With a floating floor is meant a floor that is not attached to the walls or to the support structure. By providing a plurality of elastic tension straps between the floating floor and the support structure such that the floor elements rest on the tension straps and the tension straps bear on the floor support members, transmission of sound between the upper floor and the support structure is prevented. The floor is not in direct physical contact with the support structure. The floor is only connected to the support structure via the tension straps, which absorbs the sound. Thus, the sound is not transferred to the support structure. Accordingly, sound noise in the building is reduced.

[0012] Structure-borne sound is undesirable vibration or oscillation in a construction. The tension straps absorbs structure-borne sound in the building. The invention can be used in all types of buildings in which there are problems with sound that propagates in the building.

[0013] The tension straps should preferably run freely between the floor elements and the floor support members to effectively absorb the vibrations. Due to the fact that the floor elements and floor support members are arranged spaced apart from each other, the tension straps are allowed to run freely between the floor elements and the floor support members. There are free spaces between the floor elements and the floor support members, and the tension straps extend in the free spaces between the floor elements and the floor support members.

[0014] The tension straps must be stretched to be able to vibrate with the sound and accordingly to absorb the sound. The stretched tension straps efficiently eliminates vibrations in a low-frequency band and transmission thereof. The weight of the floor and objects, such as fur-

niture, located on the floor provide a load acting on the tension straps, which stretches the tension straps.

[0015] The term elastic tension strap refers to an elongated, flexible and elastic band, which has a good tensile strength. The tension strap is designed so that it can stand to be stretched to a certain extent, and returns to its normal shape when the load on it is removed.

[0016] According to an embodiment of the invention, floor elements and the floor support members are elongated, the floor support members are arranged in parallel with the floor elements, and the tension straps extend transversally with respect to the floor elements and the floor support members along the support structure.

[0017] According to an embodiment of the invention, the floor elements at least partly extend between the floor support members, and each of the tension straps forms an undulating pattern between the floor support members and the floor elements.

[0018] The tension straps are attached to any of the support structure or the floor to enable the strap to be stretched. Preferably, the tension straps are attached to the support structure. By that mounting of the floor is facilitated. Preferably, each of the tension straps is fixedly connected to at least some of the floor support members.

[0019] According to an embodiment of the invention, the building part comprises at least two walls including a plurality of structural wall elements having horizontal support surfaces arranged spaced arranged apart from each other and connection means for connecting the support structure to the walls, and the connection means comprises two elastic second tension straps extending between the support structure and the wall elements along two opposite sides of the support structure and arranged so that the support structure is resiliently suspended from the walls by means of the tension straps.

[0020] The support structure is resiliently suspended from the walls by means of the second tension straps. Thus, the support structure is not in direct physical contact with the walls. Instead, the support structure is connected to the walls through the second tension straps. The second tension straps becomes stretched due to the weight of the support structure. Although the second tension straps are stretched, they still are slightly resilient and thus they can absorb vibrations and accordingly absorb sound. Thus, the second tension straps prevent transmission of sound noise from the support structure to the walls and further to the bearing structure of the building. This embodiment further reduces the transmission of sound in the building.

[0021] According to an embodiment of the invention, the support structure comprises a plurality of support elements arranged spaced apart from each other, and the tension straps are arranged so that they bear on the horizontal support surfaces of the wall elements and the support elements are arranged so that they rest on the tension straps.

[0022] Preferably, the wall elements at least partly extend between the support elements and each of the tension straps forms an undulating pattern between the support elements and the wall elements.

[0023] The tension straps are attached to any of the support structure or the wall to enable the strap to be stretched. Preferably, the tension straps are attached to the support structure. By that mounting of the support structure is facilitated. Preferably, each of the tension straps is fixedly connected to at least some of the support elements.

[0024] According to an embodiment of the invention, the support structure comprises at least five support elements and the wall comprises at least four wall elements to achieve a stable and robust assembly between the support structure and the wall.

[0025] According to an embodiment of the invention, the support elements are elongated, the wall elements at least partly extend between the support elements in a direction parallel with the longitudinal axes the support elements, and the second tension straps extend transversally with respect to the support elements and the wall elements.

[0026] According to an embodiment of the invention, said floor support members are arranged perpendicular to said support elements and said second tension straps extend perpendicular to said first mentioned tension straps.

[0027] According to an embodiment of the invention, the wall elements are protruding from the walls, and the wall elements protrude at least partly between the support elements.

[0028] According to an embodiment of the invention, the building part comprises an under-roof and a plurality of elastic third tension straps extending between the support structure and the under-roof so that the under-roof is resiliently suspended from the support structure by means of the third tension straps.

[0029] The under-floor is resiliently suspended from the support structure by means of the third tension straps. Thus, the under-roof is not in direct physical contact with the walls or the support structure. Instead, the under-roof is connected to the support structure through the third tension straps. The third tension straps become stretched due to the weight of the under-roof. Although the third tension straps are stretched, they still are slightly resilient and thus they can absorb vibrations and accordingly absorb sound. The third tension straps prevent transmission of sound noise from the support structure to the under-roof. This embodiment further reduces the transmission of sound in the building.

Brief description of the drawings

[0030] The invention will now be explained more closely by the description of different embodiments of the invention and with reference to the appended figures.

Fig. 1 illustrates a side view of a cross-section through a building part including a floating floor ac-

cording to an embodiment of the invention.

Fig. 2 illustrates a view from above of a building part including a floating floor according to another embodiment of the invention.

Fig. 3 illustrates a cross-section through a building part including a floating floor, a support structure connected to a wall, and an under-roof according to an embodiment of the invention.

Fig. 4 illustrates a cross-section A-A through the building part shown in figure 3.

Fig. 5 illustrates a view from above of a building part including a support structure connected to a wall according to an embodiment of the invention.

Detailed description of preferred embodiments of the invention

[0031] Figure 1 shows a side view of a cross-section through a building part according to an embodiment of the invention. Figure 2 shows a view from above of a building part including a floating floor according to another embodiment of the invention. The building part comprises a support structure 1 connected to walls 2. The support structure 1 comprises a base plate 3 and a plurality of floor support members 4 arranged spaced apart from each other on the base structure 3. The base structure 3 can, for example, be a base plate made of concrete or wood, as shown in figure 1. The base structure 3 may comprise a plurality of support beams 9 as shown in figure 2. The floor support members 4 are elongated and are, for example, crossbars. The building part comprises a floating floor 6 resting on a support structure 1. The floating floor 6 comprises an upper floor 7 and a plurality of floor elements 8 arranged spaced apart from each other and attached to the upper floor 7. The upper floor 7 is arranged so that a narrow gap is formed between the upper floor 7 and the walls 2. The floor elements 8 are elongated and arranged in parallel with the floor support members 4. The floor support members 4 are arranged spaced apart from the floor elements 8. The floor elements 8 extend between the floor support members 4. However, the floor elements 8 are position at a higher vertical level than the support elements. A lower part of the floor elements 8 is located slightly below an upper part of the support elements 4. Thus, the floor elements partly extend between the floor support members.

[0032] The building part further comprises a plurality of elastic first tension straps 10 extending between the floating floor 6 and the support structure 1 such that the floor elements 8 rest on the first tension straps 10, and the first tension straps 10 bear on the floor support members 4. The first tension straps 10 extend transversally with respect to the floor elements 8 and the floor support members 4. The entire floating floor 6 rests on the first tension straps 10. Thus, the floating floor 6 is separated from the support structure 1 by means of the first tension straps 10. Each of the first tension straps forms an undulating pattern between the floor support members 4 and the floor elements 8. The space formed between the base structure 3 and the first tension strap 10 can be filled with an insulating material.

[0033] A tension strap is an elongated, flexible and elastic band, which has a good tensile strength. The tension strap is designed so that it can stand to be stretched to a certain extent, and returns to its normal shape when the load on it is removed. The tension strap is made of a strong and stretchable material. The tension strap can be made from various materials with good tensile strength, but which does not take up compressive forces. Advantageously, the tension strap is made of a material having an elastic modulus greater than 2GPa, and preferably of a material having an elastic modulus greater than 2.5GPa to provide a sufficient tensile strength. The tension strap may, for example, be made of a woven fabric or molded plastic. Suitably, the tension strap is made of woven fibers. Examples of suitable materials for the tension strap is natural organic fibers having a small elongation, such as cotton, artificial fiber materials, for example, made of polyester, polyethylene or polypropylene, or a combination of different fiber materials with different properties. It is advantageous if the tension strap comprises fibers made of different materials, for example, natural organic fibers and artificial fibers to provide both strength and elasticity. For example, some of the fibers can be made of metal to improve the strength of the tension strap.

[0034] Due to the fact that the floor elements 8 and floor support members 4 are arranged spaced apart from each other, a space 12 is formed between the floor elements 8 and floor support members 4. The first tension straps 10 extend in the space 12 between the floor elements 8 and the floor support members 4. The tension straps must be stretched to be able to vibrate with the sound and accordingly to absorb the sound. The weight of the floor 1 and objects, such as furniture, located on the floor provide a load acting on an upper side of the first tension straps 10, and accordingly the tension straps are stretched. The stretched tension straps efficiently eliminates vibrations in the low-frequency band and transmission thereof.

[0035] The first tension straps 10 are attached to the support structure. The first tension straps 10 are preferably attached to the floor support members 4, as shown in figure 2. The first tension straps 10 can be attached to the floor support members 4 by gluing, nailing, or any other suitable attachment means. In the embodiment shown in figure 2, the floor support members 4 are attached to the support beams 9 of the support structure 1. The floor elements 8 are attached to the upper floor 7.

[0036] Figure 3 illustrates a cross-section through a building part according to another embodiment of the invention. Figure 4 illustrates a cross-section A-A through

the building part shown in figure 3. Figure 5 shows the building part in a view from above. The building part comprises a floating floor 6 designed in the same way as the floating floor shown in figure 1. The building part comprises two opposite walls 20 including a plurality of structural wall elements 22 having horizontal support surfaces 24 and arranged spaced apart from each other. Preferably, wall elements 22 are arranged on the same vertical level. In one embodiment of the invention, the wall elements are protruding from the walls. The wall elements protrude at least partly between the support elements. The wall elements 22 are, for example, wall brackets or beams made of wood.

[0037] The building part comprises a support structure 25 and two elastic second tension straps 26 for connecting the support structure 25 to the walls 20. Preferably the second tension straps 26 are of the same type as the first tension straps 10.

[0038] The support structure 25 can have many different shapes. For example, the support structure can be a building element including a plurality of inclined beams as disclosed in SE1450219A1. However, the support structure can also be a traditional support structure including wooden joists. In this embodiment, the support structure 25 comprises a plurality of elongated lower support elements 28 arranged spaced apart from each other, and a plurality of elongated upper support elements 29 arranged spaced apart from each other and at a horizontal and vertical distance from the lower support elements. The support elements 28, 29 are, for example, beams. In this embodiment of the invention, the support structure also includes a plurality of inclined beams 30 connected between the lower and upper support elements 28, 29. The wall elements 22 extend between and at a distance from the lower support elements 28. The wall elements 22 are position at a higher vertical level than the lower support elements 28, as shown in figure 4. The wall elements 22 at least partly extend between the lower support elements 28. In this embodiment of the invention, the support structure also includes a plurality of floor support members 4 attached to the upper support elements 29 and a plurality of roof support members 32 attached to the lower support elements 28. The floor support members 4 and the roof support members 32 are arranged perpendicular to the upper and lower support elements 29.

[0039] The second tension straps 26 are attached to the support structure 25. For example, the second tension straps 26 are attached to at least some of the lower support elements 28. The second tension straps 26 extend along the support structure on two opposite sides of the support structure, as shown in figure 5. The second tension straps 26 are arranged between the support structure and the wall elements 22 so that the support structure 25 is resiliently suspended from the walls 20 by means of the second tension straps 26, as shown in figure 4. The second tension straps 26 are arranged such that they bear on the horizontal support surfaces 24 of the wall elements 22 and the lower support elements 28 rest on the tension straps 26, as shown in figure 4 and 5. Thus, the second tension straps 26 form an undulating pattern between the lower support elements 28 and the wall elements 22. The wall elements 22 extend between the lower support elements 28 in parallel with the longitudinal axes of the lower support elements 28. The second tension straps 26 extend transversally with respect to the lower support elements 28 and the wall elements 22, as shown in figure 5. The weight of the support structure 25, the floor and objects located on the floor provide a load acting on the second tension straps 26, and accordingly the second tension straps are stretched. The stretched second tension straps 26 efficiently eliminates vibrations in the low-frequency band and transmission thereof between the support structure 25 and the walls 20.

[0040] The floor support members 4 are arranged perpendicular to the upper and lower support elements 28, 29, and the second tension straps 26 extend perpendicular to the first tension straps 10, as shown in figure 3.

[0041] In this embodiment, the building part comprises a roof including an under-roof 34 and a plurality of spaced apart elongated roof elements 36 attached to the under-roof 34, as shown in in figure 3. The roof elements 36 are, for example, beams or joists. The building part further comprises a plurality of elastic third tension straps 38 extending between the support structure 25 and the under-roof 34 so that the under-roof 34 is resiliently suspended from the support structure 25 by means of the third tension straps 38. Thus, the roof is separated from the support structure 25 by means of the third tension straps 38. Preferably the third tension straps 36 are of the same type as the first and second tension straps 10, 26. The third tension straps 36 extend between the roof elements 36 and the roof support members 32 so that the third tension straps bear on the roof support members 32, and the third tension straps 38 form an undulating pattern between the roof elements 36 and the roof support members 32. The third tension straps 38 extend transversally with respect to the roof elements 36 and the roof support members 32. The third tension straps 38 are attached to the support structure 25 or to the roof elements 36. Preferably, the third tension straps 38 are clamped between the under-roof 34 and the roof elements 36. The weight of the roof provide a load acting on the third tension straps 38, and accordingly the third tension straps are stretched. The stretched third tension straps 36 efficiently eliminates vibrations in the low-frequency band and transmission thereof between the roof and the support structure 25.

Claims

1. A building part comprising a floating floor (6) resting on a support structure (1), wherein the floating floor (6) comprises an upper floor (7) and a plurality of

floor elements (8) arranged spaced apart from each other and attached to the upper floor (7), **characterized in that** the support structure (1) comprises a plurality of floor support members (4) arranged spaced apart from the floor elements (8), and the building part comprises a plurality of elastic tension straps (10) extending between the floating floor (6) and the support structure (1) such that the floor elements (8) rest on the tension straps (10) and the tension straps bear on the floor support members, wherein floor elements (8) and the floor support members (4) are elongated, the floor support members are arranged in parallel with the floor elements, and the tension straps (10) extend transversally with respect to the floor elements (8) and the floor support members (4) along the support structure (1).

2. The building part according to claim 1, wherein the floor elements (8) at least partly extend between the floor support members (4), and each of the tension straps (10) forms an undulating pattern between the floor support members (4) and the floor elements (8).

3. The building part according to any of the previous claims, wherein the tension straps (10) are attached to the support structure (1).

4. The building part according to any of the previous claims, wherein the building part comprises at least two walls (20) including a plurality of structural wall elements (22) having horizontal support surfaces (24) arranged spaced apart from each other and connection means for connecting the support structure (1) to the walls (22), and the connection means comprises two elastic second tension straps (26) attached to the support structure (1) and extending between the support structure (1) and the wall elements (22) along two opposite sides of the support structure (1) and arranged so that the support structure (1) is resiliently suspended from the walls (20) by means of the second tension straps (26).

5. The building part according to claim 4, wherein the support structure (1) comprises a plurality of lower support elements (28) arranged spaced apart from each other, and the wall elements (22) at least partly extend between the lower support elements (28), the second tension straps (26) are arranged such that the they bear on the horizontal support surfaces (24) of the wall elements (22) and the lower support elements (28) rest on the second tension straps (26) and each of the second tension straps (26) forms an undulating pattern between the support elements (28) and the wall elements (22).

6. The building part according to claim 4 or 5, wherein the lower support elements (28) are elongated, the wall elements (22) at least partly extend between the lower support elements (28) in a direction parallel with the longitudinal axes the lower support elements (28), and the second tension straps (26) extend transversally with respect to the lower support elements (28) and the wall elements (22).

7. The building part according to any of the claims 4 - 6, wherein said floor support members (4) are arranged perpendicular to said lower support elements (28) and said second tension straps (26) extend perpendicular to said first mentioned tension straps (10).

8. The building part according to any of the claims 4 - 7, wherein each of the second tension straps (26) is fixedly connected to at least some of the lower support elements (28).

9. The building part according to any of the previous claims, wherein the building part comprises an under-roof (34) and a plurality of elastic third tension (38) straps extending between the support structure (1) and the under-roof (34) so that the under-roof (34) is resiliently suspended from the support structure by means of the third tension straps (38).

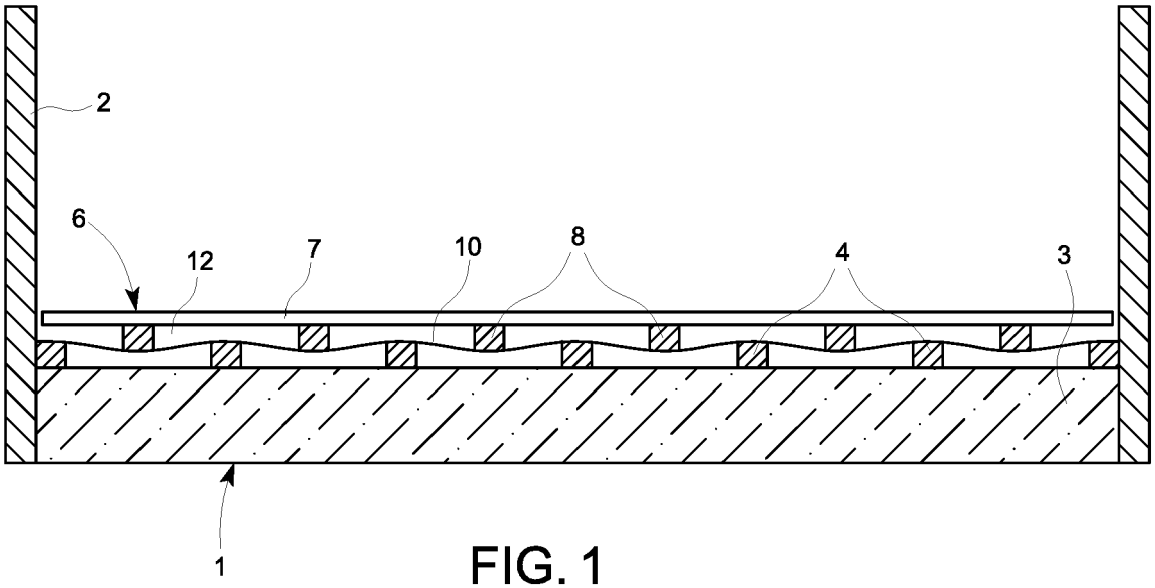

FIG. 1

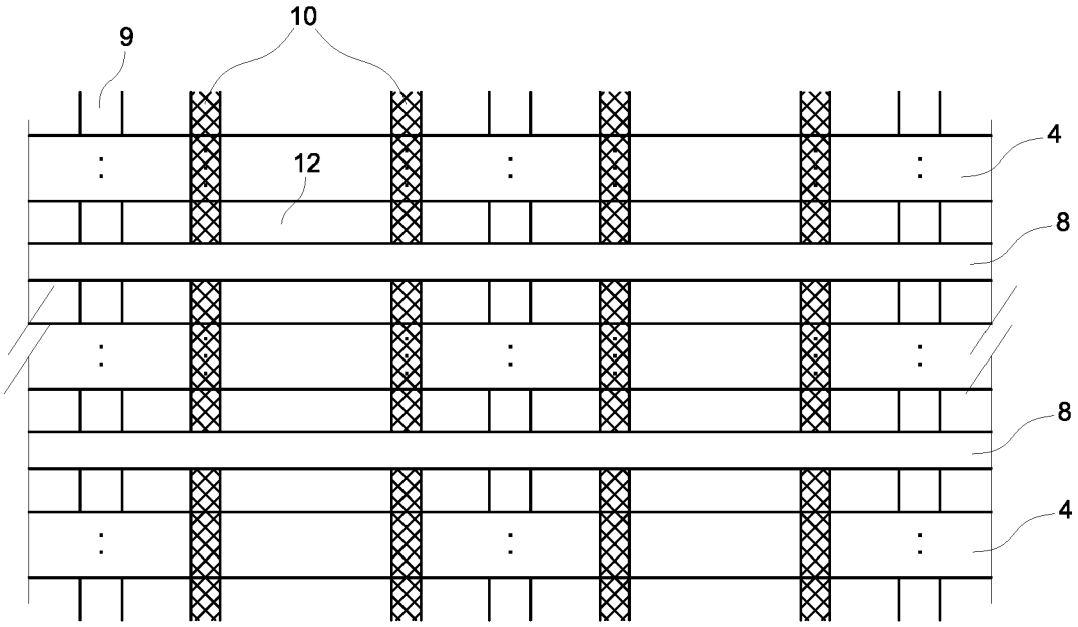

FIG. 2

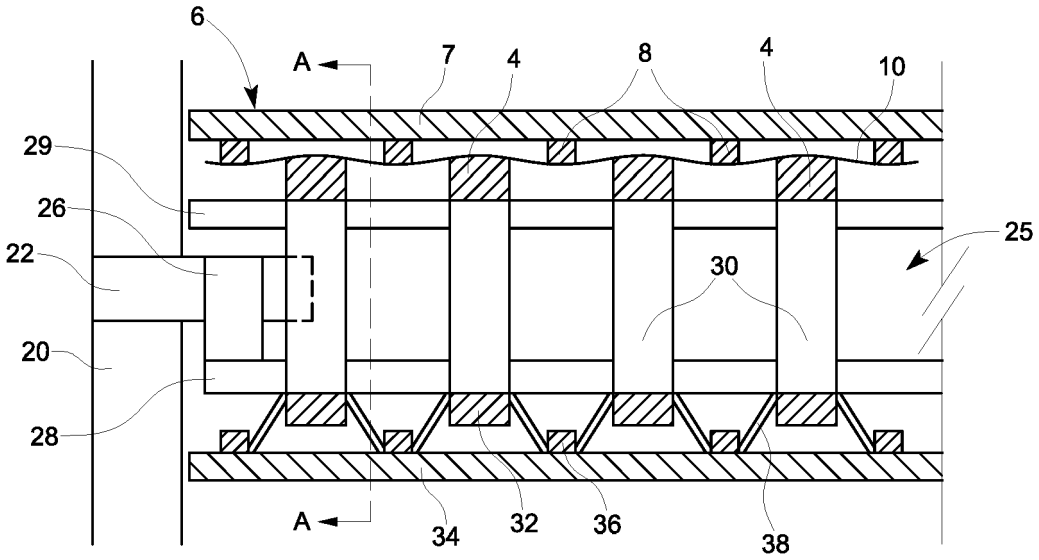
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FIG. 3

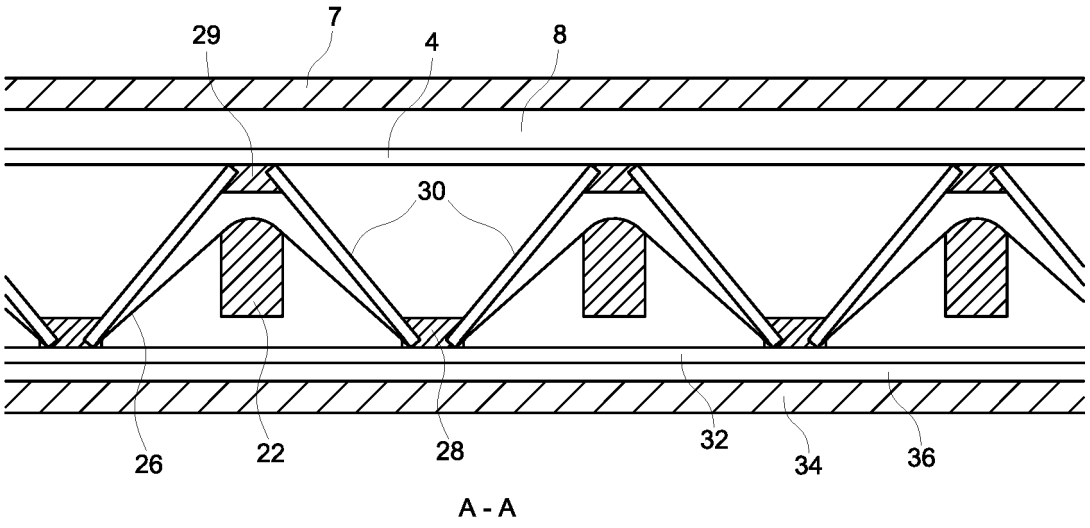
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FIG. 4

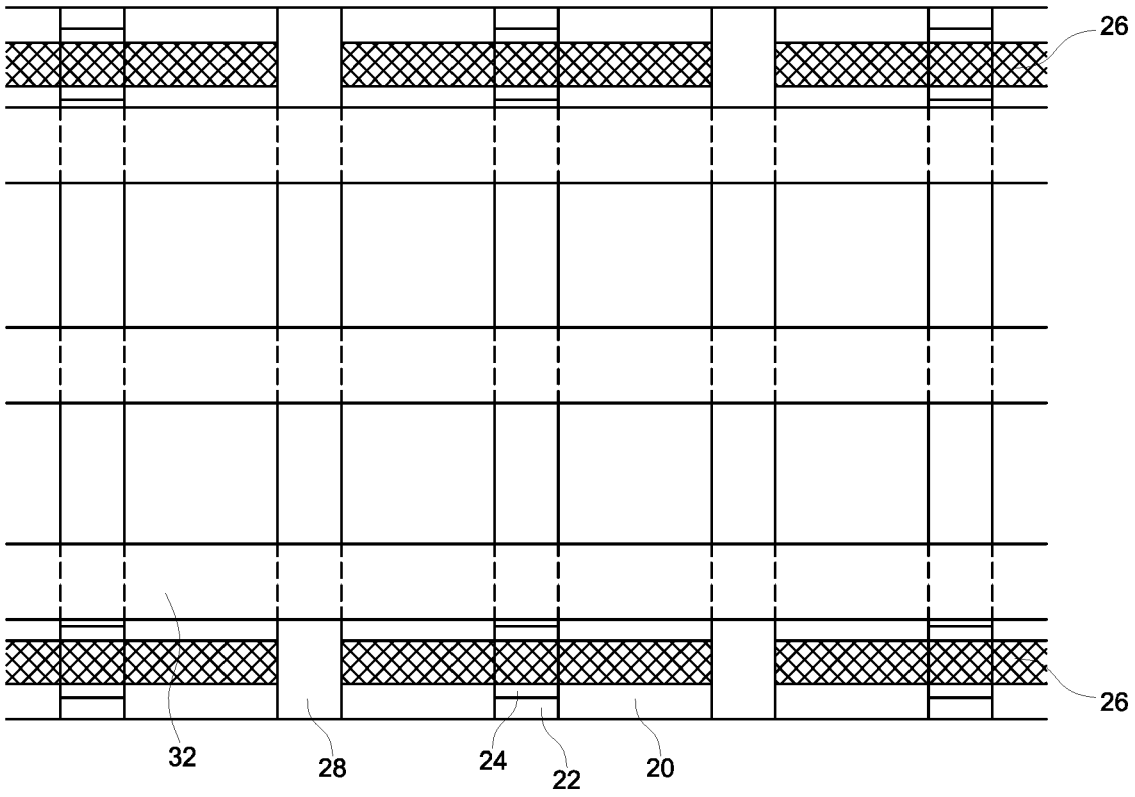

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 17 16 5520

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	SE 525 454 C2 (SAMUELSSON STURE [SE]; KARLSSON LENNART [SE]) 22 February 2005 (2005-02-22) * page 2, line 13 - page 3, last line; figures 1,10 * -----	1-9	INV. E04F15/22 E04B5/12 E04B9/00 E04B1/82
X	GB 2 440 936 A (MACA R & D LTD [IE]) 20 February 2008 (2008-02-20) * page 4, line 33 - page 5, line 13; figures 1,2 * -----	1-3	

TECHNICAL FIELDS SEARCHED (IPC)

E04F
E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 June 2017	Melhem, Charbel

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE 525454 C2	22-02-2005	----------	
GB 2440936 A	20-02-2008	NONE	

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- SE 1450219 **[0007]**
- SE 1450219 A1 **[0038]**