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(54) **Metal composite sound absorbent structural panel**

(57) A metal composite sound absorbent structural panel, characterized in that said panel has a high flexural thickness and comprises two flat plates coupled by glueing a fret element, made of aluminium, steel or other metals or alloys and comprising a first and second plate elements adapted to be coupled to one another thereby being substantially parallel, through an interposition of a

corrugated coupling element comprising a fretted element; on one or both said plate elements being formed a double hole series: a series of vertical holes and a series of horizontal holes; the hole pattern geometry of one of said plate elements or both said plate elements, independent from one another, being made based on a Hemholtz resonance principle.

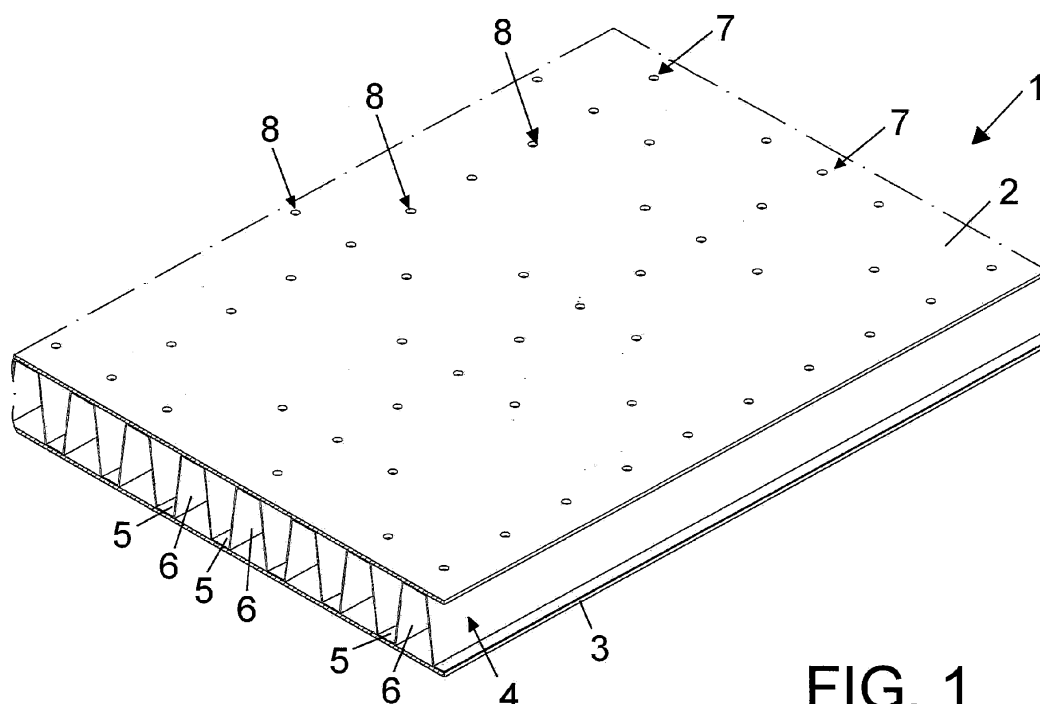


FIG. 1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a metal composite sound absorbent structural panel, comprising two flat plates coupled by glueing through a fretted element.

[0002] The above flat plates may be made of aluminium, steel or other metal materials.

[0003] For making panels, walls and other sound absorbent elements, materials provided with well known sound absorbent properties are conventionally used.

[0004] Prior sound absorbent characteristic materials, however, are affected by several drawbacks, such as a high cost, a difficult machining, a high environmental impact and other problems related to the aesthetic aspect of the material which must be moreover painted or coated, depending on its intended use.

SUMMARY OF THE INVENTION

[0005] The aim of the present invention is to provide such a sound absorbent construction for making panels, walls and other elements having sound absorbent properties, made starting from an inexpensive raw material not necessarily having per se sound absorbent characteristics.

[0006] Within the scope of the above mentioned aim, a main object of the invention is to provide such a sound absorbent construction which may be easily made at a small making cost.

[0007] Another object of the present invention is to provide such a panel which has very high stiffness and mechanical strength properties.

[0008] Yet another object of the present invention is to provide such a sound absorbent panel which may be easily made starting from easily available materials and apparatus.

[0009] Yet another object of the present invention is to provide such a panel adapted for making structural components to be used in several fields.

[0010] Yet another object of the present invention is to provide such a panel having, notwithstanding its high mechanical performance, a very small weight.

[0011] Yet another object of the present invention is to provide such a metal composite sound absorbent structural panel which, owing to its specifically designed constructional features, is very reliable and safe in operation.

[0012] According to one aspect of the present invention, the above mentioned aim and objects, as well as yet other objects, which will become more apparent hereinafter, are achieved by a metal composite sound absorbent structural panel, characterized in that said panel comprises a first and a second plate elements coupled to one another thereby being substantially parallel, through an interposition of a corrugated coupling element constituted by a fretted element.

[0013] Through the first plate-like element a double se-

ries of holes, i.e. a series of vertical holes and a series of horizontal holes, are formed.

[0014] The geometry of the hole pattern of the first plate-like element is made based on a Hemholtz resonance principle.

[0015] The geometrical hole arrangement provides that the vertical hole series is constituted by holes spaced by a single spacing pitch from one another, whereas in the horizontal hole series the holes may be from one to a maximum of three, even with different hole pitches.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Further characteristics and advantages of the present invention will become more apparent hereinafter from the following disclosure of a preferred, though not exclusive, embodiment of the invention, which is illustrated, by way of an indicative, but not limitative, example in the accompanying drawings, where:

Figure 1 is a perspective view of a length of the sound absorbent panel according to the present invention; Figure 2 is an exploded perspective view of the sound absorbent panel length shown in figure 1;

Figure 3 is a top plan view of the structural component at a side of the perforated plate-like element; Figure 4 is a cross-sectional view of the structural component, substantially taken along the cross-section plane IV-IV of figure 3;

and

Figure 5 is a further cross-sectional view of the structural component, substantially taken along the section plane V-V of figure 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0017] With reference to the number references of the above mentioned figures, the structural sound absorbent panel according to the present invention, which has been generally indicated by the reference number 1, comprises a first plate element 2 and a second plate element 3 coupled to one another, thereby being substantially parallel, through an interposition of a corrugated coupling element comprising, according to the invention, a fretted element 4, made of a metal material such as aluminium, steel, AISI, galvanized sheet metal element, titanium and alloys thereof.

[0018] The fretted element 4 comprises, advantageously, a contour including a plurality of horizontal portions 5 corresponding to peaks and valleys of the contour, joined by a plurality of slanted portions 6, thereby forming a trapezium series.

[0019] The fretted element 4 is applied, by its horizontal surfaces 5, to contact the plate elements 2 and 3 for coupling said plate elements 2 and 3 for example by glueing.

[0020] This embodiment has the advantage of provid-

ing a broad contacting surface between the fretted element 4 and the inner surfaces of the plate elements 2 and 3, thereby providing a strong glued coupling.

[0021] According to the present invention, through the first plate element 2 a double series of holes are formed, that is a vertical hole series 7 and a horizontal hole series 8, the terms "vertical" and "horizontal" being merely referred to the orientation thereof shown in Figure 3, for simplifying the disclosure.

[0022] According to the present invention, the geometry of the hole pattern of the first plate element is made based on the Hemholtz resonance principle.

[0023] The holes may alternatively have different diameters.

[0024] According to a preferred embodiment, 1944 holes per m² are formed, the diameter of each said hole being of 2 mm.

[0025] The vertical hole series has a pitch of 16.6 mm, whereas the horizontal hole series has three different hole pitches: 18 mm, 36 mm and 72 mm.

[0026] The average absorption coefficient α_W is 0.27.

[0027] It has been found that the invention fully achieves the intended aim and objects.

[0028] In fact, the invention has provided a sound absorbent structural component made without using sound absorption material or fibers, and being made by perforating either one or both the plate elements of the composite constructions with a specifically designed distribution geometry of the holes based on the Hemholtz resonance principle.

[0029] The structural sound absorbent panel according to the present invention may be advantageously used in several application fields, such as the ship field, and provides optimum sound absorbent and insulating characteristics which make the panel optimally suitable to be used either in an industrial and/or naval field.

[0030] In fact, the structural sound absorbent panel according to the present invention has a specific gravity much lower than that of conventional panels, and this would be very important in naval applications, where the weight of the panels can be very important.

[0031] Moreover, the inventive structural sound absorbent panel has very good resistance properties against high temperatures and fire.

[0032] In practicing the invention, the used materials, as well as the contingent size, may be any, depending on requirements.

[0033] The structural composite panel according to the present invention is characterized in that it has mechanical and acoustic features related to its specific intended use.

[0034] The resonance sound absorbent performance may be defined depending on the different thicknesses and holes either on one surface or on both surfaces, and will be independent from the contour surfaces, thereby differentiating such a panel from other prior sound absorbent structures.

[0035] Moreover, the inventive panels are environ-

mentally compatible, and have good hygienic properties and, moreover, are not combustible.

[0036] By using the inventive panel, it is moreover possible to achieve very good aesthetic effects.

[0037] Thus, the inventive panel is particularly suitable to be used in civil, industrial, naval, railroad, sanitary, educational and catering fields.

10 Claims

1. A metal composite sound absorbent structural panel, **characterized in that** said panel has a high flexural thickness and comprises two flat plates coupled by glueing a fret element, made of aluminium, steel or other metals or alloys and comprising a first and second plate elements adapted to be coupled to one another thereby being substantially parallel, through an interposition of a corrugated coupling element comprising a fretted element; on one or both said plate elements being formed a double hole series: a series of vertical holes and a series of horizontal holes; the hole pattern geometry of one of said plate elements or both said plate elements, independent from one another, being made based on a Hemholtz resonance principle.
2. A metal composite sound absorbent structural panel, according to claim 1, having mechanical and acoustic performance related to its intended use, **characterized in that** said panel comprises a hole horizontal series, the holes of which being from one to a maximum of three, even with different pitches; said holes having alternatively different diameter holes.
3. A metal composite sound absorbent structural panel, according to claim 2, **characterized in that** said panel has a resonance sound absorbent performance depending on different thickness and holes formed on one surface or on both surfaces and being independent for the contour surfaces thereby differentiating from other sound absorbent systems.
4. A metal composite sound absorbent structural panel, according to claim 1, **characterized in that** said panel is environmentally compatible, hygienic and incombustible, while simultaneously providing good aesthetic effects.
5. A metal composite sound absorbent structural panel, according to claim 1, **characterized in that** said panel is designed to be used in civil, industrial, naval, railroad, sanitary, educational and catering fields.
6. A metal composite sound absorbent structural panel, according to one or more of the preceding claims, **characterized in that** said holes are so arranged depending on a required frequency performance.

7. A metal composite sound absorbent structural panel,
according to one or more of the preceding claims,
characterized in that said panel has an average
absorption coefficient depending on a thickness of
said panel and the hole arrangement thereof. 5
8. A metal composite sound absorbent structural panel,
according to one or more of the preceding claims,
characterized in that said fretted element is made
of a metal material such as aluminium, steel, AISI, 10
galvanized sheet metal elements, titanium and al-
loys thereof.
9. A metal composite sound absorbent structural panel,
according to one or more of the preceding claims, 15
characterized in that said fretted element has a
fretted element contour including a plurality of hori-
zontal portions, corresponding to peaks and valleys
of said contour, adjoined by a plurality of sloping por-
tions, thereby forming a trapezium succession ar- 20
rangement, said fretted element being applied with
its horizontal surfaces contacting plate elements to
connect said plate elements to one another by a
glued connection. 25
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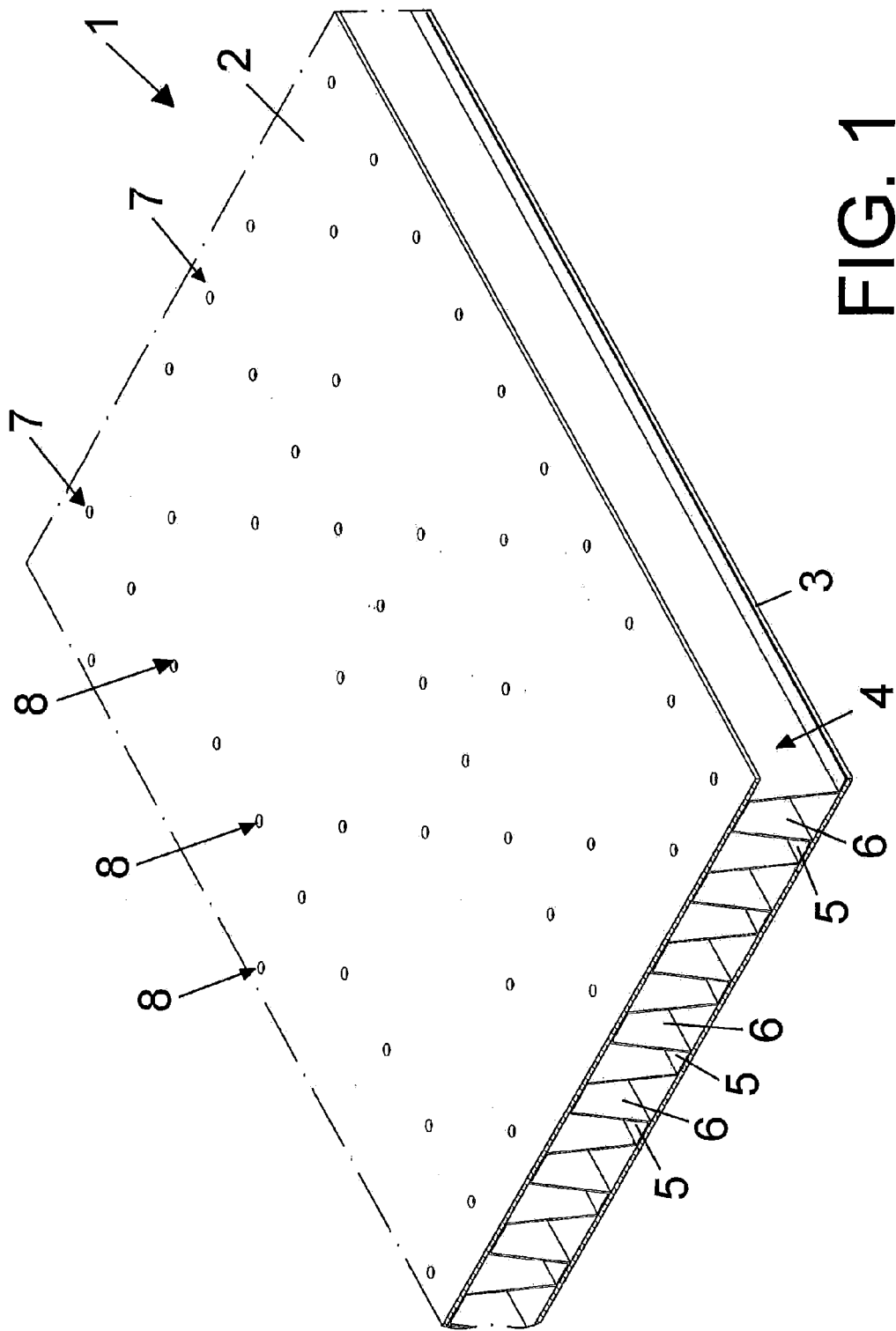
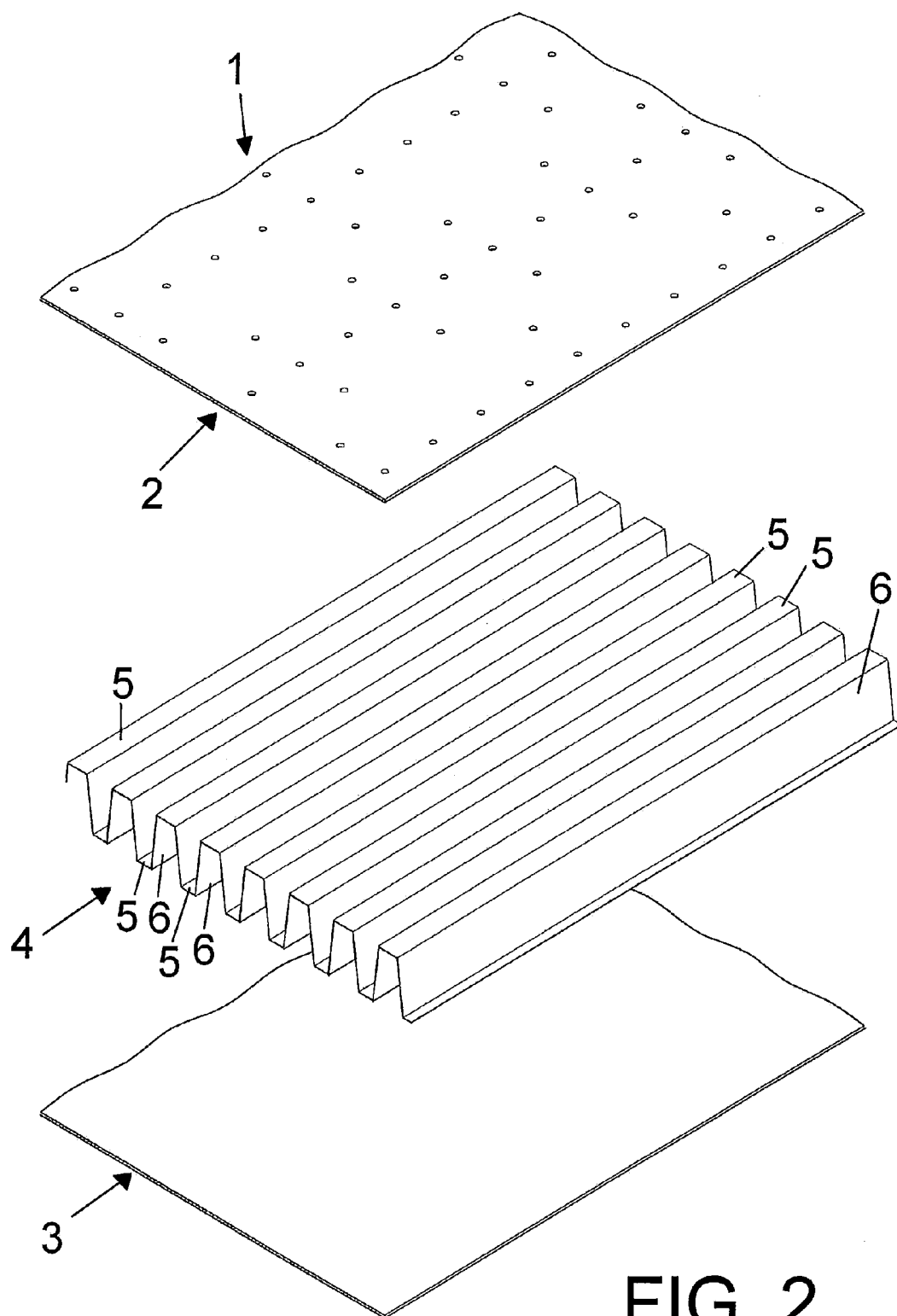


FIG. 1



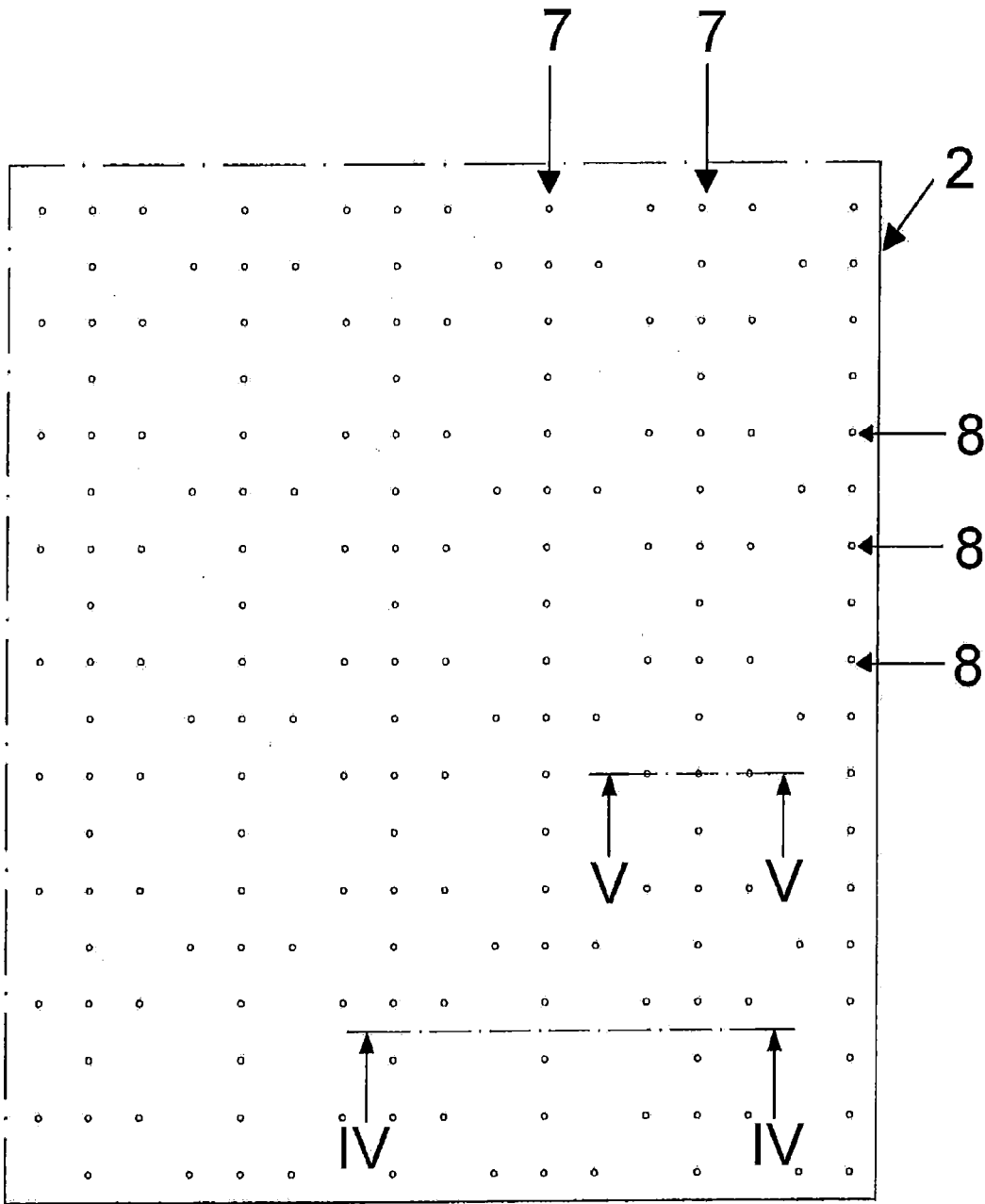


FIG. 3

