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(71) Applicant: **Sandvik SRP AB**
233 81 Svedala (SE)

(72) Inventor: **HENSSIEN, Adrien**
233 81 Svedala (SE)

(74) Representative: **Sandvik**
Sandvik Intellectual Property AB
811 81 Sandviken (SE)

(54) **A SCREEN PANEL FOR MOUNTING ON A SCREEN DECK AND SCREENING BULK MATERIALS**

(57) A screen panel (10) for mounting on a screen deck frame and screening bulk materials, the screening panel comprising a panel housing having an upper surface (32) and a lower surface (33) and a plurality of apertures extending through the panel arranged in a grid array having at least three rows of apertures and at least three columns of apertures, wherein the apertures comprise first apertures (2) defining a first aperture size (5) and second apertures (2') defining a second aperture size (8) that is smaller than the first aperture size. The second apertures (2') comprise a first aperture section (12) defining the second aperture size (8) and one or more second aperture sections (13) defining a third aperture size (9) that is smaller than the second aperture size. The first apertures (2) have a regular 4-sided polygon shape and the second apertures (2') have a regular n-sided polygon shape where $n \geq 6$, and the first aperture section (12) and second aperture section (13) of the second apertures (2') have a regular 4-sided polygon shape.

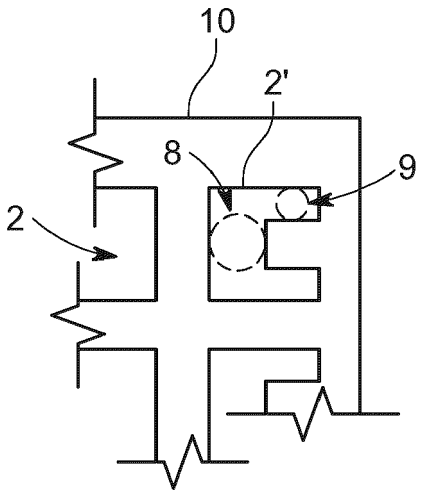

FIG. 10

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Description

Field of the Invention

[0001] The present invention relates to a screen panel for mounting on a screen deck and screening bulk materials. Also contemplated is a screen deck assembly for a screening machine comprising a frame with structural supports and one or more screen panels mounted on the structural supports, a screening device comprising one or more screen deck assemblies, and a screening plant assembly (static or mobile) comprising a screening device.

Background to the Invention

[0002] Vibrating screening devices for screening bulk materials such as quarry stone generally comprises a vibrating screen deck with screening media mounted to the deck. The media includes through holes (apertures) of a defined size to screen the bulk materials resulting in fractionation of (for example) crushed stones and gravel into fractions of stones with different sizes.

[0003] To optimize the screening efficiency of any screening media, it is usually preferred to cover as much area as possible with screening apertures. In an ideal world, screening media should be one piece over the whole deck and have no interruption in the tightly-packed aperture pattern. In reality this is difficult to achieve and most screening media are provided as modular panels that are mounted on structural members forming part of the screening deck. This is illustrated in **Figure 1** (prior art) showing in sectional view four screening panels 1 having apertures 2 mounted across structural supports 3 defining a gap 3' between adjacent structural supports. Some of the apertures are mounted over the structural supports (referenced herein as "second apertures" 2') which in effect reduces the aperture size due to the obstruction defined between the structural support and an underside of the screen panel. This inhibits the free flow of the screened material, leading to particles becoming blocked halfway through the apertures, reducing the screening efficiency, and leading to mechanical damage of the structure. **Figures 2 and 3** (prior art) show a single screen panel mounted to two structural support members having two columns of apertures 2 positioned over a gap 3' defined between the support members 3 and two columns of second apertures 2' each positioned over a support member. **Figure 3** is a sectional view taken along the line III-III of Figure 2, showing the largest (and desired) aperture size 5 (referred to herein as *"unobstructed aperture size")* that can allow particles of the desired size through the top of second aperture 2', the obstructed aperture size 6 (referred to herein as *"obstructed aperture size*") that can allow particles pass fully through second aperture 2' and past the obstruction, and the unhindered flow aperture size 7 (referred to herein as *"unhindered flow aperture size"*) that is sufficiently small to allow particles through second aperture 2' and past the obstruction with unhindered free flow. This arrangement will therefore inevitably lead to stuck particles and poor performance and lifetime of the screen components.

[0004] A partial solution to this problem is to change the aperture size of the second apertures 2' above a support member, as illustrated in **Figures 4 and 5** (prior art). The two illustrations above show a common practice of reducing the size of the second apertures to an *ideal obstructed aperture size* 8 this is dimensionally close to *unhindered flow aperture size* 7 but it can be bigger as long as it is significantly smaller than the *obstructed aperture size* 6. This ensures that the particles do not get stuck in the aperture or between the fixed obstruction and the underside of the screen panel. These *ideal obstructed aperture size* 8 will of course not give a perfect screening result as they are not the *unobstructed aperture size* 5 but they will still let through any particle smaller than particle size 8 which still contributes to the overall screening process. The drawback of this method is that the overall performance of the screen is reduced since the effective open area is reduced.

[0005] It is an object of the invention to overcome at least one of the above-referenced problems.

Summary of the Invention

[0006] In a first aspect, there is provided a screen panel for mounting across two structural supports of a screen deck frame and screening bulk materials, the screening panel comprising a panel housing having an upper surface and a lower surface and a plurality of apertures extending through the panel arranged in a grid array having at least three rows of apertures and at least three columns of apertures wherein the apertures comprise:

first apertures that in use are positioned over a gap defined between the two structural supports, wherein each first aperture defines a first aperture size; and

second apertures that in use are positioned over a structural support, wherein the second apertures each define a second aperture size that is smaller than the first aperture size and is dimensioned to allow particles pass an obstruction defined between the panel and a structural support,

characterised in that each second aperture comprise a first aperture section defining the second aperture size and one or more second aperture sections defining a third aperture size that is smaller than the second aperture size.

[0007] In contrast to the prior art, the second apertures have a first aperture section that defines the first aperture size (i.e., *ideal obstructed particle aperture size)* and one or more second aperture sections having a third aperture size that is smaller than the *ideal obstructed particle ap-*

erture size. This results in a screen panel that like the prior art provides the *ideal obstructed particle aperture size* but also provides additional screen area for smaller particles increasing the effective open area of the panel and improving screening efficiency.

[0008] In any embodiment, the screen panel comprises supporting legs disposed along opposed sides of the panel housing that in use support the panel housing above the structural supports. Having a screen panel with legs allows the panel to be spaced from the supporting legs to vary the size of obstruction defined between the panel and a structural support.

[0009] In any embodiment, the screen panel is configured such that in use the first aperture section of the second apertures is disposed above and laterally offset with respect to a structural support, and the or each second aperture section of the second apertures is disposed directly above the structural support. This arrangement provides a screen panel in the which the larger (first) aperture section is spaced from the obstruction and the smaller (second) aperture section that in use provides the additional screening area is disposed above the obstruction.

[0010] In any embodiment, the apertures in any one column of apertures are all first apertures or all second apertures and in which the apertures in any one row of apertures include first apertures and second apertures. This is a suitable arrangement for a screen panel configured to be mounted across two parallel supports where each support defines an obstruction under a column of apertures disposed at each side of the panel.

[0011] In any embodiment, the screen panel comprises a first column consisting of second apertures disposed along the first side of the screen panel, a second column consisting of second apertures disposed along the second opposite side of the screen panel, and at least one column consisting of first apertures disposed in between the first and second columns. This is a suitable arrangement for a screen panel configured to be mounted across two parallel supports where each support defines an obstruction under a column of apertures disposed at each side of the panel.

[0012] In any embodiment, the screen panel comprises two columns consisting of first apertures disposed in between the first and second columns of second apertures. This is a suitable arrangement for a screen panel configured to be mounted across two parallel supports where each support defines an obstruction under a column of apertures disposed at each side of the panel.

[0013] In any embodiment, the screen panel has a square or rectangular shape.

[0014] In any embodiment, the first apertures have a regular 4-sided polygon shape and the second apertures have a regular n-sided polygon shape where $n \geq 6$. Thus the first apertures may be square or rectangular. In other embodiments they may be circular or oval or have curved sidewalls. In any embodiment, $n \geq 8$, 10 or 12.

[0015] In any embodiment, the first aperture section and second aperture section of the second apertures have a regular 4-sided polygon shape. This is a preferred shape to provide optimal screening efficiency for most materials.

[0016] In any embodiment, the second apertures have one first aperture section and at least two or three second aperture sections. Thus, the second apertures may be L-shaped , C-shaped or E-shaped. C-shaped second apertures are preferred as they provide a balance of maximal added screen area without compromising the strength of the panel, although depending on the size of the first aperture section, one, two or three second aperture sections may be provided.

[0017] In any embodiment, a ratio of the second aperture size to the third aperture size is 1.2:1.0 to 1:8:1.0. In any embodiment, a ratio of the second aperture size to the third aperture size is about 1.4:1.0 to about 1:6:1.0. These ratios have been found to provide optimal balance between maintaining the screening efficiency of the second aperture while increasing the screening area of the panel.

[0018] In any embodiment, a ratio of the first aperture size to the second aperture size is 1.0:0.75 to 1.0:0.25. In any embodiment, a ratio of the first aperture size to the second aperture size is 1.0:0.6 to 1.0:0.4. These ratios have been found to provide optimal balance between maintaining the screening efficiency of the second aperture while increasing the screening area of the panel.

[0019] In a second aspect, there is provided a screen deck assembly comprising a screen deck frame comprising two structural supports, a gap defined between the two structural supports, and a screen panel according to the invention mounted across the two structural supports, wherein the second apertures are disposed over at least one of the structural supports and the first apertures are disposed over the gap defined between the two structural supports.

[0020] In any embodiment, the first aperture section of the second apertures are disposed above and laterally offset with respect to one of the structural supports and the second aperture sections of the second apertures are disposed directly over a structural support.

[0021] In any embodiment, the screen panel comprises a first column of second apertures disposed along the first side of the screen panel above one of the structural supports, a second column of second apertures disposed along the second opposite side of the screen panel above another of the structural supports, and at least one column of first apertures disposed in between the first and second columns.

[0022] In any embodiment, the screen deck assembly comprises a plurality of panels mounted across two spaced-apart co-parallel structural supports.

[0023] The invention also provides a screening device comprising a main frame, a screen box coupled to the main frame, and one or more screen box assemblies of the invention mounted to the screen box.

[0024] The invention also provides a screening plant

machine comprising a screening device of the invention. The machine may be a mobile or static screening plant machine.

[0025] Other aspects and preferred embodiments of the invention are defined and described in the other claims set out below.

Brief Description of the Figures

[0026]

FIG. 1 (Prior Art) is a sectional view of part of screen deck assembly showing four screen panels mounted on structural supports.

FIG.2 (Prior Art) is a top plan view of part of the screen deck assembly of Figure 1 showing one screen panel mounted between two structural supports.

FIG. 3 (Prior Art) is a sectional view taken along the line III-III of Figure 2.

FIG. 4 (Prior Art) is a top plan view of another screen deck assembly of the prior art screen deck assembly showing one screen panel mounted between two structural supports in which the screen panel has four columns of apertures including two columns of first apertures and two columns of second apertures disposed on opposed sides of the panel.

FIG. 5 (Prior Art) is a sectional view taken along the line V-V of Figure 4.

FIG. 6 is a top plan view of a screen deck assembly of the invention showing one screen panel of the invention mounted between two structural supports in which the screen panel has four columns of apertures including two columns of first apertures and two columns of second apertures disposed on opposed sides of the panel.

FIG. 7 is a top plan view of the screen panel shown in Figure 6.

FIG. 8 is a sectional view taken along the lines VIII-VIII of Figure 6.

FIG. 9 is a sectional view taken along the lines IX-IX of Figure 6.

FIG. 10 is a detail E illustrated in Figure 7.

FIG. 11A is a detail F illustrated in Figure 7.

FIG. 11B is a top plan view of a second aperture of the screen panel of the invention showing the first aperture section (first shading) and two second aperture sections (second shading).

FIG. 12 is a perspective view of a screen panel according to the invention.

FIG. 13 is a perspective view of a screen deck assembly according to the invention and incorporating a modular array of screen panels according to the invention.

FIG. 14A is a perspective view of a screening device according to the invention comprising two screen deck assemblies according to the invention mounted to a screen box.

FIG. 14B is a detailed view of part of Figure 14A.

Detailed Description of the Invention

[0027] All publications, patents, patent applications and other references mentioned herein are hereby incorporated by reference in their entireties for all purposes as if each individual publication, patent or patent application were specifically and individually indicated to be incorporated by reference and the content thereof recited in full.

[0028] Where used herein and unless specifically indicated otherwise, the following terms are intended to have the following meanings in addition to any broader (or narrower) meanings the terms might enjoy in the art: Unless otherwise required by context, the use herein of the singular is to be read to include the plural and *vice versa.* The term "a" or "an" used in relation to an entity is to be read to refer to one or more of that entity. As such, the terms "a" (or "an"), "one or more," and "at least one" are used interchangeably herein.

[0029] As used herein, the term *"comprise,"* or variations thereof such as *"comprises"* or *"comprising,"* are to be read to indicate the inclusion of any recited integer (e.g. a feature, element, characteristic, property, method/process step or limitation) or group of integers (e.g. features, element, characteristics, properties, method/process steps or limitations) but not the exclusion of any other integer or group of integers. Thus, as used herein the term "comprising" is inclusive or openended and does not exclude additional, unrecited integers or method/process steps.

[0030] *"Screen panel"* refers to a media for screening material that is mounted to a screening deck and comprises apertures that extend through the panel that are dimensioned to screen material to a desired size. The screening panel may be 300 mm x 300 mm to 1500 mm x 1500 mm - in the example described below the screen panel is 300 mm x 610 mm. The screen panel may have a thickness of 25 mm to 65 mm. Thus, if the desired screen size is X cm, the screening apertures will have an *"unobstructed aperture size",* which is a dimension that is slightly larger than X cm to allow particles of X cm

pass through the screen and leave particles larger than X cm unscreened on top of the deck. The apertures are arranged on the panel in the form of a grid array typically comprising a plurality of rows and columns, for example n rows and m columns where n and m are each independently a whole number greater than 2 or 3. In one embodiment, the grid array is a regular array of apertures. The screen panel may comprise up to 1000 apertures or more, typically 9-100 apertures and in many embodiments the screen panel comprises 20-50 apertures. When the apertures are square, the aperture size may be 2mm to 70 mm. The apertures may also be rectangular, either along or across the material flow for different applications. The screen panels may be made of vulcanized rubber (for example 35 to 75 shore A hardness), with or without a reinforcement frame made of steel or hard plastic. They may also be made of polyurethane (cast or injection molded), usually 40 shore A to 40 shore D in hardness, usually with some reinforcement. The screen panels are generally mounted on structural supports that results in some apertures being obstructed. The screen panels may be mounted by direct bolting of the panels to the supports, or by pin and sleeve-type fixing systems, or using snap-fit connectors or magnets. Often the structural supports have the same width, but in some embodiments adjacent supports may have different dimensions, for example one could be wider than the other. Often these apertures are located along opposite sides of the panel where the panel is supported, although they may be located on other parts of the panel. These apertures are referred to herein as "second apertures". In addition, apertures may be obstructed by other formations under the panel. The panels of the invention therefore include two types of apertures, first apertures having a first aperture size and second apertures have a second aperture size that is smaller than the first aperture size. As explained above, the prior art (See Figs 4 and 5) describes such panels having different types of apertures, where the second apertures have an aperture size that is dimensioned to be at least as big as an aperture size that allows unhindered flow through the second aperture (*unhindered flow aperture size* 7) but smaller than an aperture size defined between the aperture and the support (*obstructed aperture size* 6). The aperture size of these second apertures are referred to herein as *"ideal obstructed aperture size"* and are referenced as 8 in the figures. Unlike the prior art, the screen panels of the invention have second apertures that define two or more distinct sections, a first aperture section that defines the *ideal obstructed particle aperture size* and a second aperture section that defines a third aperture size that is smaller than the *ideal obstructed particle aperture size.* This results in a screen panel that like the prior art provides the ideal obstructed particle aperture size but also provides additional screen area for smaller particles increasing the effective open area of the panel and improving screening efficiency. The screen panel may include legs to space the panel above the structural supports.

[0031] *"Screen deck assembly"* refers to a screen deck having a frame comprising panel structural supports and one or more panels mounted to the structural support. The assembly generally comprises a modular arrangement of panels mounted to the structural supports. In most instances the structural supports are elongated struts spanning the length or width of the deck. Generally the panels are mounted between pairs of supports. A screen deck assembly incorporating a modular arrangement of screen panels is shown in Figure 13.

[0032] *"Screening device"* refers to a part of screen plant machine that comprises a main sub-frame, one or more screen boxes coupled to the main sub-frame (optionally via a screen box sub-frame), a screen box assembly mounted in the screen box and usually a vibrational mechanism configured to vibrate the screen box to effect screening of the material delivered on to the screen deck. The device may be a split screen screening device in which case it may include a primary screen box and a secondary screen box, and each screen box may incorporate one screen deck assembly or a number of screen decks assemblies stacked vertically on top of each other. A screening device incorporating two screen deck assemblies is shown in Figures 14A and 14B.

[0033] *"Screen plant machine"* refers to a machine having a main frame and a screening device mounted to the main frame. The plant machine may be a static plant machine or a mobile plant machine. The machine may include a plurality of conveyors configured to deliver bulk material to a top deck of the screening device and receive screened and unscreened material from the screening device and deliver the material to separate stockpiles.

[0034] The invention will now be described with reference to specific Examples. These are merely exemplary and for illustrative purposes only: they are not intended to be limiting in any way to the scope of the monopoly claimed or to the invention described. These examples constitute the best mode currently contemplated for practicing the invention.

[0035] Referring to the drawings, and initially to Figures 6 to 12, there is illustrated a screen panel according to the invention, indicated generally by the reference numeral 10 in which parts described with reference to Figures 1 to 5 are assigned the same reference numerals. In this embodiment, the screen panel 10 has a rectangular shape (300 mm x 610 mm x 30 mm) with longitudinal sides 30A, 30B and ends 31A, 31B, an upper surface 32 and lower surface 33, and legs 34 mounted to the lower surface 33 at each side 30A, 30B of the panel. The legs have a height of about 30 mm which is approximately equal to the thickness of the panel and are formed from steel with a U-shaped profile. In Figure 6 the panel is shown mounted to elongated parallel spaced-apart structural supports 3 that define a gap 3' of about 230 mm in between the supports.

[0036] The panel comprises an array of thirty two apertures including two columns of eight first apertures 2

and two columns of eight second apertures 2'. The second apertures 2' are disposed along each side 30A, 30B of the panel and overlie where the panel is mounted across the two parallel spaced apart structural supports 3. In this embodiment, the structural supports have the same width. The two columns of first apertures 2 are disposed above the gap 3' between the columns of obstructed apertures 2' and above the gap 3' defined between the structural supports 3. The first apertures 2 have an aperture size 5. Referring to Figure 11B, the second apertures 2' have a C-shape made up of a first aperture section 12 and two second aperture sections 13. The first aperture section 12 defines an ideal obstructed particle aperture size 8 and the second aperture section 13 defines a third aperture size 9 that is smaller than the ideal obstructed particle aperture size 8. In the embodiment shown and referring to Figures 7, 11A and 11B, the first apertures 2 are square with dimensions of about 46 mm x 46 mm.. The first aperture section 12 of the second aperture 2' has a rectangular footprint with a length of 46 mm and a width of 23 mm, and the second aperture sections 13 of the second aperture 2' each have a rectangular footprint with a width of 23 mm and a length of about 15 mm. Thus, the first aperture sections 12 can only permit particles through that are sufficiently small to pass through the obstructed aperture size 6, thereby inhibiting clogging of the obstructed apertures. The second aperture sections 13 have an aperture size 9 (see Figure 10) that is smaller than the ideal obstructed particle aperture size 8 but increases the screening area of each obstructed aperture and therefore the screening performance of the panel 10.

[0037] The screen panel of the invention is formed from vulcanized rubber (35 to 75 shore A hardness) with a reinforcement frame of steel (not shown).

[0038] In the embodiment shown, the second apertures have one first aperture section and two smaller second aperture sections, and are generally C-shaped. It will be appreciated however that the second apertures may have one first apertures section and one or three (or more) second aperture section, and thus may have a substantially E-shape or L-shape.

[0039] Referring to Figure 13, a screen deck assembly 20 is illustrated in which parts described with reference to the previous embodiments are assigned the same reference numerals. The screen deck assembly 20 comprises a screen deck frame comprising end plates 23, 23, supporting members 21 mounted between the end plates 22, 23, and structural supports 3 mounted laterally across the supporting members 21 - in this embodiment, the structural supports have a L-shaped profile. A modular array of screen plates 10 are fixed on top of the struts using anchors 26 and screws 25 to form a single composite screen. End plates 24 are also provided to secure the panels 10 at each end of the deck to a mounting bracket 27.

[0040] Referring to Figures 14A and 14B, a screening device 30 forming part of a screening plant assembly is illustrated in which parts described with reference to the previous embodiments are assigned the same reference numerals. The screening device 30 comprises a main sub-frame (not shown), and a screen box 31 coupled to the main sub-frame, and two screen deck assemblies 20 mounted in the screen box 31 with one vertically stacked above the other. In use the screen box is vibrated and material to be screened is delivered to one end of the upper screen deck assembly and screened material falls through the first and second apertures on to the screen deck below and the unscreened material passes along the upper deck where it is delivered to a first conveyor (not shown). The material that falls on to the second deck is screened in a similar fashion and with screened material passing through the apertures onto a lower conveyor (not shown), and unscreened material remaining on the second deck passing to a conveyor (not shown). In this way, the material is screened into three fractions of differing size. The use of panels according to the invention in the screen decks does not greatly affect the size of the three screen fraction, but increases the screening efficiency of each deck, resulting is material being screened faster with less blockages.

Equivalents

[0041] The foregoing description details presently preferred embodiments of the present invention. Numerous modifications and variations in practice thereof are expected to occur to those skilled in the art upon consideration of these descriptions. Those modifications and variations are intended to be encompassed within the claims appended hereto.

Claims

1. A screen panel (10) for mounting across two structural supports (3) of a screen deck frame and screening bulk materials, the screening panel comprising a panel housing having an upper surface (32) and a lower surface (33) and a plurality of apertures extending through the panel arranged in a grid array having at least three rows of apertures and at least three columns of apertures wherein the apertures comprise:

   first apertures (2) that in use are positioned over a gap (3') defined between the two structural supports, wherein each first aperture defines a first aperture size (5); and
   second apertures (2') that in use are positioned over a structural support (3), wherein the second apertures each define a second aperture size (8) that is smaller than the first aperture size and is dimensioned to allow particles pass an obstruction defined between the panel and a structural support,

characterised in that each second aperture (2') comprise a first aperture section (12) defining the second aperture size (8) and one or more second aperture sections (13) defining a third aperture size (9) that is smaller than the second aperture size.

2. A screen panel according to Claim 1, comprising supporting legs (34) disposed along opposed sides (30A, 30B) of the panel housing that in use support the panel housing above the structural supports,

3. A screen panel according to Claim 1 or 2, whereby in use the first aperture section (12) of the second apertures (2') is disposed above and laterally offset with respect to a structural support, and the or each second aperture section (13) of the second apertures (2') is disposed directly above the structural support.

4. A screen panel (10) according to any preceding Claim, in which the apertures in any one column of apertures are all first apertures or all second apertures and in which the apertures in any one row of apertures include first apertures and second apertures.

5. A screen panel (10) according to any preceding Claim, including a first column consisting of second apertures (2') disposed along the first side (30A) of the screen panel, a second column consisting of second apertures (2') disposed along the second opposite side (30B) of the screen panel, and at least one column consisting of first apertures (2) disposed in between the first and second columns.

6. A screen panel (10) according to Claim 5, including two columns consisting of first apertures (2) disposed in between the first and second columns of second apertures.

7. A screen panel (10) according to any preceding Claim having a square or rectangular shape.

8. A screen panel (10) according to any preceding Claim, in which the first apertures (2) have a regular 4-sided polygon shape and the second apertures (2') have a regular n-sided polygon shape where $n \geq 6$.

9. A screen panel (10) according to any preceding Claim, in which the first aperture section (12) and second aperture section (13) of the second apertures (2') have a regular 4-sided polygon shape.

10. A screen panel (10) according to any preceding Claim, in which the second apertures (2') have one first aperture section (12) and two second aperture sections (13).

11. A screen panel (10) according to Claim 10, in which the second apertures (2') are C-shaped.

12. A screen panel (10) according to any preceding Claim, in which a ratio of the second aperture size (8) to the third aperture size (9) is 1.2:1.0 to 1:8:1.0, and a ratio of the first aperture size (5) to the second aperture size (8) is 1.0:0.75 to 1.0:0.25.

13. A screen deck assembly (20) comprising a screen deck frame comprising two structural supports (3), a gap defined between the two structural supports (3), and a screen panel (10) according to any of Claims 1 to 12 mounted across the two structural supports,
wherein the second apertures (2') are disposed over the structural supports (3) and the first apertures (2) are disposed over the gap defined between the two structural supports (3).

14. A screen deck assembly (20) according to Claim 13, in which the first aperture section (12) of the second apertures (2') are disposed above and laterally offset with respect to one of the structural supports (3) and the second aperture sections (13) of the second apertures (2') are disposed directly over a structural support (3).

15. A screen deck assembly (20) according to Claim 13 or 14, in which the screen panel (10) comprises a first column of second apertures (2') disposed along the first side (30A) of the screen panel above one of the structural supports (3), a second column of second apertures (2') disposed along the second opposite side (30B) of the screen panel above another of the structural supports (3), and at least one column of first apertures (2) disposed in between the first and second columns.

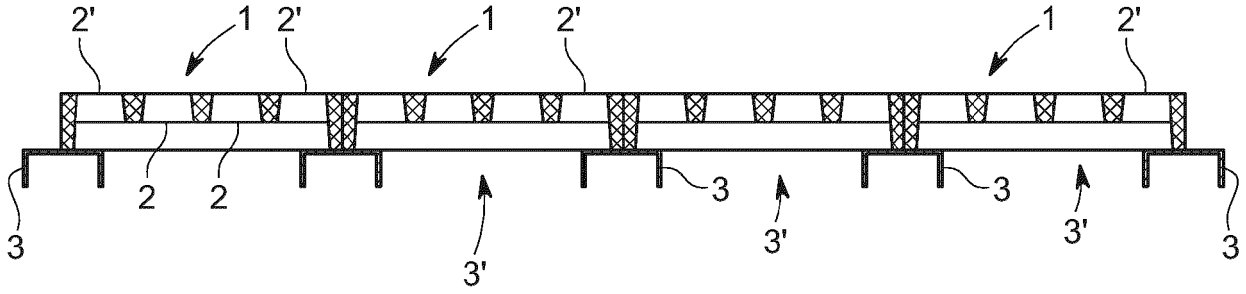

FIG. 1
(PRIOR ART)

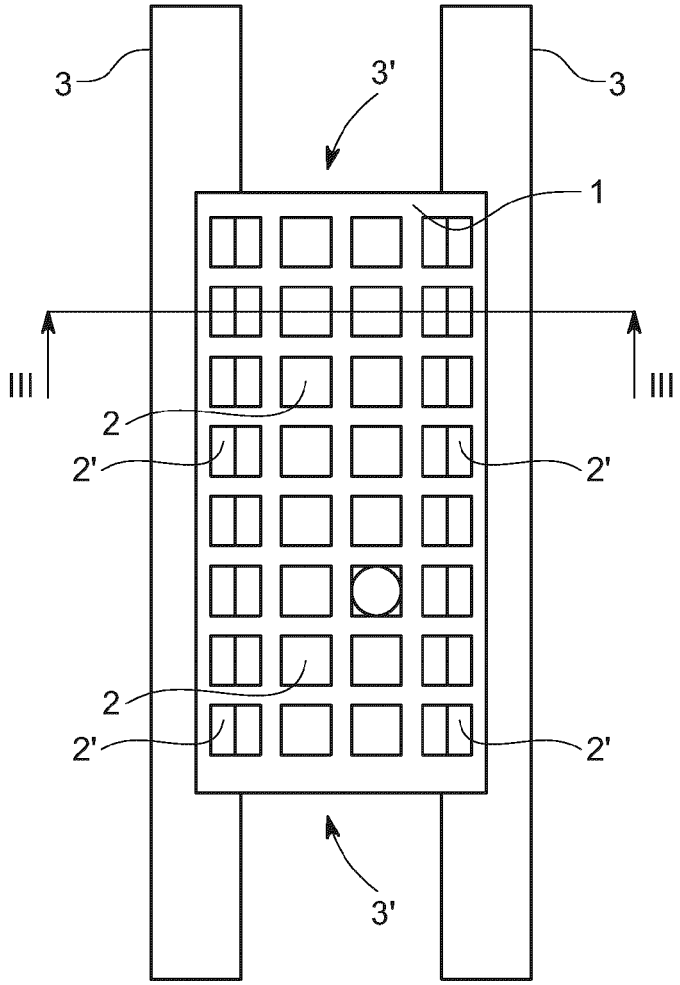

FIG. 2
(PRIOR ART)

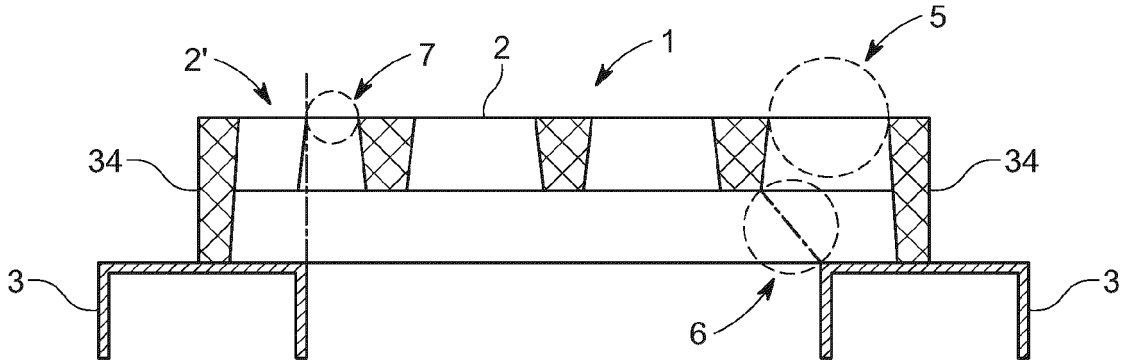

FIG. 3
(PRIOR ART)

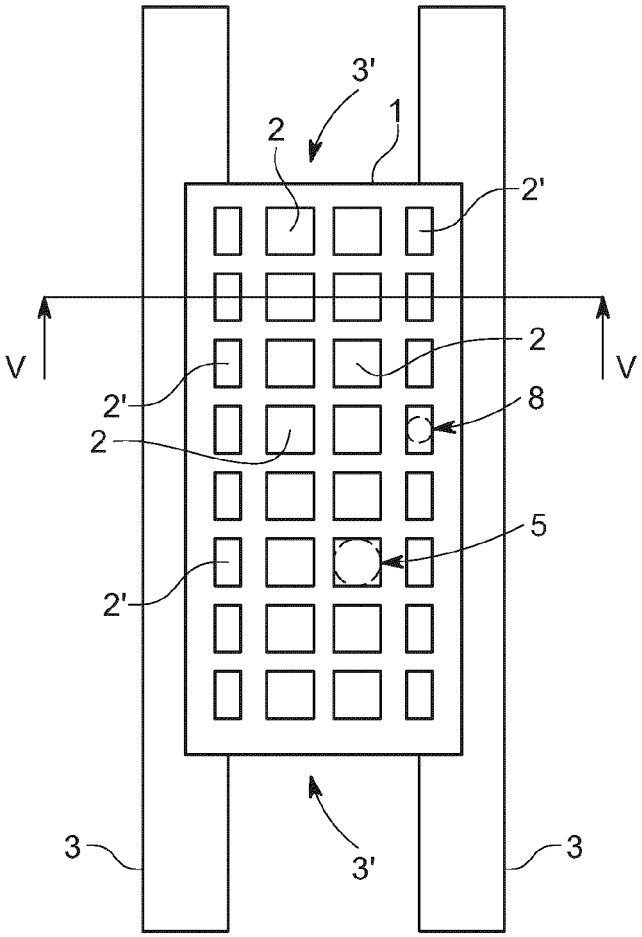

FIG. 4
(PRIOR ART)

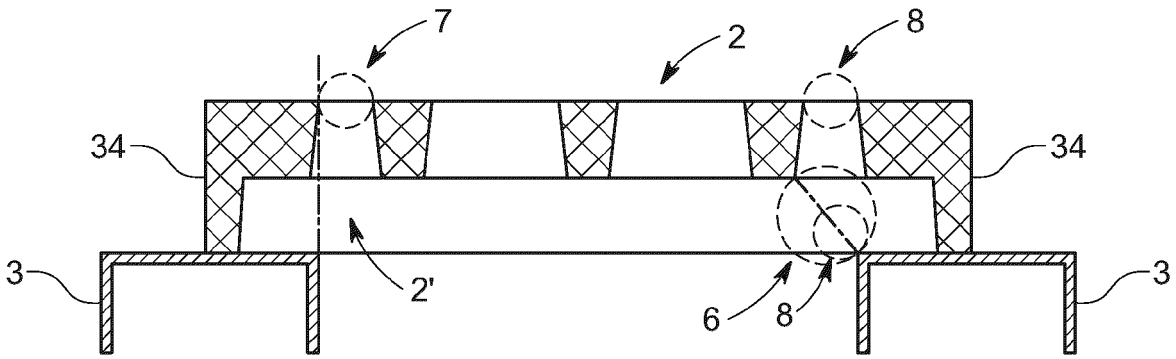

FIG. 5
(PRIOR ART)

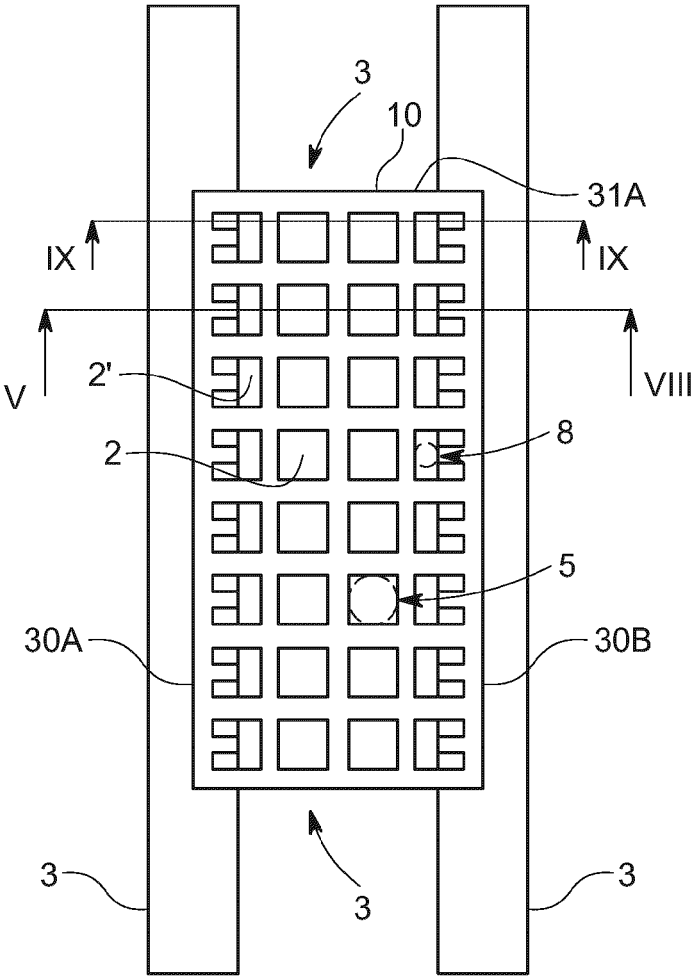

FIG. 6

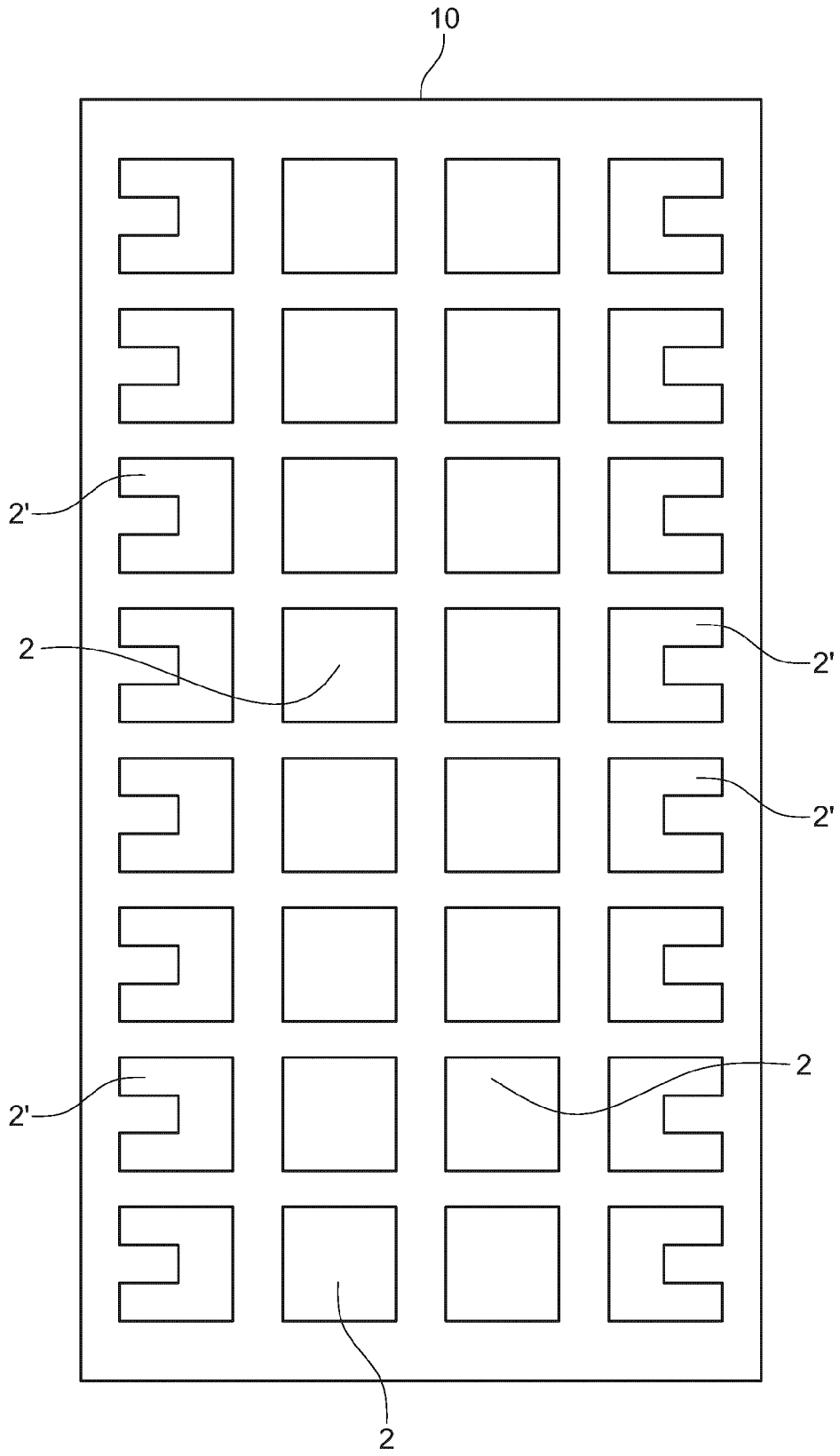

FIG. 7

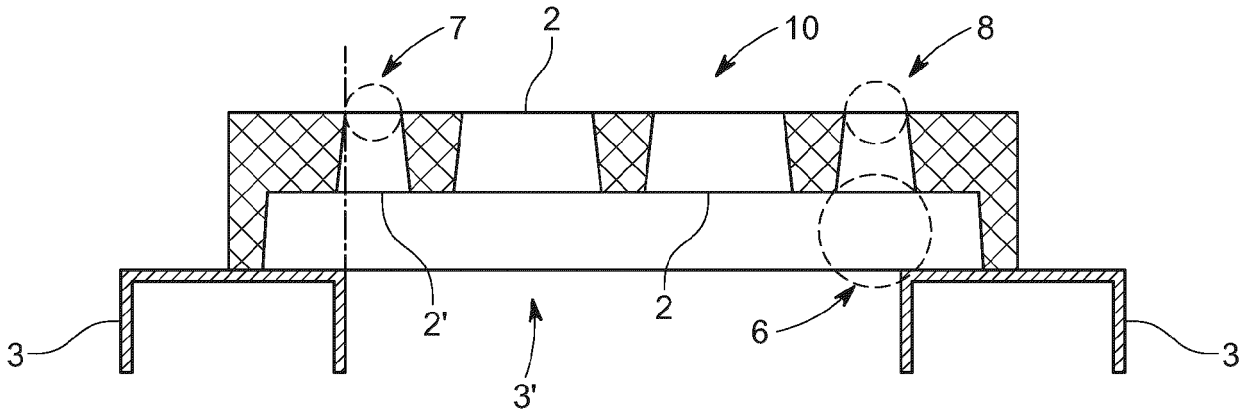

FIG. 8

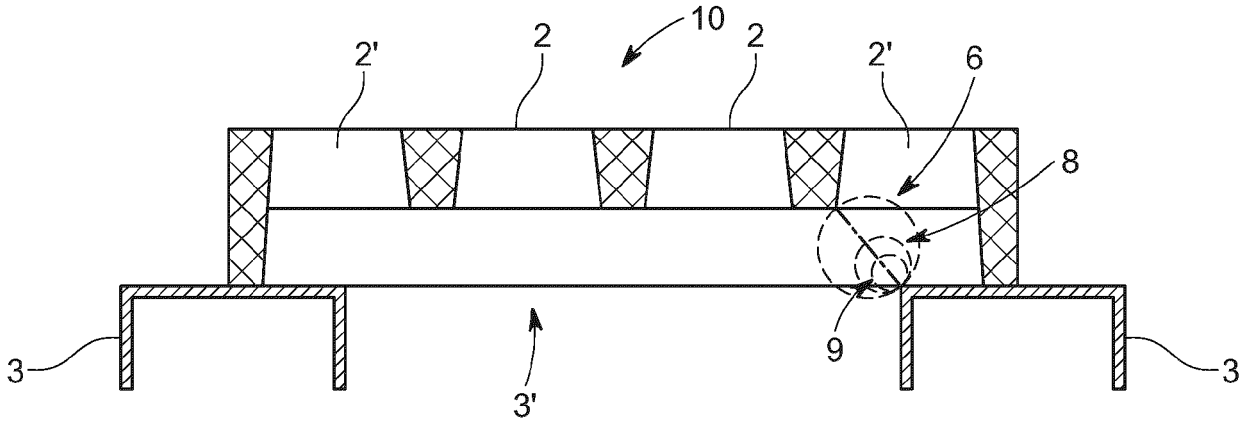

FIG. 9

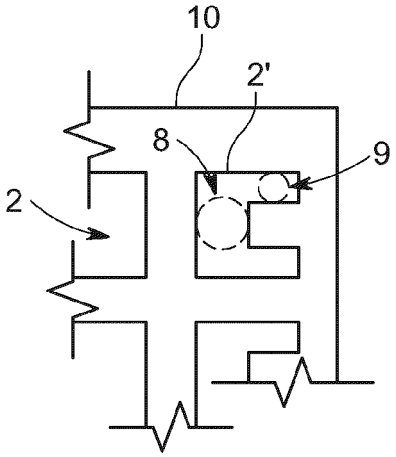

FIG. 10

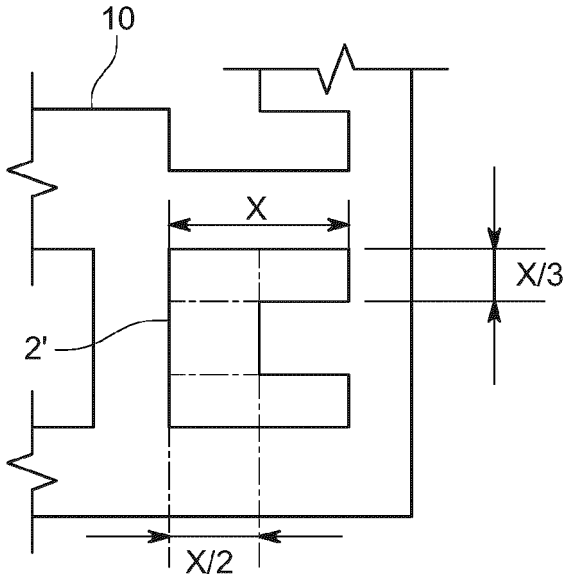

FIG. 11A

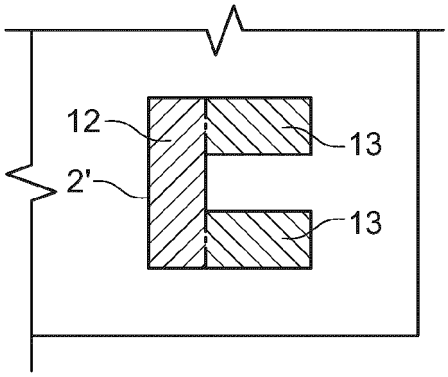

FIG. 11B

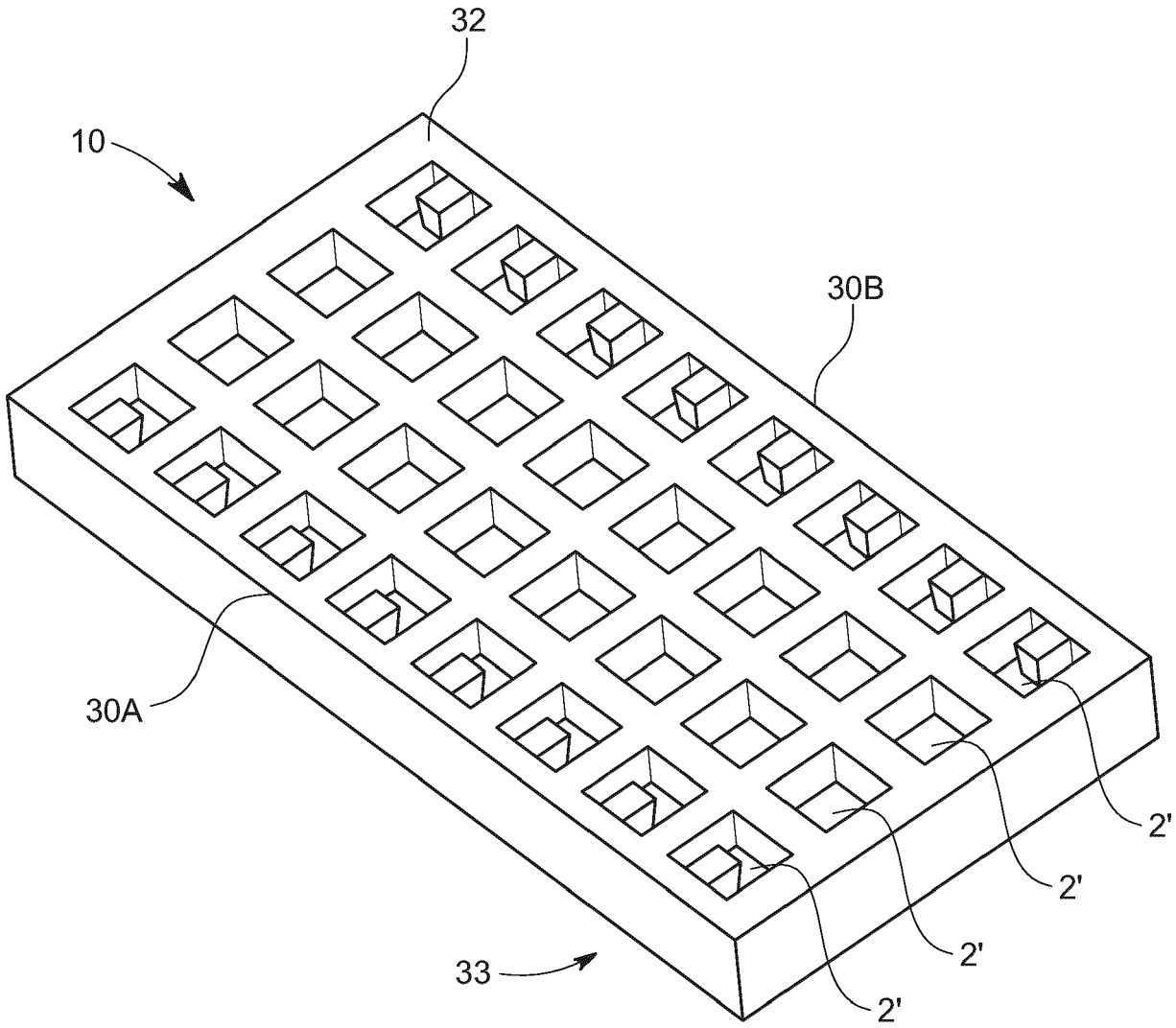

FIG. 12

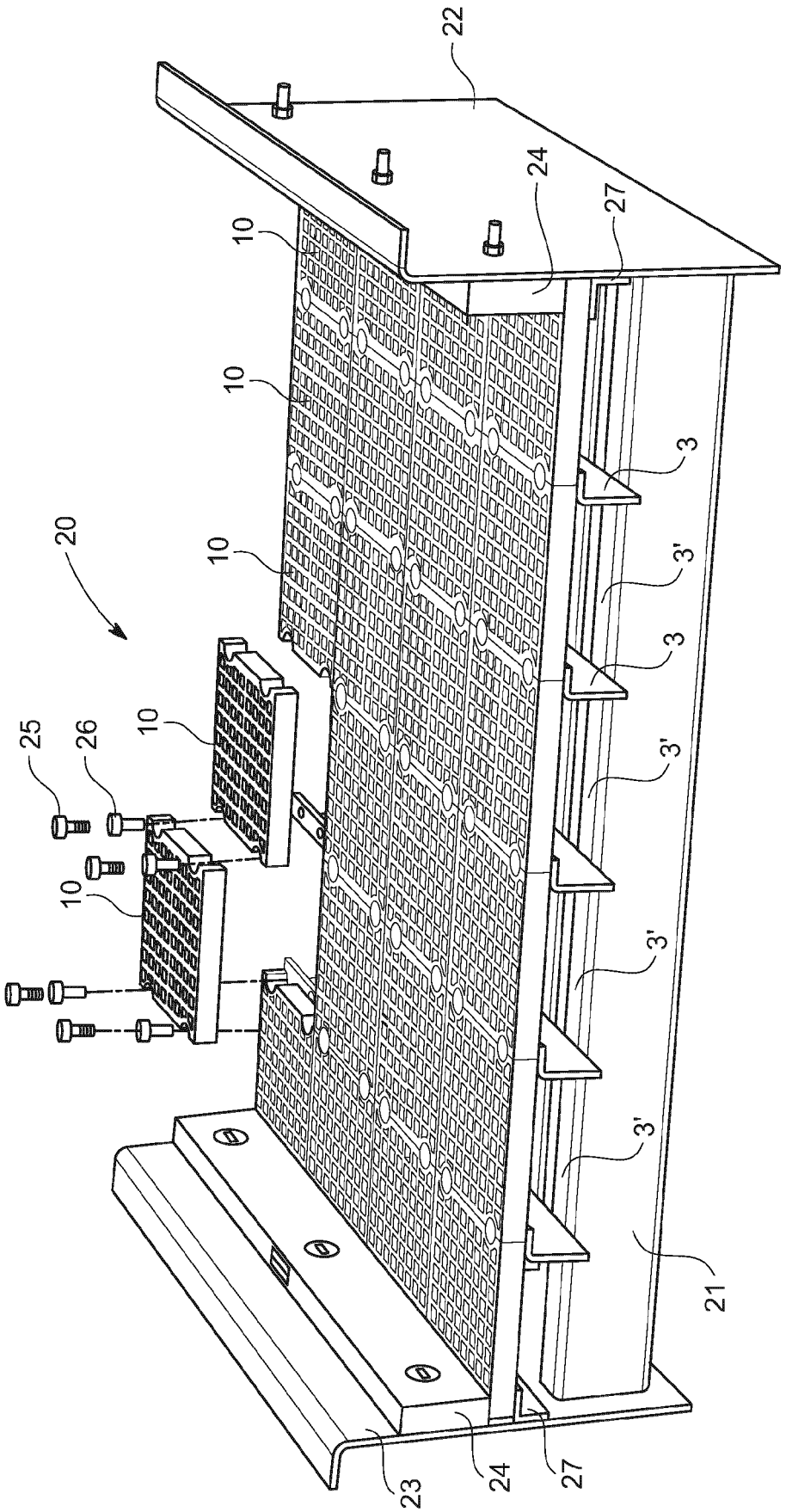

FIG. 13

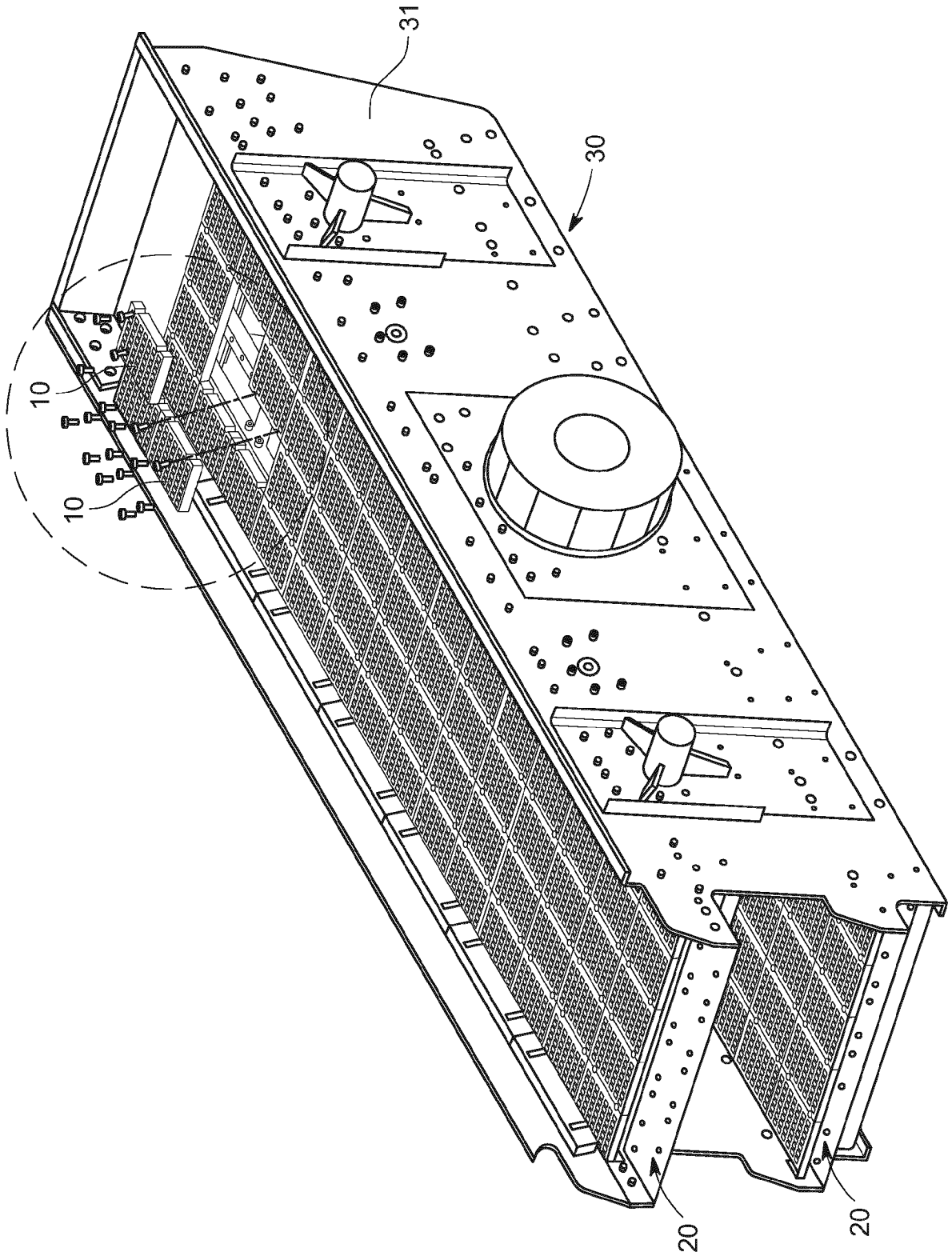

FIG. 14A

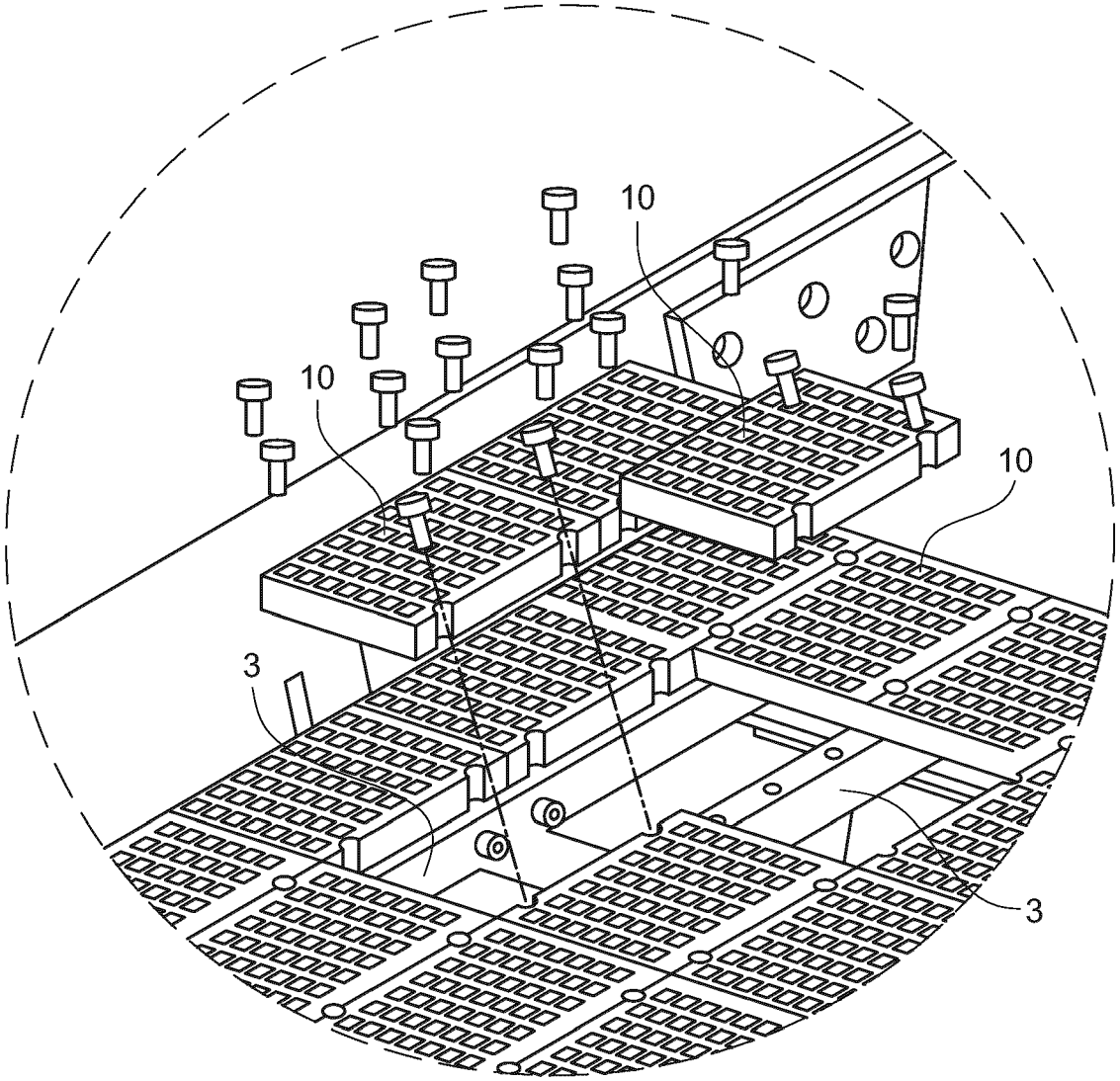

FIG. 14B

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EUROPEAN SEARCH REPORT

Application Number
EP 21 17 7951

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 0 036 858 A1 (STEINHAUS GMBH [DE]) 7 October 1981 (1981-10-07) * column 1, line 41 - column 2, line 2 * * column 6, lines 1-17 * * claims; figures 1,10 *	1-15	INV. B07B1/46
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			TECHNICAL FIELDS SEARCHED (IPC)
			B07B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 November 2021	Martins Lopes, Luis

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15-11-2021

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