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(54) A HEADLAMP THICKWALL ELEMENT

(57) The present invention relates to a headlamp thickwall element (1) for homogenising and focusing an incoming light beam to be emitted from a vehicle headlamp. The headlamp thickwall element (1) is of polygonal shape defined by at least three circumferential sidewalls (2), and within the sidewalls (2), the headlamp thickwall element (1) comprises: a circumferential rib (3); a first circumferential planar array of first optical elements (4) for refracting, and optionally also reflecting, an incoming light beam at a specific angle; a second circumfer-

ential planar array of second optical elements (5) for dispersing an incoming light beam into a plurality of directions; and a central planar array of decorative optical elements (6) surrounded by the first and second circumferential planar arrays. The circumferential rib (3) is arranged along an inner circumference of all sidewalls (2). The first circumferential array is arranged on the circumferential rib (3) along one of the sidewalls (2). The second circumferential array is arranged on the circumferential rib (3) along the remaining sidewalls (2).

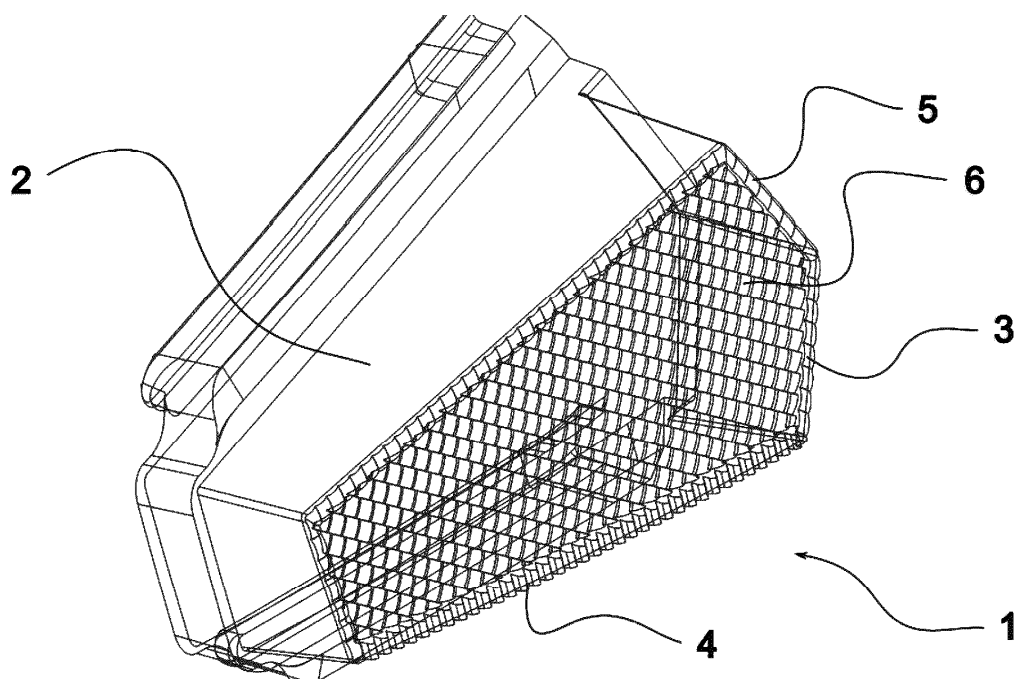


Fig. 1

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Description

Technical Field

[0001] The present invention relates to a headlamp thickwall element for homogenising and focusing an incoming light beam to be emitted from a vehicle headlamp. In other words, headlamp thickwall elements are combined optical elements on the surface of a headlamp for auxiliary modification of an incoming light beam.

Background of the Invention

[0002] Auxiliary light functions in automotive industry are typically formed by light guides covered with headlamp thickwall elements. The headlamp thickwall elements aim to generate homogeneously appearing light-emitting elements when looking at a vehicle from the front, often in line with a preferred design of the headlamp, and at the same time, a specific illumination on the road when looking ahead from the vehicle interior. This is usually achieved by optical elements arranged in the headlamp thickwall element, also having a decorative or design function.

[0003] All headlamps are designed based on legal requirements. The legal requirements are set in order to increase the driver and passenger safety and to prevent the environment from being violated. Every headlamp is allowed to have higher intensity at HOVO position where most of the light hits the road, i. e. at 0° angle horizontal and at 0° angle vertical. So, the main focus when designing or manufacturing a headlamp is usually given to the HOVO position. However, most of the time, the headlamp is not viewed from HOVO position. This leads to be a challenging factor for the manufacturers to maintain homogeneity even when the headlamp is viewed from different angles.

[0004] Known vehicle headlamp thickwall elements comprising one kind of optical elements can be found in prior art documents US 2018372279 A1, US 2020079284 A1, CN 118463068 A, EP 4078021 A1, KR 102621888 B1 and CN 210568142 U. A disadvantage of such headlamp thickwall elements is insufficient homogeneity and focusing of the illumination and/or limitations in modifying the decorative aspects of the headlamp.

[0005] There is therefore a need in the prior art and the object of the present invention is to provide a headlamp thickwall element providing sufficiently homogenised and focused light beam while keeping the possibility for decorative modifications.

Summary of the Invention

[0006] The object of the present invention is achieved by a headlamp thickwall element according to claim 1. The preferred embodiments of the headlamp thickwall element are disclosed in claims 2 to 8. The headlamp

thickwall element serves for homogenising and focusing an incoming light beam to be emitted from a vehicle headlamp, and it is of polygonal shape defined by at least three circumferential sidewalls.

[0007] The underlying idea of the headlamp thickwall element according to the present invention lies in a specific arrangement of optical elements within the circumferential sidewalls. The headlamp thickwall element comprises:

a. a circumferential rib arranged along an inner circumference of all sidewalls;

b. a first circumferential planar array of first optical elements for refracting, and optionally also reflecting, an incoming light beam at a specific angle, wherein the first circumferential array is arranged on the circumferential rib along one of the sidewalls;

c. a second circumferential planar array of second optical elements for dispersing an incoming light beam into a plurality of directions, wherein the second circumferential array is arranged on the circumferential rib along the remaining sidewalls; and

d. a central planar array of decorative optical elements surrounded by the first and second circumferential planar arrays.

[0008] Such an arrangement of optical elements allows to emit a homogenous light beam from the headlamp (mainly due to the decorative optical elements), wherein at the same time, this light beam is focused at a specific angle on a specific area on the road ahead of the vehicle, the area representing at least the HOVO position (mainly due to the first and second optical elements). The fact that the first and second optical elements are arranged around the decorative optical elements, along the inner circumference of the sidewalls, does not disturb the visual appearance or design of the headlamp. The circumferential rib supports the first and second optical elements along the sidewalls.

[0009] When viewed from the front, the sidewalls thus surround the optical elements and form a polygonal shape. The direction from back to front is the main direction into which the thickwall element outputs light, e.g., it is parallel to direction of travel of vehicle carrying this thickwall element in its front lamp.

[0010] The first and second optical elements can provide a more intensive illumination than the decorative elements. The thickwall element can then provide an illumination pattern (especially polygonal) with a higher intensity on the border than in the middle. The pattern thus provides decorative illumination, but the border also provides an illumination function to improve visibility, e.g., of a sidewalk. The decorative function and appearance of the lamp is not significantly impacted by this added illumination function.

[0011] The first and second optical elements can in some variants of the invention provide illumination pattern separate and distanced from the pattern from the decorative elements. E.g., the first and second elements can provide traffic sign illumination.

[0012] The specific angle of the light beam by the first element can thus also be chosen by a skilled person as needed for a specific application, such as illumination of the road ahead, illumination of sidewalks or traffic signs etc.

[0013] A decorative thickwall element according to the invention can thus provide a practical illumination function without having deteriorated look when compared with standard decorative-only optical elements.

[0014] Preferably, the first optical elements are lenses having a ridged surface, wherein a ridge of the ridged surface is preferably orthogonal to the adjacent sidewall.

[0015] Preferably, the second optical elements are lenses having a concave, convex or planar surface, wherein a line connecting two adjacent second optical elements is preferably orthogonal to the adjacent sidewall.

[0016] Preferably, the decorative optical elements are lenses having a concave, convex or planar surface, wherein a line connecting two adjacent decorative optical elements is preferably non-orthogonal to the adjacent sidewall. In a view from ahead of the vehicle, the layout (raster) of the decorative optical elements can be square, rectangular, with alternating smaller and larger rectangles, brick-like, diamond-shaped, hexagonal with two sides arranged horizontally, hexagonal with two sides arranged vertically, or octagonal with diamonds spaced in between.

[0017] Brick-like layout can be formed from rectangular elements arranged in rows or columns, wherein neighboring rows or columns are offset in the direction of their length such that a border between the rectangles in a row/column is not aligned with a border between rectangles in neighboring rows/columns. Each row/column can especially be shifted by half a brick length relative to neighboring rows/columns.

[0018] Diamond-shaped layout can especially include parallelogram-shaped elements, e.g., rhombus shaped.

[0019] Overall, such an arrangement based on orthogonality and non-orthogonality allows to clearly distinguish between the decorative optical elements and the first and second optical elements, thus contributing to the design of the headlamp and emphasising the decorative optical elements arranged in the centre.

[0020] Preferably, the headlamp thickwall element has a pentagonal shape with two long and three short sidewalls, the long sidewalls being arranged opposite each other (such as the shape of a coffin). The first circumferential planar array is arranged on the circumferential rib along one of the long sidewalls. Nonetheless, the headlamp thickwall element can have another shape, such as square, rectangular, trapezoid, triangular, circular, oval or rectangular with bevelled or rounded corners.

Description of Drawings

[0021] A summary of the invention is further described by means of exemplary embodiments thereof, which are described with reference to the accompanying drawings, in which:

Figure 1 shows a perspective view of the headlamp thickwall element.

Figure 2 shows a detailed perspective view of Figure 1.

Figure 3 shows a detailed top view of Figure 1.

Figure 4A shows an optical simulation of a pentagonal embodiment of a headlamp thickwall element at HOVO position.

Figure 4B shows a 3D view of the headlamp thickwall element of Figure 4A at H45V-15 position.

Figure 4C shows an optical simulation of the headlamp thickwall element of Figure 4B at H45V-15 position.

Figures 5A to 5G show layouts (rasters) of the decorative optical elements.

Exemplary Embodiments of the Invention

[0022] The invention will be further described by means of exemplary embodiments with reference to the respective drawings.

Example 1

[0023] Figure 1 shows a pentagonal embodiment of a headlamp thickwall element 1 according to the invention. The headlamp thickwall element 1 has a pentagonal shape with two long and three short sidewalls 2, the long sidewalls 2 being arranged opposite each other. A circumferential rib 3 is arranged along an inner circumference of all sidewalls 2. A first circumferential planar array of first optical elements 4 is arranged on the circumferential rib 3 along one of the long sidewalls 2. A second circumferential planar array of second optical elements 5 is arranged on the circumferential rib 3 along the remaining long sidewall 2 and along all short sidewalls 2. A central planar array of decorative optical elements 6 is surrounded by the first and second circumferential planar arrays.

[0024] According to figures 2 and 3, the first optical elements 4 are lenses having a ridged surface, wherein the ridge 7 is orthogonal to the adjacent sidewall 2. The first optical elements 4 serve for refracting, and optionally also reflecting, an incoming light beam at a specific angle, thus focusing the emitted light beam on a specific area on

the road ahead of the vehicle, the area representing at least the HOVO position. The second optical elements 5 are lenses having a concave surface 8, wherein a line 9 connecting two adjacent second optical elements 5 is orthogonal to the adjacent sidewall 2. The second optical elements 5 serve for dispersing an incoming light beam into a plurality of directions, such as into all planar directions, to achieve a similar light homogeneity in all positions as compared to the HOVO position. The decorative optical elements 6 are also lenses having a concave surface 8, but opposed to the second optical elements 5, a line 10 connecting two adjacent decorative optical elements 6 is non-orthogonal to the adjacent sidewall 2. The decorative optical elements 6 are arranged in a square-shaped layout (raster), see figure 3, and serve for forming and homogenising the emitted light beam in line with legal requirements.

[0025] Figure 4A on the right shows an optical simulation of a headlamp thickwall element 1 forming an arm of a shape of a three-pointed star at HOVO position. The central planar array of decorative optical elements 6 is depicted in red (at highest light intensity) and the first and second circumferential planar arrays of first and second optical elements 4, 5 are depicted in blue (at lowest light intensity).

[0026] Figure 4B on the centre left shows a 3D view of the headlamp thickwall element 1 of Figure 4A at H45V-15 position, i. e. at 45° angle horizontal and -15° angle vertical, meaning as if squatting directly in front of the middle of the vehicle and looking to the right towards the headlamp. A detailed section shows the first optical elements and the decorative optical elements.

[0027] Figure 4C on the far left shows an optical simulation of the headlamp thickwall element 1 of Figure 4B at H45V-15 position. The first and second circumferential planar arrays of first and second optical elements 4, 5 are depicted in blue (at lowest light intensity) and the central planar array of decorative optical elements 6 is depicted in red (at highest light intensity). It can be seen that the first and second optical elements 4, 5 direct the light beam to a specific angle to form a specific illumination on the road when looking ahead from the vehicle interior.

Example 2

[0028] The second optical elements 5 of Example 1 can be lenses having a convex or planar surface.

Example 3

[0029] The decorative optical elements 6 of Example 1 can be lenses having a convex or planar surface.

Example 4

[0030] The decorative optical elements 6 of Example 1 can be arranged in other layouts (rasters), such as rectangular, with alternating smaller and larger rectangles,

brick-like, diamond-shaped, hexagonal with two sides arranged horizontally, hexagonal with two sides arranged vertically, or octagonal with diamonds spaced in between, see figures 5A-G.

Industrial applicability

[0031] The headlamp thickwall element according to the present invention can be used in vehicle headlamps.

Reference List

[0032]

- | | | |
|----|----|---|
| 15 | 1 | headlamp thickwall element |
| | 2 | sidewall |
| | 3 | circumferential rib |
| | 4 | first optical element |
| | 5 | second optical element |
| 20 | 6 | decorative optical element |
| | 7 | ridge |
| | 8 | concave surface |
| | 9 | connecting line of two adjacent second optical elements |
| 25 | 10 | connecting line of two adjacent decorative optical elements |

Claims

- | | | |
|----|----|--|
| 30 | 1. | A headlamp thickwall element (1) for homogenising and focusing an incoming light beam to be emitted from a vehicle headlamp, the headlamp thickwall element (1) being of polygonal shape defined by at least three circumferential sidewalls (2), characterised in that within the sidewalls (2), the headlamp thickwall element (1) comprises: |
| 35 | | a. a circumferential rib (3) arranged along an inner circumference of all sidewalls (2); |
| 40 | | b. a first circumferential planar array of first optical elements (4) for refracting, and optionally also reflecting, an incoming light beam at a specific angle, wherein the first circumferential array is arranged on the circumferential rib (3) along one of the sidewalls (2); |
| 45 | | c. a second circumferential planar array of second optical elements (5) for dispersing an incoming light beam into a plurality of directions, wherein the second circumferential array is arranged on the circumferential rib (3) along the remaining sidewalls (2); and |
| 50 | | d. a central planar array of decorative optical elements (6) surrounded by the first and second circumferential planar arrays. |
| 55 | 2. | The headlamp thickwall element (1) according to claim 1, characterised in that the first optical elements (4) are lenses having a ridged surface. |

3. The headlamp thickwall element (1) according to claim 2, **characterised in that** a ridge (7) of the ridged surface is orthogonal to the adjacent sidewall (2). 5
4. The headlamp thickwall element (1) according to any of the previous claims, **characterised in that** the second optical elements (5) are lenses having a concave, convex or planar surface (8). 10
5. The headlamp thickwall element (1) according to claim 4, **characterised in that** a line (9) connecting two adjacent second optical elements (5) is orthogonal to the adjacent sidewall (2). 15
6. The headlamp thickwall element (1) according to any of the previous claims, **characterised in that** the decorative optical elements (6) are lenses having a concave, convex or planar surface (8). 20
7. The headlamp thickwall element (1) according to claim 6, **characterised in that** a line (10) connecting two adjacent decorative optical elements (6) is non-orthogonal to the adjacent sidewall (2). 25
8. The headlamp thickwall element (1) according to claim 6, **characterised in that** the decorative optical elements (6) are arranged in a layout, the shape of the layout being square, rectangular, with alternating smaller and larger rectangles, brick-like, diamond-shaped, hexagonal with two sides arranged horizontally, hexagonal with two sides arranged vertically, or octagonal with diamonds spaced in between. 30
9. The headlamp thickwall element (1) according to any of the previous claims, **characterised in that** the headlamp thickwall element (1) has a pentagonal shape with two long and three short sidewalls (2), the long sidewalls (2) being arranged opposite each other, wherein the first circumferential planar array is arranged on the circumferential rib (3) along one of the long sidewalls (2). 35 40

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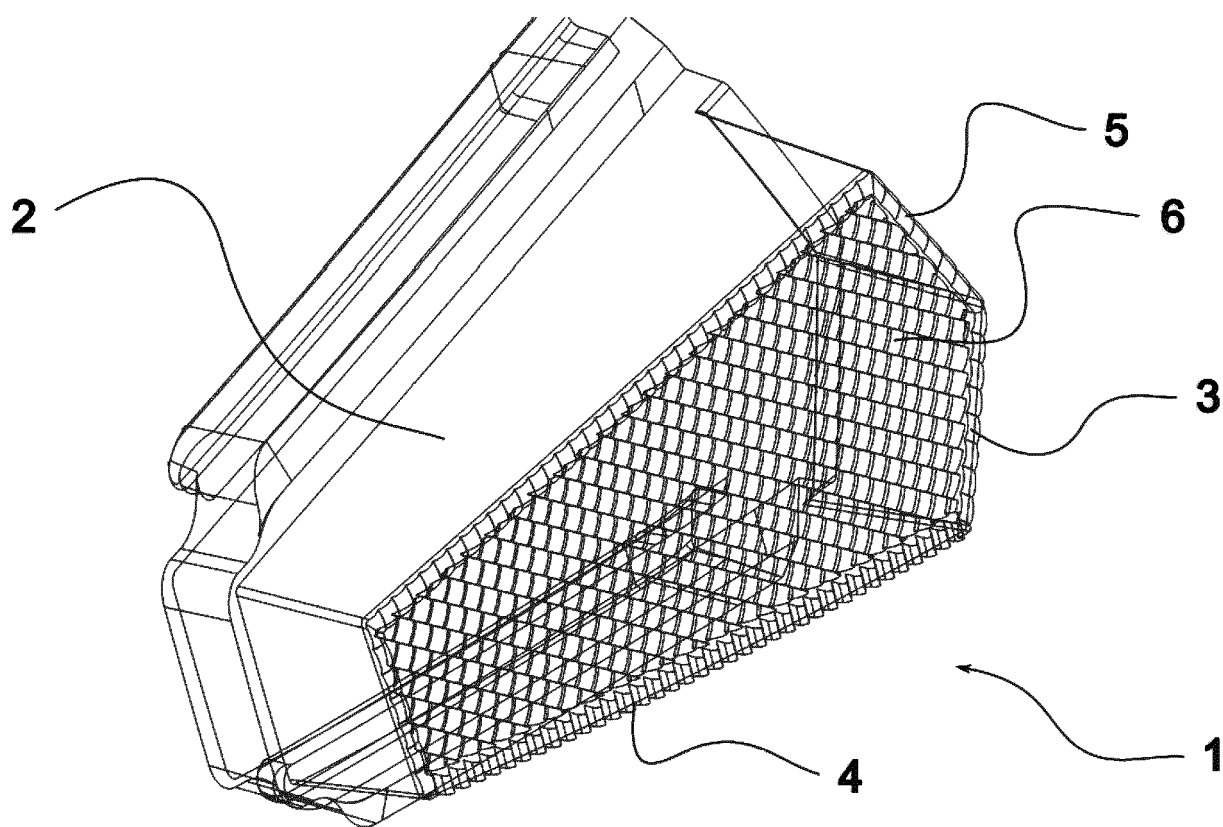


Fig. 1

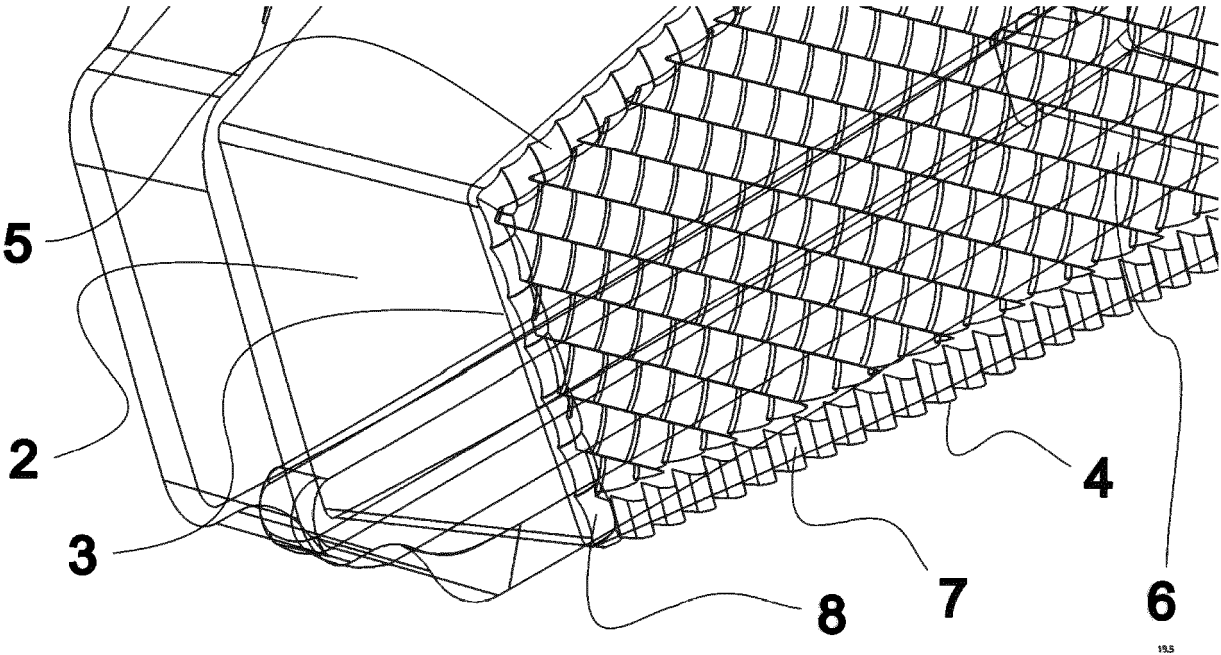
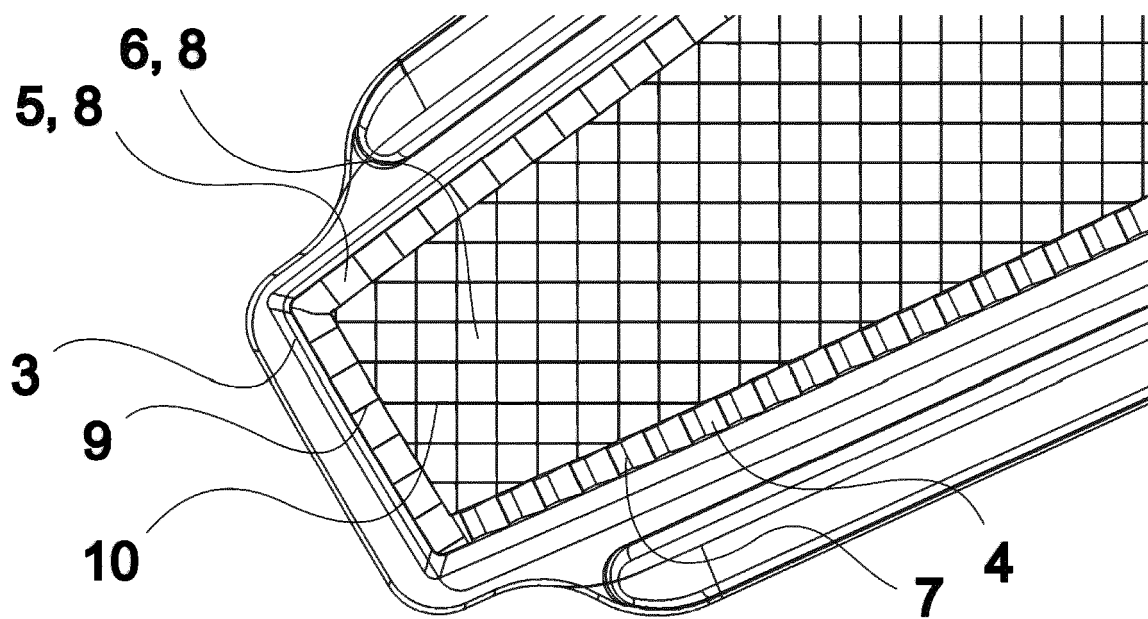
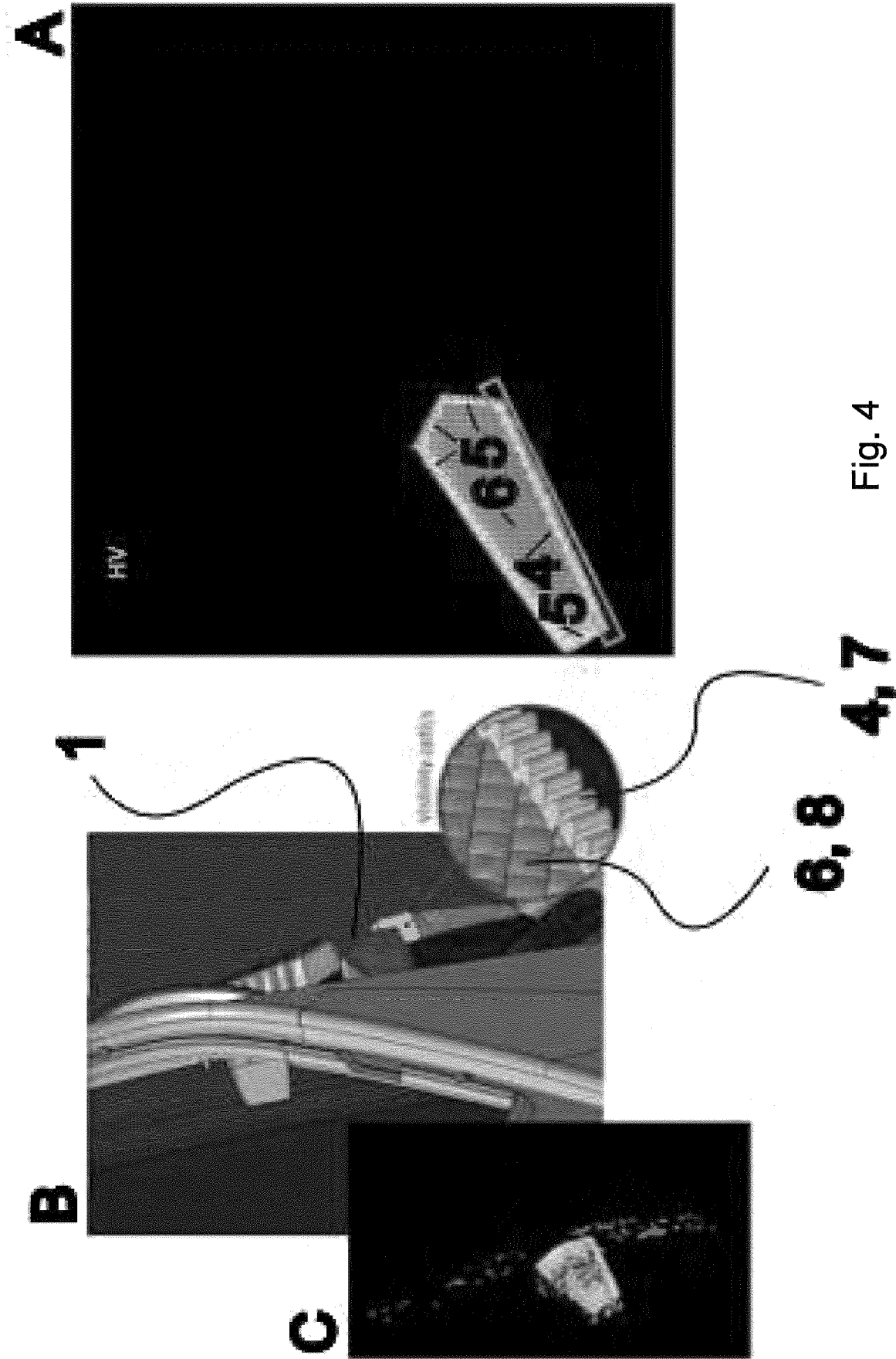


Fig. 2



15.5

Fig. 3



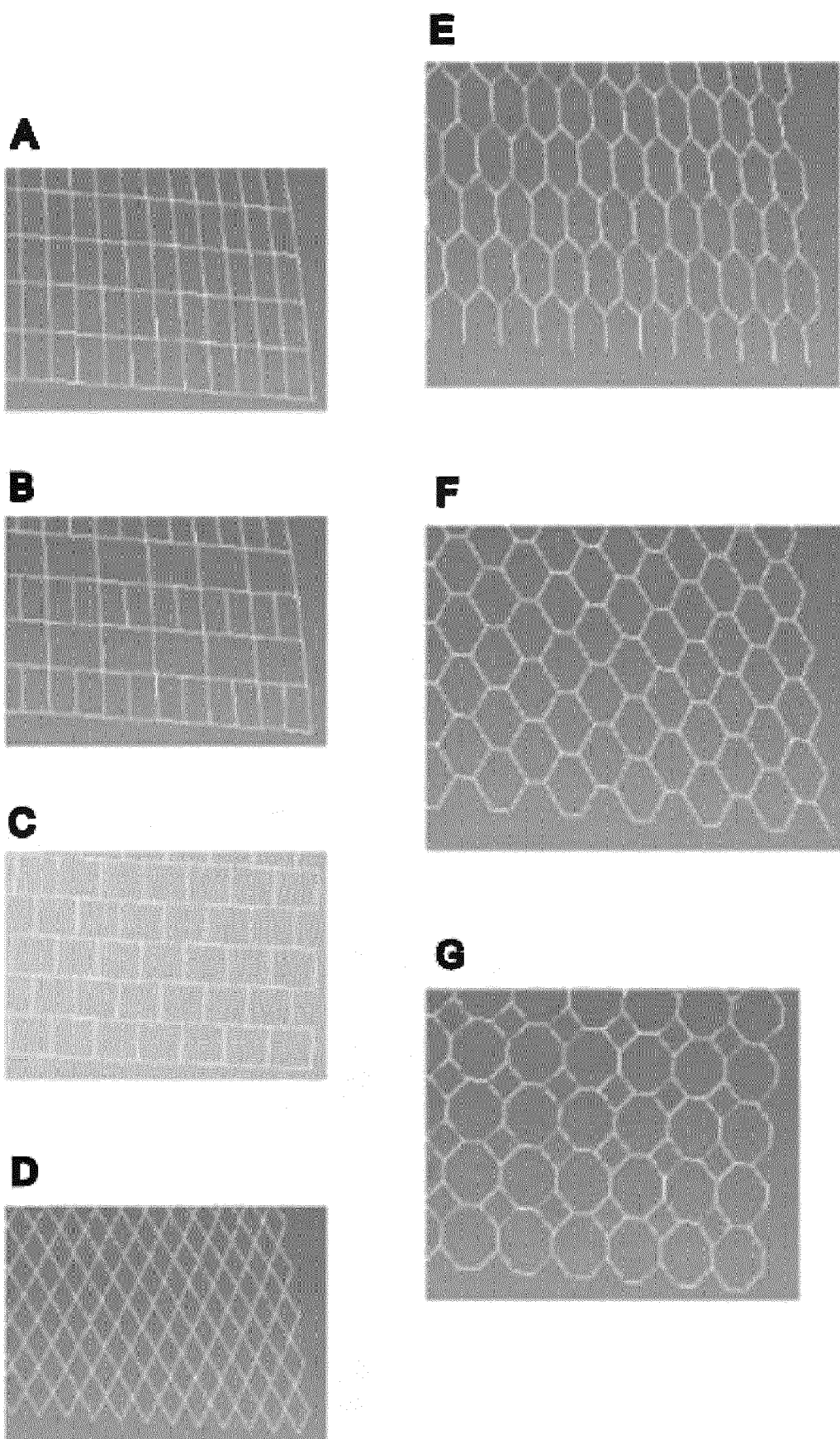


Fig. 5



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Application Number

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