(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 899 124 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
08.11.2023 Bulletin 2023/45

(21) Application number: **19901245.1**

(22) Date of filing: **22.05.2019**

(51) International Patent Classification (IPC):
D06F 37/26 *(2006.01)* *D06F 25/00* *(2006.01)*

(52) Cooperative Patent Classification (CPC):
D06F 37/264; D06F 25/00; D06F 37/269

(86) International application number:
PCT/TR2019/050362

(87) International publication number:
WO 2020/130966 (25.06.2020 Gazette 2020/26)

(54) **A LAUNDRY WASHER-DRYER HAVING A TUB WITH IMPROVED MECHANICAL STRENGTH**

WÄSCHEWASCHTROCKNER MIT EINEM BEHÄLTER MIT VERBESSERTER MECHANISCHER FESTIGKEIT

MACHINE À LAVER/SÉCHER LE LINGE AYANT UNE CUVE À RÉSISTANCE MÉCANIQUE AMÉLIORÉE

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **18.12.2018 TR 201819632**

(43) Date of publication of application:
27.10.2021 Bulletin 2021/43

(73) Proprietor: **Arçelik Anonim Sirketi**
34445 Istanbul (TR)

(72) Inventors:
- **ATAGUN, Cahit**
  34445 Beyoglu/Istanbul (TR)
- **AYDOGDU, Yunus Emre**
  34445 Beyoglu/Istanbul (TR)
- **MUGAN, Ata**
  34445 Beyoglu/Istanbul (TR)
- **AYAS, Recep**
  34445 Beyoglu/Istanbul (TR)

(56) References cited:
EP-A1- 3 330 428
DE-A1- 19 756 516
KR-A- 20080 040 338
US-A1- 2010 192 640
US-A1- 2013 255 328
US-A1- 2013 255 328
US-A1- 2018 080 161

EP 3 899 124 B1

Description

[0001] The present invention relates to a laundry washer-dryer having a tub produced from plastic material.

[0002] In laundry washer-dryers, washing and drying processes are realized by placing the laundry into a drum moving in the tub. The tub is produced from rigid thermoplastic material such as polyethylene or polypropylene due its high chemical resistance values and low costs. The drum makes rotational movement in the tub. The unbalanced load caused by the laundry in the drum and the forces generated during the spin-drying step of the laundry washer-dryer strain the tub. Especially the surrounding area around the hub where the shaft rotating the drum is borne in the ball bearing in the tub is subjected to mechanical loads, thus causing wear or cracking risks in time. At least the rear wall of the tub is required to be produced from materials with high mechanical strength, which increases the production costs.

[0003] In the Patent No. US9376767 (B2), a plastic tub for a washing machine is disclosed which includes a cylindrical casing, and an end face wall sealing the cylindrical casing, wherein the end face includes a bearing mount for a shaft of a laundry drum and radially-aligned reinforcing ribs molded into the end face wall. The reinforcing ribs begin at the bearing mount and branch in a Y-shape along their radial extent.

[0004] In the Patent Application No. US2011283746 (A1), a washing machine having a tub with a structurally strengthened rear wall is disclosed.

[0005] In the Patent Application No. EP2460924 (A2), a method for manufacturing a tub section for a washing machine is disclosed.

[0006] In the Patent Application No. DE19756516 (A1), a thin-walled sheet metal component of an appliance which has an embossed honeycomb surface structure is disclosed.

[0007] In the Patent Application No. KR20080040338 (A), a washing machine having a tub with increased the rigidity and strength is disclosed.

[0008] The aim of the present invention is the realization of a laundry washer-dryer which comprises a tub with increased mechanical strength.

[0009] In the laundry washer-dryer according to claim 1 realized in order to attain the aim of the present invention,
the rear wall of the tub are provided with inner radial ribs which are in the form of a hyperbolic open curve, which have a curved section and two symmetrical arms which extend symmetrically in the radial direction from the vertex of the curved section towards the tub on the inside, and which are positioned all around the hub. Outer radial ribs which are again in the form of a hyperbolic open curve and which have arms extending from inside to the outside in a direction opposite to the inner radial ribs.

[0010] The laundry washer-dryer realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

Figure 1 - is the schematic view of a laundry washer-dryer.

Figure 2 - is the schematic view of the rear wall of the tub.

Figure 3 - is the schematic view of the rib structure on the rear wall of the tub.

Figure 4 - is the detailed view of the rib structure on the rear wall of the tub.

Figure 5 - is the perspective view of the rear side of the tub.

Figure 6 - is the view of the tub rear wall in an embodiment of the present invention.

Figure 7 - is the view of the tub rear wall in another embodiment of the present invention.

[0011] The elements illustrated in the figures are numbered as follows:

1. Laundry washer-dryer
2. Drum
3. Rear wall
4. Hub
5. Tub
6. Curved section
7. Vertex
8. Arm
9. Inner radial rib
10. Outer radial rib
11. Circumferential rib
12. Segment
13. Motor
14. Shaft
15. Ball bearing

[0012] The laundry washer-dryer (1) comprises a drum (2) which is rotated around the horizontal axis by a motor (13) and wherein the laundry is placed, a shaft (14) which transmits the movement received from the motor (13) to

the drum (2), and a tub (5) wherein the drum (2) moves, which is produced from plastic (rigid thermoplastic) and which has a circular front wall with the laundry loading opening arranged at the center thereof, a cylindrical side wall, a circular rear wall (3) and a hub (4) which is arranged at the rear wall (3) and where the shaft (14) is borne with the ball bearing (15).

[0013] The laundry washer-dryer (1) of the present invention comprises a plurality of inner radial ribs (9)

- which are produced from plastic and integrated onto the tub (5) rear wall (3),
- which is in the form of a hyperbolic open curve of which the hyperbolic cosine function is defined as "hyperbolic cosine function : f(x) = cosh (x)",
- which has a curved section (6) and two symmetrical arms (8) symmetrically extending inwardly from the vertex (7) of the curved section (6) in the radial direction, and
- which are positioned all around the hub (4) (Figure 4).

[0014] The concave surfaces of the curved sections (6) of the inner radial ribs (9) face the hub (4). The arms (8) of the inner radial ribs (9) extend on the rear wall (3) from the curved sections (6) towards the hub (4) from outside to inside.

[0015] The laundry washer-dryer (1) furthermore comprises a plurality of outer radial ribs (10)

- which are produced from plastic and integrated onto the tub (5) rear wall (3),
- which are in the form of a hyperbolic open curve,
- which has the common or adjacent vertices (7) with inner radial ribs (9), the curved sections (6) positioned back to back with the curved sections (6) of the inner radial ribs (9) and two symmetrical arms (8) extending outwardly from the vertices (7) in a direction opposite to the inner radial ribs (9) and towards the outer circumference of the rear wall (3) (Figure 4).

[0016] In an embodiment of the present invention, the laundry washer/dryer (1) comprises at least one circumferential rib

- which is produced from plastic and concentrically integrated onto the tub (5) rear wall (3), and
- which has a diameter smaller than the outer diameter of the rear wall and larger than a circle formed by the vertices (7) of the inner radial ribs (9) and the outer radial ribs (10).

[0017] In another embodiment of the present invention, at least one circumferential rib (11) is composed of arc-shaped segments (12) which are inwardly concave in the radial direction. In the laundry washer-dryer (1) wherein the circumferential ribs (11) are composed of arc-shaped segments (12), the strength of the tub (5) rear wall (3) increases and bending under load decreases.

[0018] The rear wall (3) of the tub (5) of the laundry washer-dryer (1) of the present invention, in particular the region of the rear wall (3) around the hub (4) bearing the shaft (14) is strengthened against mechanical stress. The hyperbolic inner radial ribs (9) disposed around the hub (4) at the rear wall (3) transfer the tensions created by the balanced and unbalanced load in the drum (2) on the hub (4) of the tub (5) rear wall (3) to the outer radial ribs (10), the strain is homogeneously distributed along the rear wall (3) and thus the strength of the tub (5) is increased. The amount of plastic raw material used and thus material costs are decreased.

Claims

1. - A laundry washer-dryer (1) **comprising** a drum (2) which is rotated around a horizontal axis by a motor (13) and wherein the laundry is placed, a shaft (14) which transmits the movement received from the motor (13) to the drum (2), and a tub (5) wherein the drum (2) moves, which is produced from plastic and which has a circular rear wall (3) and a hub (4) which is arranged at the rear wall (3) and where the shaft (14) is borne with a ball bearing, and a plurality of inner radial ribs (9)

   - which are produced from plastic and integrated onto the tub (5) rear wall (3),
   - which are in the form of a hyperbolic open curve of which the hyperbolic cosine function is defined as "hyperbolic cosine function : f(x) = cosh (x)",
   - which has a curved section (6) and two symmetrical arms (8) symmetrically extending inwardly from the vertex (7) of the curved section (6) in the radial direction
   - which are positioned all around the hub (4).

2. - A laundry washer-dryer (1) as in Claim 1, comprising a plurality of outer radial ribs (10) which are integrated onto the tub (5) rear wall (3), which are in the form of a hyperbolic open curve and which has the common or adjacent vertices (7) with inner radial ribs (9), the curved sections (6) positioned back to back with the curved sections (6) of the inner radial ribs (9) and two symmetrical arms (8) extending outwardly from the vertices (7) in a direction opposite to the inner radial ribs (9) and towards the outer circumference of the rear wall (3).

3. - A laundry washer-dryer (1) as in Claim 1 or 2, comprising at least one circumferential rib (11) which is concentrically integrated onto the tub (5) rear wall (3) and which has a diameter smaller than the outer diameter of the rear wall and larger than a circle formed by the vertices (7) of the inner radial ribs (9) and the outer radial ribs (10).

4. - A laundry washer-dryer (1) as in Claim 3, comprising at least one circumferential rib (11) which is composed of arc-shaped segments (12) which are inwardly concave in the radial direction.

Patentansprüche

1. - Ein Wäschewaschtrockner (1) **umfasst** eine Trommel (2), die von einem Motor (13) um eine horizontale Achse gedreht wird und in der die Wäsche abgelegt wird, einen Schaft (14), die die vom Motor (13) empfangene Bewegung auf die Trommel (2) überträgt, und eine Wanne (5), in der sich die Trommel (2) bewegt, die aus Kunststoff hergestellt ist und die eine kreisförmige Rückwand (3) und eine an der Rückwand (3) angeordnete Nabe (4), in der die Welle (14) kugelgelagert ist, und eine Vielzahl von inneren Radialrippen (9) aufweist

   - die aus Kunststoff gefertigt und an der Rückwand (3) der Wanne (5) integriert sind,
   - die die Form einer hyperbolischen offenen Kurve haben, deren hyperbolische Kosinusfunktion als "hyperbolische Kosinusfunktion: f(x) = cosh (x)" definiert ist,
   - das einen gekrümmten Abschnitt (6) und zwei symmetrische Arme (8) aufweist, die sich vom Scheitelpunkt (7) des gekrümmten Abschnitts (6) in radialer Richtung symmetrisch nach innen erstrecken
   - die rundum um die Nabe (4) positioniert sind.

2. - Ein Wäschewaschtrockner (1), wie in Anspruch 1 aufgeführt, umfasst eine Vielzahl von äußeren radialen Rippen (10), die in die Rückwand (3) der Wanne (5) integriert sind, die die Form einer hyperbolischen offenen Kurve haben und die gemeinsame oder benachbarte Scheitelpunkte (7) mit inneren radialen Rippen (9) aufweisen, die gekrümmten Abschnitte (6) Rücken an Rücken mit den gekrümmten Abschnitten (6) der inneren radialen Rippen (9) positioniert sind und zwei symmetrische Arme (8), die sich von den Scheitelpunkten (7) nach außen in eine Richtung entgegengesetzt zu den inneren radialen Rippen (9) und in Richtung des äußeren Umfangs der Rückwand (3) erstrecken.

3. - Ein Wäschewaschtrockner (1), wie in Anspruch 1 oder 2 aufgeführt, umfasst mindestens eine umlaufende Rippe (11), die konzentrisch in die Rückwand (3) der Wanne (5) integriert ist und einen Durchmesser aufweist, der kleiner ist als der Außendurchmesser der Rückwand und größer als ein Kreis, der von den Scheitelpunkten (7) der inneren radialen Rippen (9) und der äußeren radialen Rippen (10) gebildet wird.

4. - Ein Wäschewaschtrockner (1), wie in Anspruch 3 aufgeführt, umfasst mindestens eine umlaufende Rippe (11), die aus bogenförmigen Segmenten (12) besteht, die in radialer Richtung nach innen konkav sind.

Revendications

1. - Un lave-linge séchant (1) **comprenant** un tambour (2) qui est tourné autour d'un axe horizontal par un moteur (13) et dans lequel le linge est placé, un arbre (14) qui transmet le mouvement reçu du moteur (13) au tambour (2), et une baignoire (5) dans laquelle le tambour (2) se déplace, qui est fabriquée en plastique et qui a une paroi arrière circulaire (3) et un moyeu (4) qui est disposé sur la paroi arrière (3) et où l'arbre (14) est supporté par un roulement à billes, et une pluralité de nervures radiales intérieures (9)

   - qui sont fabriqués en plastique et intégrés à la paroi arrière (3) de la baignoire (5),
   - qui se présentent sous la forme d'une courbe ouverte hyperbolique dont la fonction cosinus hyperbolique est définie comme "fonction cosinus hyperbolique : f(x) = cosh (x)",
   - qui présente une section incurvée (6) et deux bras symétriques (8) s'étendant symétriquement vers l'intérieur à partir du sommet (7) de la section incurvée (6) dans la direction radiale
   - qui sont placés tout autour du moyeu (4).

2. - Lave-linge séchant (1) selon la déclaration 1, comprenant une pluralité de nervures radiales extérieures (10) intégrées à la paroi arrière (3) de la baignoire (5), qui se présentent sous la forme d'une courbe ouverte hyperbolique et dont les sommets (7) sont communs ou adjacents à des nervures radiales intérieures (9), les sections incurvées (6) positionnées dos à dos avec les sections incurvées (6) des nervures radiales intérieures (9) et deux bras symétriques (8) s'étendant vers l'extérieur à partir des sommets (7) dans une direction opposée aux nervures radiales intérieures (9) et vers la circonférence extérieure de la paroi arrière (3).

3. - Lave-linge séchant (1) selon la déclaration 1 ou 2, comprenant au moins une nervure circonférentielle (11) intégrée concentriquement à la paroi arrière (3) de la baignoire (5) et dont le diamètre est inférieur

au diamètre extérieur de la paroi arrière et supérieur à un cercle formé par les sommets (7) des nervures radiales intérieures (9) et des nervures radiales extérieures (10).

4. - Un lave-linge séchant (1) selon la déclaration 3, comprenant au moins une nervure circonférentielle (11) qui est composée de segments (12) en forme d'arc qui sont concaves vers l'intérieur dans la direction radiale.

Figure 1

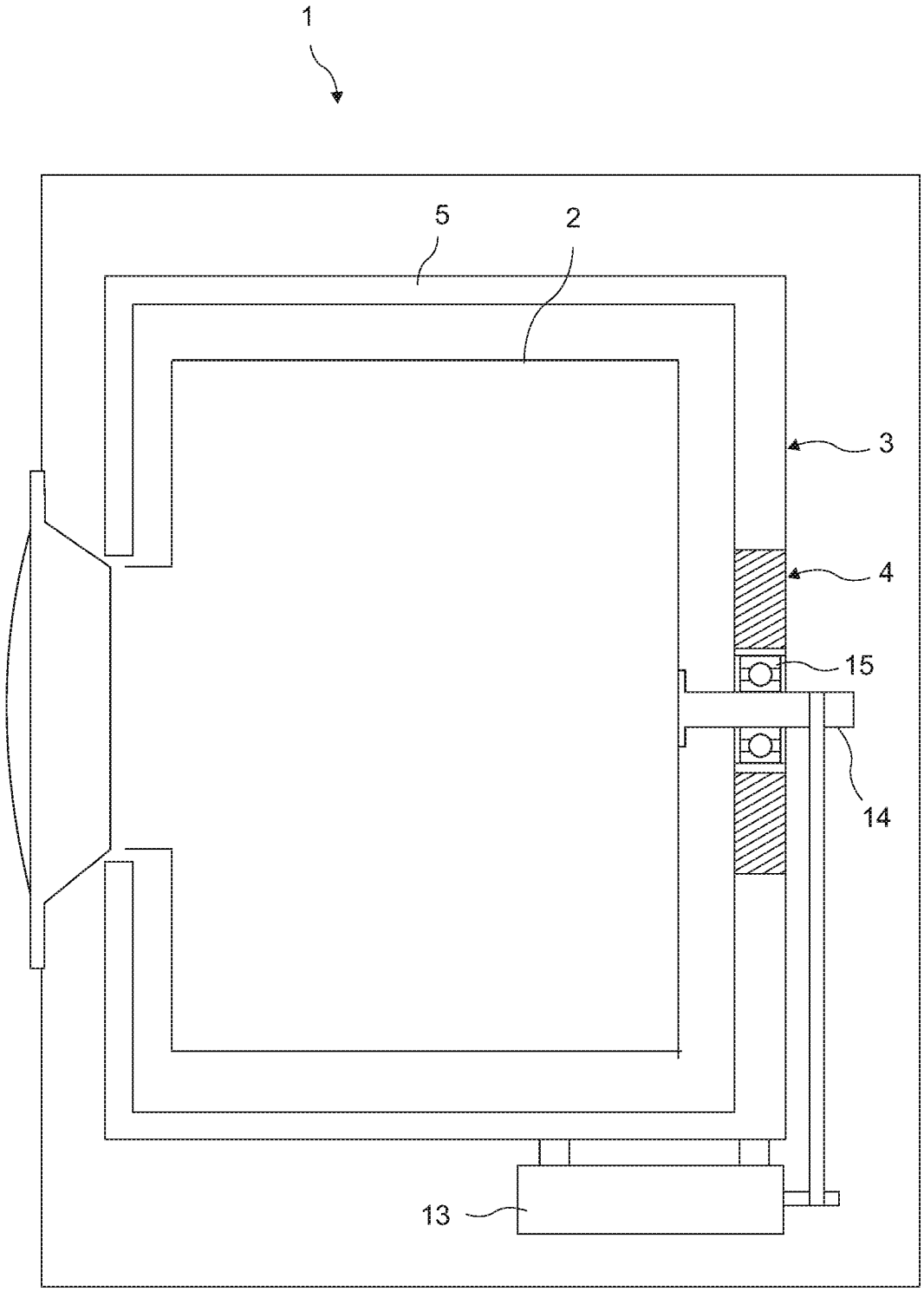


Figure 2

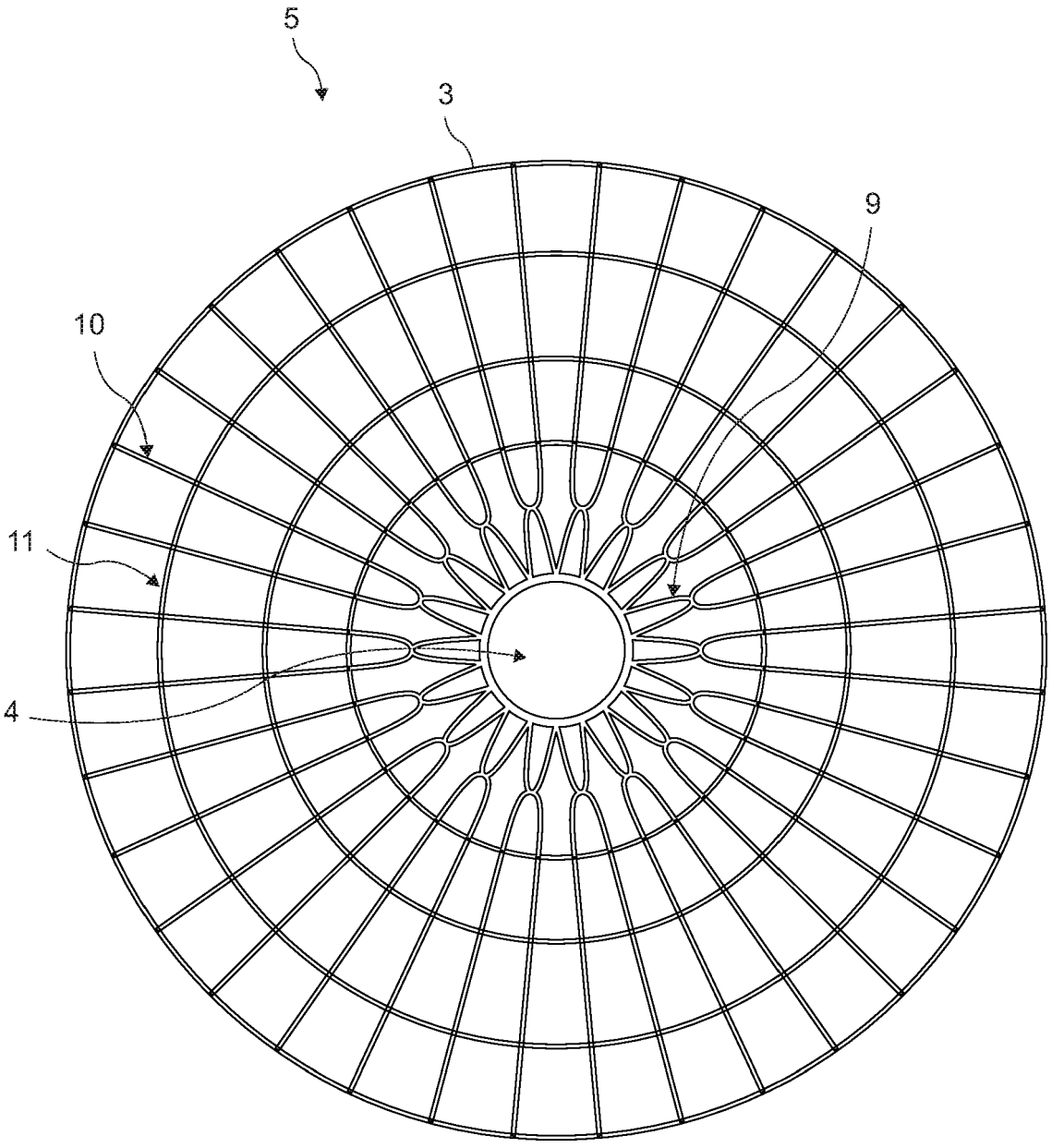


Figure 3

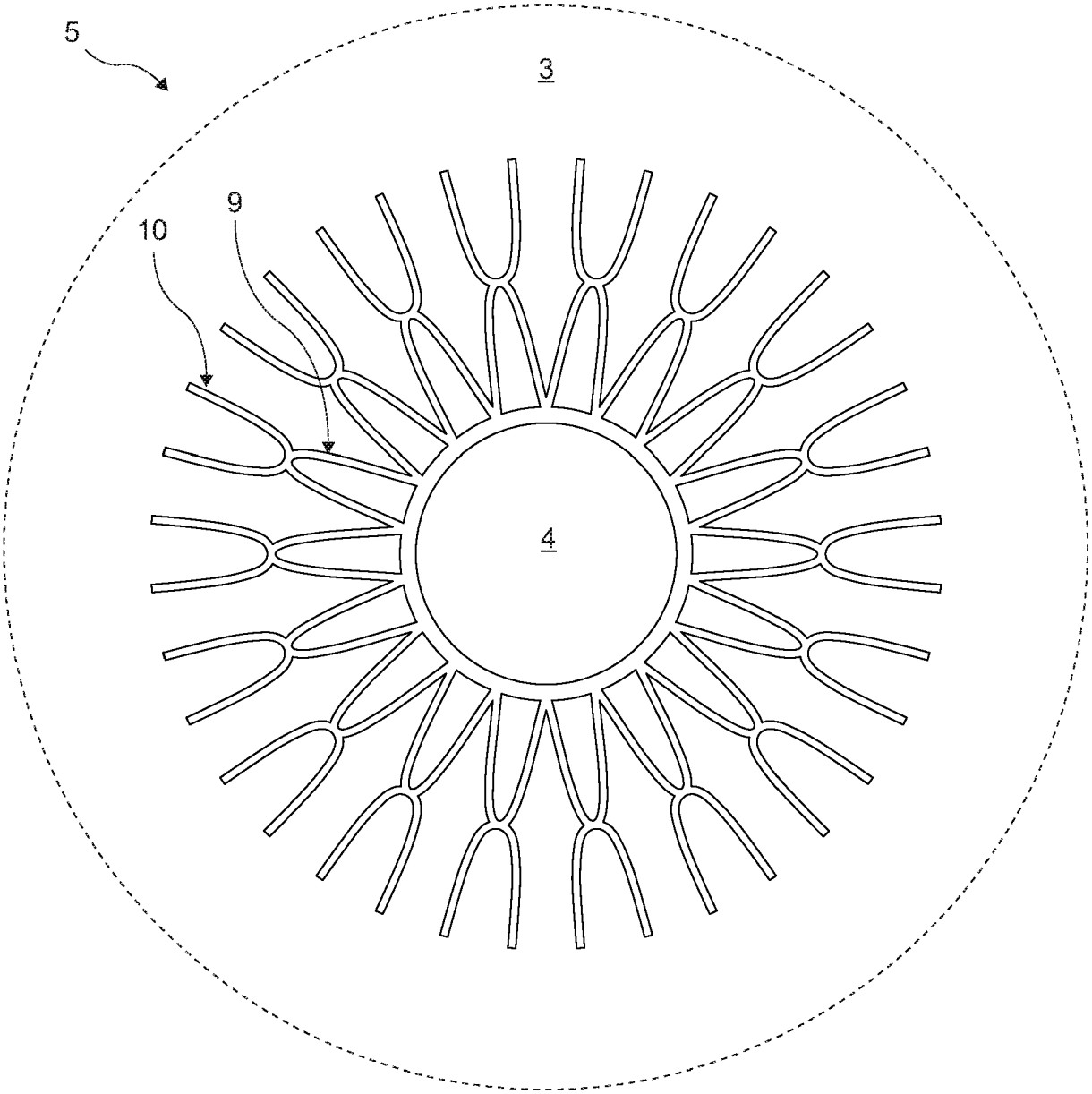


Figure 4

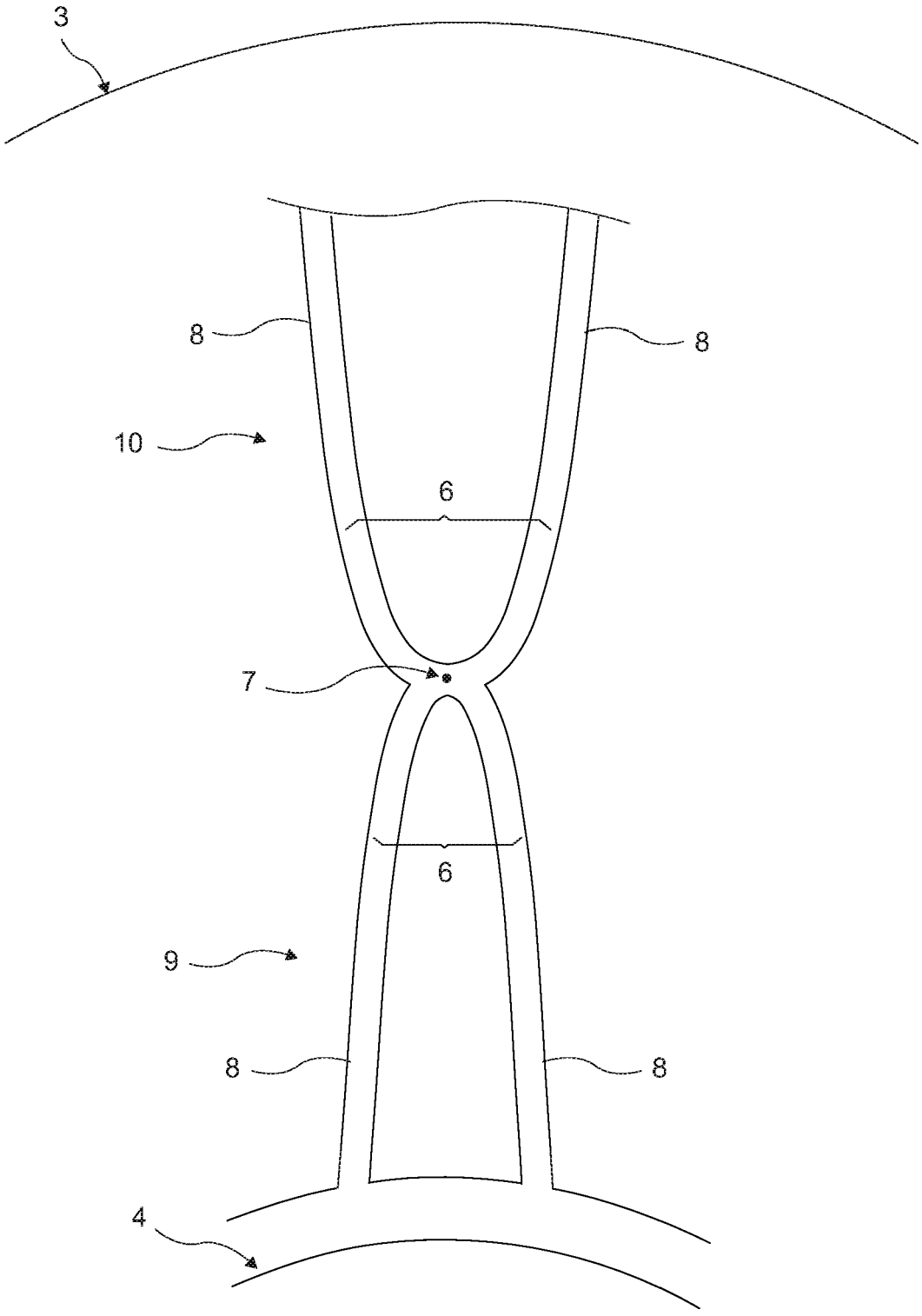


Figure 5

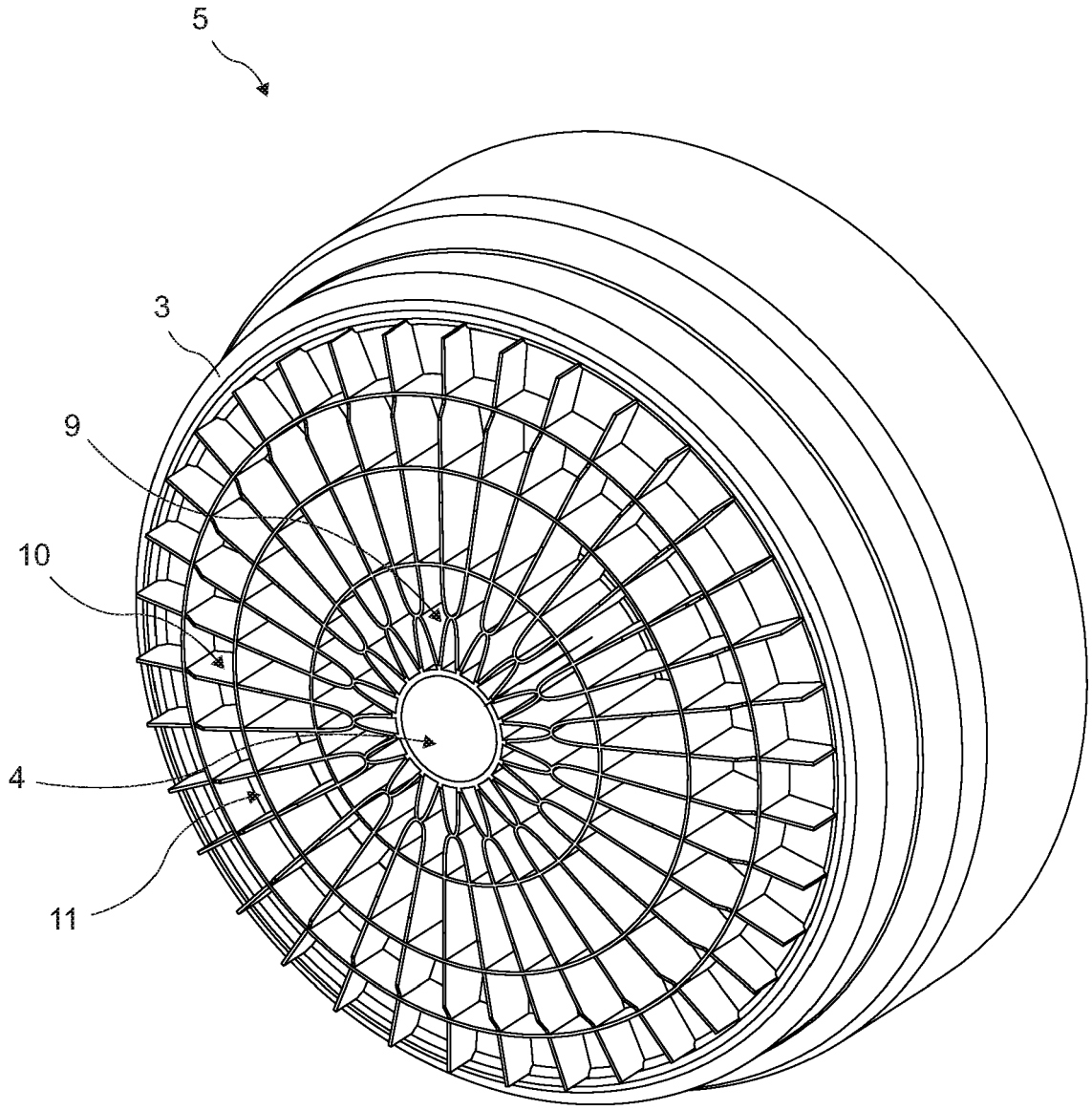


Figure 6

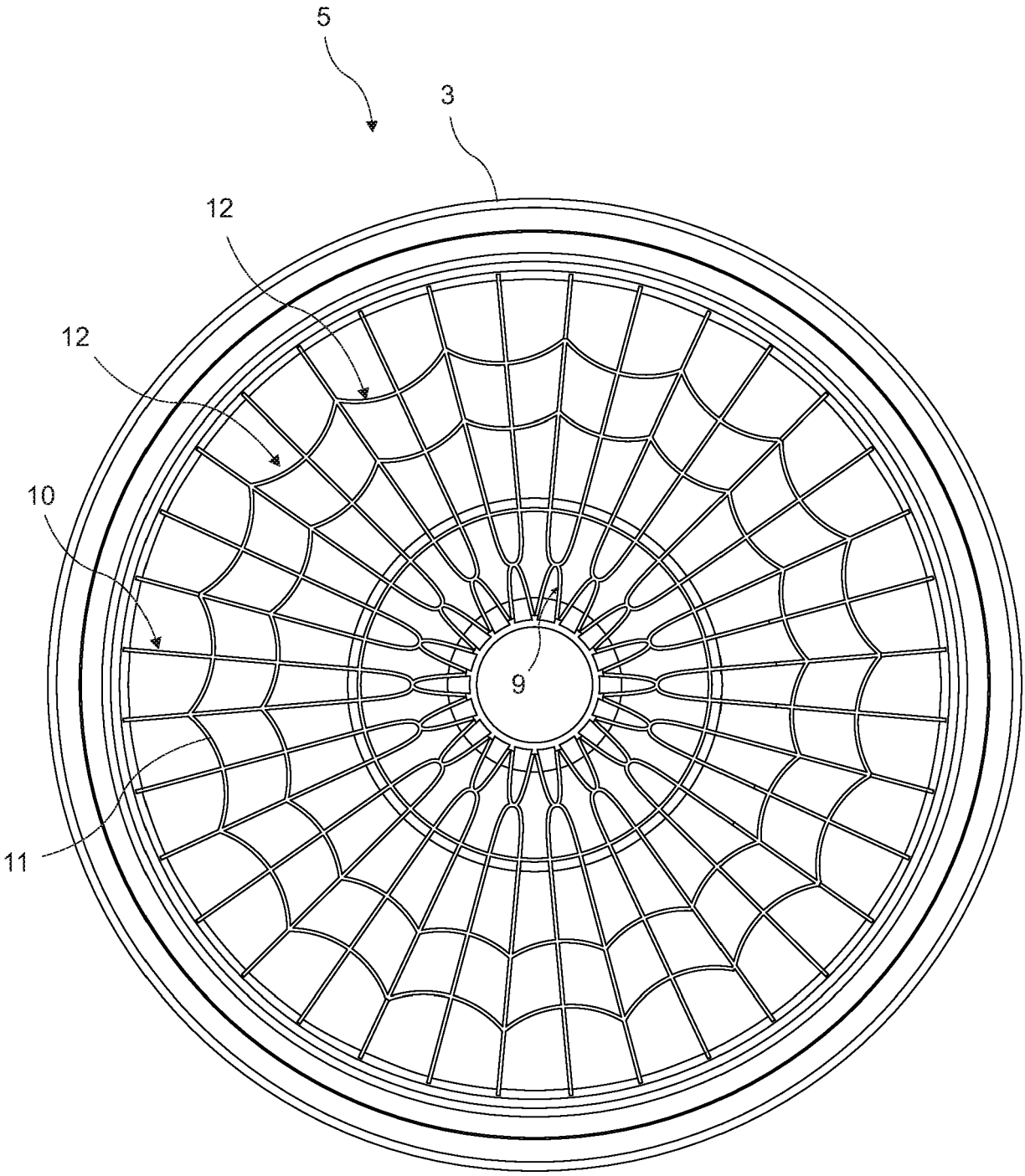
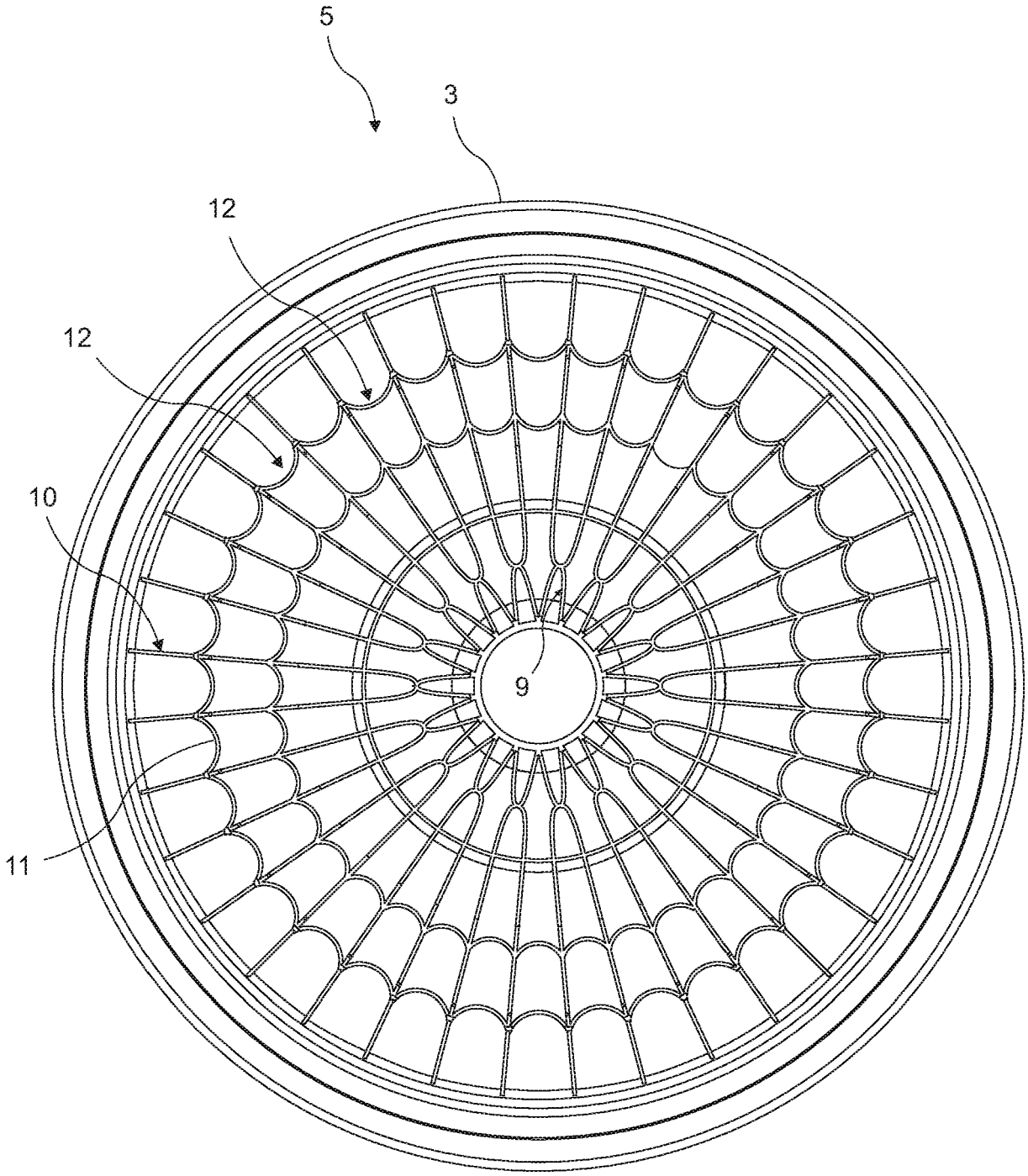


Figure 7



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 9376767 B2 **[0003]**
- US 2011283746 A1 **[0004]**
- EP 2460924 A2 **[0005]**
- DE 19756516 A1 **[0006]**
- KR 20080040338 A **[0007]**