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(54) **A spreading device**

(57) A spreading device for spreading granular material mixed with a liquid. It comprises a disc adapted to rotate around an axle/shaft placed and supports a number of wings for spreading the material. The spreading device further comprises a mixing chamber for mixing the liquid and the granulated material, said mixing chamber comprises a wall in which discharge openings are provided and a mixing disc adapted to rotate together with the disc. The mixing disc comprises flexible means placed at the periphery of the mixing disc and are adapted to mix the liquid and granulated material and guide the mixed material through the discharge openings to the wings during the rotation of the disc.

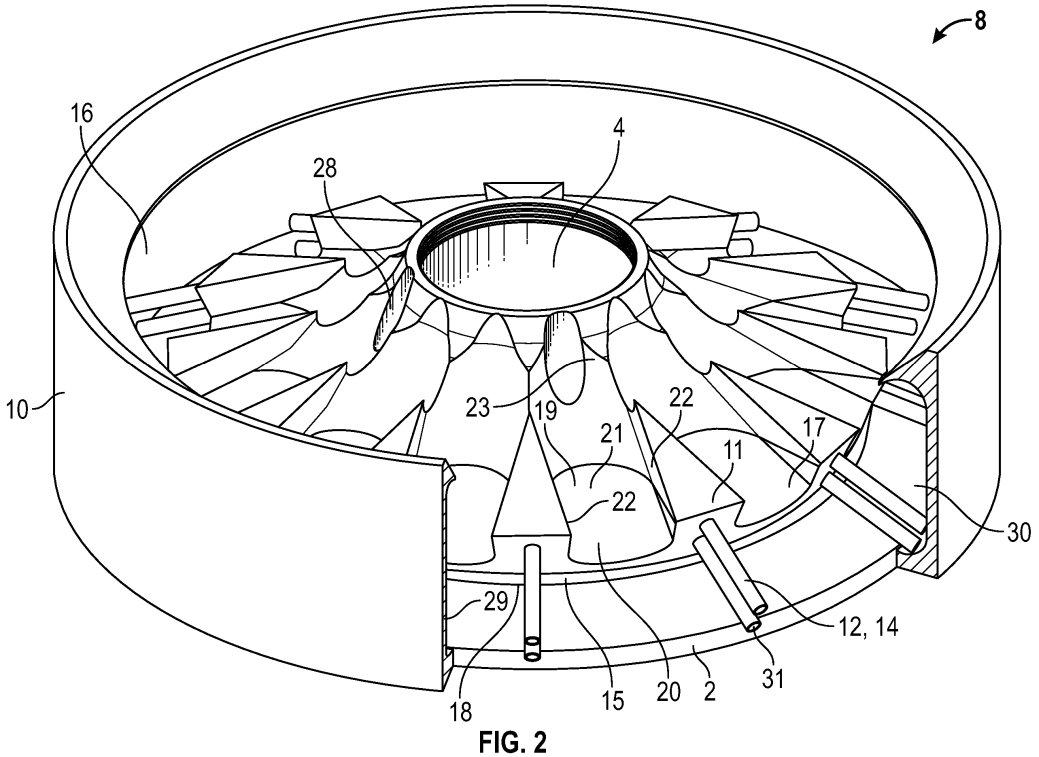


FIG. 2

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## Description

**[0001]** The present invention relates to a spreading device for spreading granular material such as salt, slurry, sand, grit, aggregate, brine and/or powdery materials mixed with a liquid such as water, comprising a disc with a central bore adapted to rotate around an axle/shaft placed in said bore, said axle/shaft being driven by moving means, said disc supporting a number of wings for spreading the material, the spreading device further comprising a mixing chamber for mixing the liquid and the granulated material, said mixing chamber comprising a wall in which a discharge opening is provided.

Background

**[0002]** DE 19933647 describes a spreading device comprising a rotatable disc for spreading granular moisture material such as brine and road salt. It comprises a chamber in which brine is placed. The chamber comprises an opening and closing distribution member such as a brush which is placed above the spreading disc. A funnel guides grid such as salt to the rotating spreading plate.

**[0003]** The spreader device does not provide a mixture before the brine and the salt reach the rotating spreading plate and therefore, the delivered substance may be quite unevenly mixed and thereby unevenly distributed.

**[0004]** EP1670992 discloses a spreader arrangement for a road machine. It comprises a rotating disc and a mixing chamber placed at the centre of the rotating disc. Liquid and granular material such as salt is led to the mixing chamber. In the chamber, mixing blades made in metal or other expensive materials are provided. They are exposed to great friction and thereby, they are worn out quite fast and must be replaced. This is an expensive and troublesome process.

**[0005]** Therefore, it is an object of the present invention to provide a spreading device overcoming at least some of the disadvantages of the prior art or providing at least a useful alternative.

Description of the invention

**[0006]** According to a first aspect of the invention, the spreading device further comprises a mixing disc adapted to rotate together with the disc, said mixing disc comprising a bore being coaxial with the central bore of the disc, the mixing disc comprising flexible means placed at the periphery of the mixing disc, said flexible means being adapted to mix the liquid and granular material and guide the mixed materials through the discharge opening to the wings during rotation of the mixing disc.

**[0007]** The salt or other granular material is led from a container through a funnel and down to the mixing chamber. Water or brine is led to the mixing chamber from another inlet. The mixing chamber is delimited by a cylindrical, vertical wall and at the bottom, the mixing disc is placed. The mixing disc is rotating around the axle of the spreading disc and is attached to the rotating disc. However, the two discs may rotate with different speed independently of each other. When the salt and the liquid reach the rotating mixing disc, they mix due to the flexible means being placed at the periphery of the rotating mixing disc. The flexibility of the means ensures that an excellent mixing of the two components takes place. Further, the flexible means also press and direct the mixture through the discharge openings.

**[0008]** The flexibility has the advantage that the flexible means mix the substance very well. The flexibility is chosen in such a way that on one hand, an optimal mixing of the substance takes place and on the other hand, the flexible means are so stiff that the mixture is directed out through the discharge openings. Advantageously, the flexible means are brushes formed by filaments/fibres/. The fibres are cylindrical or oval in cross section and advantageously, they are formed in a synthetic material such as a polymer, for instance PBT. The diameter of each cylindrical fibre is 1-2mm, preferably 1.5mm.

**[0009]** Due to the construction of the mixing disc as such, it is easy to replace the disc without replacing the rest of the mixing chamber as it is a part of the mixing disc - the elongated fibres - that is being worn.

**[0010]** The fibres are placed in bundles, each bundle comprising around 8-16 fibres, preferably around 12 bundles. The bundles are substantially cylindrical.

**[0011]** When the mixture leaves the mixing chamber through the discharge openings, it reaches the wings of the disc. Due to the rotation of the wings, the mixture is spread on the ground.

**[0012]** The spreading device is fixed/attached to a suitable vehicle comprising a motor for rotating the disc around a shaft. A container is placed in connection with the rotatable spreader disc. The container contains the granular material to be distributed. Then, the material is led down to the rotatable mixing disc. Fluid is led down to the rotating mixing disc as described above.

**[0013]** In another embodiment of the invention, the flexible means comprise elongated flexible means spaced apart and attached to the periphery of the mixing disc.

**[0014]** By forming the flexible means as elongated devices, the mixing and guiding properties are improved. The flexible means may be arranged in bundles of fibres, said bundles being spaced apart. Having a certain distance between each bundle ensures an even, controlled mixing and spreading pattern.

**[0015]** In another embodiment of the invention, the cross-sectional area of each elongated flexible means is substantially circular or oval.

**[0016]** This shape of the cross-sectional area ensures that the flexible properties of the flexible means are properly regulated.

**[0017]** In another embodiment of the invention, the mixing disc has a substantially circular periphery and the periphery is placed at a distance d1 from the inner surface

of the wall of the mixing chamber, said wall being substantially circular in cross section and the free end of the flexible means being placed at a distance d2 from the inner surface of the wall of the mixing chamber, said distance d2 being larger than 0mm and smaller than d1.

**[0018]** By placing the periphery of the mixing disc at a distance from the wall of the mixing chamber, sufficient place for the elongated fibres is obtained. Thereby, their function is improved. Advantageously, the distance is around 45mm.

**[0019]** The fibres are the part of the rotating mixture disc being worn during the friction between the material and the fibres. The wall of the mixing chamber is made in a wear-resistant material while the fibres are made in a softer material, which is why they are worn out. The distance d2 is around 1-3mm. It is avoided that the rotation force is transferred from the rotating mixing disc to the delimiting walls of the mixing chamber.

**[0020]** In another embodiment of the invention, the mixing disc comprises a mixing upper surface and an oppositely placed mixing lower surface, said upper surface pointing towards the wall of the mixing chamber and comprising a number of grooves being spaced apart, each groove having an opening in the periphery of the mixing disc.

**[0021]** By making such grooves at the upper surface of the mixing disc, the granular and the liquid are caught in said grooves. During the rotation of the disc, the mixture is led to the openings of the grooves placed at the periphery of the mixing disc. Due to the centrifugal force, the mixture is hurled outwards and hits the inner surface of the wall of the mixing chamber. The rotating flexible means support the mixing by pressing it towards the inner surface of the wall leading the mixture out through the discharge opening.

**[0022]** The mixed material leaving the rotating disc falls in a parabolic curve.

**[0023]** In another embodiment of the invention, the grooves comprise a bottom wall, two oppositely placed side walls and a back wall connecting the three walls, said bottom wall being inclined downwards and towards the periphery of the mixing disc and the opening.

**[0024]** Thereby, the mixture is caught by the grooves and directed to the periphery of the rotating mixture disc where it is mixed and from where it is finally distributed. By downward is to understand the direction towards the ground.

**[0025]** In another embodiment of the invention, the flexible means are arranged in at least two circumferential rows placed in the periphery of the mixing disc, said one row being placed above the other row.

**[0026]** By having at least two rows of flexible means, one placed above the other, the mixing is improved and the discharge of the mixed substance is also improved. If only one row of flexible means is present, the capacity of mixing and discharging is remarkably reduced

**[0027]** In another embodiment of the invention, bundles of elongated flexible means are placed in the periphery of the mixing disc and between the openings of the grooves, and the bundles are arranged in such a way that at least two bundles of elongated flexible means are places between two neighbouring openings, said bundles being placed with one bundle placed above the other bundle.

**[0028]** This is one advantageous embodiment for constructing the mixing disc.

**[0029]** In another embodiment of the invention, the mixing disc comprises several displaceable disc parts for forming the mixing disc, said each displaceable disc part comprising at least one groove and flexible means attached to the periphery of said disc part.

**[0030]** This is an advantageous embodiment of the invention as it makes it possible to replace the part of the mixing disc being worn out with a new one without having to replace the entire mixing disc.

**[0031]** In another embodiment of the invention, some parts of the mixing disc are provided with additional flexible means compared to other parts of the mixing disc, said additional flexible means being placed above the other flexible means.

**[0032]** The additional flexible means have the purpose of cleaning the mixing chamber whereby clogging of the substance is avoided.

**[0033]** In another embodiment of the invention, the flexible means being detachably attached to the periphery of the mixing disc.

**[0034]** In another embodiment of the invention, the mixing disc is a replaceable part comprising fastening means for fastening the mixing disc to (the upper surface of) the disc.

**[0035]** Thereby, it is simple and cheap to improve the function of the mixing chamber when all the fibres of the mixing disc are worn out.

**[0036]** In another embodiment of the invention, the grooves are placed with their longitudinal axis being radially directed and that the grooves are placed with the same distance to their longitudinal axis measured on a circle with a centre being the centre of the bore.

**[0037]** This creates an even mixture and distribution of the substance.

**[0038]** In another embodiment of the invention, a mixing space is provided between the periphery of the mixing disc and the inner surface of the wall of the mixing chamber, and in that the flexible means are placed in said mixing space.

**[0039]** Thereby, the flexible means are free to move, and the space improves the mixing property of the construction.

**[0040]** The invention also relates to a vehicle or device comprising a spreading arrangement, said vehicle/device comprising a motor for rotating the spreading device, a container for containing and supplying the granular material and a second container for supplying the liquid.

**[0041]** In another embodiment of the invention, the bundles of elongated flexible means are made in a polymer material such as polypropylene or PBT.

**[0042]** In another embodiment of the invention, the mixing disc is made in a polymer material such as polypropylene.

**[0043]** In another embodiment of the invention, the flexible means are arranged in several separated units placed on the periphery of the mixing disc, each unit being placed between the openings of the grooves.

**[0044]** In another embodiment of the invention, the flexible means are flexible plates placed at the periphery of the mixing disc spaced apart.

**[0045]** This may be rectangular plates made in a rubber or a polymer.

**[0046]** The invention is explained in details below with reference to the drawings in which:

Fig. 1 shows a perspective view of a spreading device according to the invention.

Fig. 2 shows a first embodiment of a mixing chamber comprising a mixing disc according to the invention.

Fig. 3 shows a second embodiment of a mixing disc for a mixing chamber according to the invention.

Fig. 4 shows a cross-sectional view of a mixing disc without flexible means.

Fig. 5 shows a sectional view of the mixing disc shown in Fig. 4 along the line V-V.

Detailed description of the drawings

**[0047]** Fig. 1 shows a perspective view of a spreading device 1. The spreading device 1 comprises a disc 2 with a central bore (not shown) and wings 5 attached to the periphery of the disc 2. The spreading device 1 is to be arranged on a vehicle, such as a lorry, and includes a telescopic funnel 9 feeding granular material such as salt, sand, grit or aggregate from an electronically controlled dosing means on the vehicle. The spreader disc 2 is suspended at the lower part of a funnel 9. The arrangement further comprises a pipe 27 for feeding liquid such as brine or water, said liquid being provided next to the funnel 25. The spreading device 1 communicates with a container charging the granular material and a container for discharging liquid, such as salt water. The discharge of the granular material and the discharge of salt water or similar ingredients are electronically controlled by means of control circuits. A motor 26 drives the spreading device 1 and other rotating elements. A mixing chamber 8 and the associated means are placed at the upper side of the disc 2. The mixing chamber 8 comprises a mixing disc 11 placed with a central bore axis coincident with the central bore of the disc 2. The technical details of the mixing disc 11 is not shown but is shown and will be explained with reference to fig. 2,3,4. The mixing chamber 8further comprises a delimiting, vertically placed and cylindrically shaped wall 10 enclosing the mixing disc 11. The mixing disc 11 is fastened to the disc 2 by bolts and is replaceable. It rotates together with the rotation of the disc 2. The wall 10 is stationary during rotation of the mixing disc 11 and the disc 2. Salt and salt water or other materials are fed into the mixing chamber 8 and conveyed during rotation of the spreading device 1 through a discharge opening 29 of the mixing chamber 8. The discharge opening 29 is placed in such a way that it points in the opposite direction of the travelling direction of the vehicle carrying the assembly in question.

**[0048]** When the mixture leaves the mixing chamber 8, the mixture hits/reaches the rotating wings 5. The wings 5 comprise a horizontal wing part 7 attached to the disc 2 and a vertical wing part 6. The slope of the vertically orientated wing part 6 has an impact on the spread pattern of the granular material.

**[0049]** Fig. 2 shows a first embodiment of a mixing chamber comprising a mixing disc 11 and the cylindrically shaped wall 10 with a discharge opening 29 for the mixed material leaving the mixing chamber. In the circular periphery 15 of the mixing disc 11, a number of flexible means 12 are attached; they may be detachably attached to the disc 11. The flexible means 12 are designed as elongated flexible means 14 formed in a flexible material such as brush fibres with properties in relation to flexibility and the module of elasticity as is used for machines cleaning streets. It may also be formed in a rubber or plastic material such as polypropylene, PBT. They may also be formed from metal wires.

**[0050]** It is important for the chosen material and design that it is flexible and less wearresistant compared to the material of the wall. When the mixing disc 11 rotates, the end 31 of the flexible means does not touch the inner surface 16 of the chamber. Further, the elongated flexible means should have a certain length - advantageously around 40-45mm, preferably 42mm. The distance d1 between the periphery 15 of the mixing disc 11 and the inner surface 16 of the wall 10 of the mixing chamber 8 is around 40-50mm, preferably 43-45mm. The distance d2 between the end 31 of the flexible means 12 and the inner surface of the wall is 1-3mm.

**[0051]** Thereby, it is secured that it is the mixing disc being exposed to abrasion. When it has been worn out, it is easy to replace. This is done by loosening and removing the bolts placed in the bores 28 of the mixing disc 11, said bolts detachably fastening the mixing disc 11 to the disc 2. Thereby, cheap and easy repair of the mixing chamber 8 is provided as it is not necessary to replace other parts of the mixing chamber 8 than the mixing disc 11.

**[0052]** The mixing disc 11 comprises an upper surface 17 and an oppositely placed lower surface 18, the lower surface 18 resting against the disc 2. The upper surface is provided with grooves 19. The grooves are equally shaped with their longitudinal axis pointing in a radial direction towards the periphery of the mixing disc 11. The grooves 19 are formed with a bottom wall 19, two oppositely placed side walls 22 and a back wall 23 delimiting

the groove towards the central bore 4 of the mixing disc 11. Opposite the back wall 23 in the periphery of the mixing disc 11, the grooves 19 are provided with an opening 20 through which the mixture leaves the mixing disc 11 and falls into a mixing space 30 between the inner surface of the wall 10 and the periphery 15 of the mixing disc 11. In this space 30, the mixture is finally mixed by the flexible means 12 and leaves the mixing chamber 8 through the discharge opening 29 due to the rotation of the flexible means 12 guiding the mixture out of the discharge opening 29.

**[0053]** Fig. 3 shows another embodiment of a mixing disc 11 according to the invention. The reference numbers applying to Fig. 2 also apply to Fig. 3. The principal differences between the two embodiments are the construction of the flexible means 12 and also the placement of the flexible means 12. In this embodiment, the flexible means 8 comprise a number of flexible fibres arranged in bundles 13. Two bundles 13 of flexible fibres are placed at the periphery 15 of the mixing disc 11, one above the other. The bundles 13 are placed in an area of the periphery between the openings of the grooves 19, exactly as is the case in Fig. 2. Each fibre is circular or oval in cross section, and each bundle comprises 5-10 fibres. The flexible means/the bundles 13 are arranged in at least two circumferential rows placed in the periphery 15 of the mixing disc 11, said one row being placed above the other row.

**[0054]** Fig. 4 shows a cross-sectional view of the mixing disc 11 shown in Figs. 2 and 3 without the flexible means. The reference numbers applying to Figs. 2 and 3 also apply to Fig. 4. It shows the shape of the bottom wall 21 and back wall 23 of the grooves 19. The bottom 21 is running straight, but in an inclined angle V° of around 50-80 degrees, preferably around 70 degrees measured between the longitudinal axis of the bore 4 and a line following the straight course of the bottom wall 21. The bottom 21 continues into the back wall 23. The back wall 23 is round in shape, the shape having a bending radius: R 50.

**[0055]** The flexible means (not shown) are attached to the periphery of the mixing disc. The fibres are longitudinally shaped and are running straight. The longitudinal axis of the fibres provides an angle V° of around 50-80 degrees, preferably around 70 degrees measured between the longitudinal axis of the bore 4 and the longitudinal axis of the fibres.

**[0056]** Fig. 5 shows a sectional view of the mixing disc shown in Fig. 4 along the line V-V. The opposing side walls 19 are substantially parallel and continue into the bottom wall 21. The area between them is slightly rounded, whereby clogging of the substance is avoided.

References

**[0057]**

1 Spreading device

2 Disc/spreading rotor

3

4 Central bore of mixing disc

5 Wings

6 Vertical wing part

7 Horizontal wing part

8 Mixing chamber

9 Funnel

10 Wall

11 Mixing disc

12 Flexible means

13 Bundles

14 Elongated flexible means

15 Circular periphery of the mixing disc

16 Inner surface of wall

17 Mixing upper surface

18 Mixing lower surface

19 Grooves

20 Groove opening

21 Bottom wall of 19

22 Side walls of 19

23 Back wall

24 Fastening means

25 Funnel for dry material feed?

26 Motor/moving means

27 Pipe for liquid?

28 Bores for fastening means

29 Discharge opening for

30 Mixing space

31 End of elongated fibres

32

33

34

## Claims

1. A spreading device (1) for spreading granular material such as salt, slurry, sand, grit, aggregate, brine and/or powdery materials mixed with a liquid such as water comprising a disc (2) with a central bore (4) adapted to rotate around an axle/shaft placed in said bore (4), said axle/shaft being driven by moving means, said disc (2) supporting a number of wings (5) for spreading the material, the spreading device (1) further comprising a mixing chamber (8) for mixing the liquid and the granulated material, said mixing chamber (8) comprising a wall (10) in which a discharge opening (29) is provided, **characterised in that** the spreading device (1) further comprises a mixing disc (11) adapted to rotate together with the disc (2), said mixing disc (11) comprising a bore (4) being coaxial with the central bore of the disc (2), the mixing disc 11 comprising flexible means (12) placed at the periphery of the mixing disc (11), said flexible means (12) being adapted to mix the liquid and granular material and guide the mixed materials through the discharge opening (29) to the wings (5) during rotation of the mixing disc (11).

2. A spreading device (1) according to claim 1, **characterised in that** the flexible means (12) comprise elongated flexible means (14) spaced apart and attached to the periphery of the mixing disc (11).

3. A spreading device (1) according to claims 1-2, **characterised in that** the cross-sectional area of each elongated flexible means (14) is substantially circular or oval.

4. A spreading device (1) according to claims 1-3, **characterised in** the mixing disc (11) having a substantially circular periphery (15) and the periphery (15) being placed at a distance d1 from the inner surface (16) of the wall of the mixing chamber (8), said wall (10) being substantially circular in cross section and the free (31) end of the flexible means (12) being placed at a distance d2 from the inner surface of the wall of the mixing chamber, said distance d2 being larger than 0mm and smaller than d1.

5. A spreading device (1) according to any of the preceding claims, **characterised in that** the mixing disc (11) comprises a mixing upper surface (17) and an oppositely placed mixing lower surface (18), said upper surface (17) pointing towards the wall of the mixing chamber (8) and comprising a number of grooves (19) being spaced apart, each groove (19) having an opening (20) in the periphery (15) of the mixing disc (11).

6. A spreading device (1) according to claim 5, **characterised in that** the grooves (19) comprise a bottom wall (21), two oppositely placed side walls (22) and a back wall (23) connecting the three walls, said bottom wall (21) being inclined downwards and towards the periphery (15) of the mixing disc (11) and the opening (20).

7. A spreading device (1) according to any of the preceding claims, **characterised in that** the flexible means are arranged in at least two circumferential rows placed in the periphery of the mixing disc (11), said one row being placed above the other row.

8. A spreading device (1) according to claims 5-7, **characterised in that** bundles (13) of elongated flexible means (14) are placed in the periphery (15) of the mixing disc (11) and between the openings (20) of the grooves (19), and that the bundles (13) are arranged in such a way that at least two bundles (13) of elongated flexible means (14) are placed between two neighbouring openings (20), said bundles (13) being placed with one bundle (13) placed above the other bundle (13).

9. A spreading device (1) according to any of the preceding claims, **characterised in that** the mixing disc (11) comprises several displaceable disc parts for forming the mixing disc, said each displaceable disc part comprising at least one groove and flexible means attached to the periphery of said disc part.

10. A spreading device (1) according to any of the preceding claims, **characterised in that** some parts of the mixing disc (11) are provided with additional flexible means compared to other parts of the mixing disc (11), said additional flexible means being placed above the other flexible means.

11. A spreading device (1) according to any of the preceding claims, **characterised in** the flexible means (12) being detachably attached to the periphery (15) of the mixing disc (11).

12. A spreading device (1) according to any of the preceding claims, **characterised in that** the mixing disc (11) is a replaceable part comprising fastening means (24) for fastening the mixing disc (11) to (the upper surface of) the disc (2).

13. A spreading device (1) according to claims 5-12,

**characterised in that** the grooves (19) are placed with their longitudinal axis being radially directed and that the grooves (19) are placed with the same distance to their longitudinal axis measured on a circle with a centre being the centre of the bore.

**14.** A spreading device (1) according to any of the preceding claims, **characterised in that** a mixing space (30) is provided between the periphery of the mixing disc (11) and the inner surface of the wall of the mixing chamber, and **in that** the flexible means (12) are placed in said mixing space.

**15.** Vehicle or device comprising a spreading device according to any of the preceding claims, said vehicle/device comprising a motor for rotating the spreading device, a container for containing and supplying the granular material and a second container for supplying the liquid.

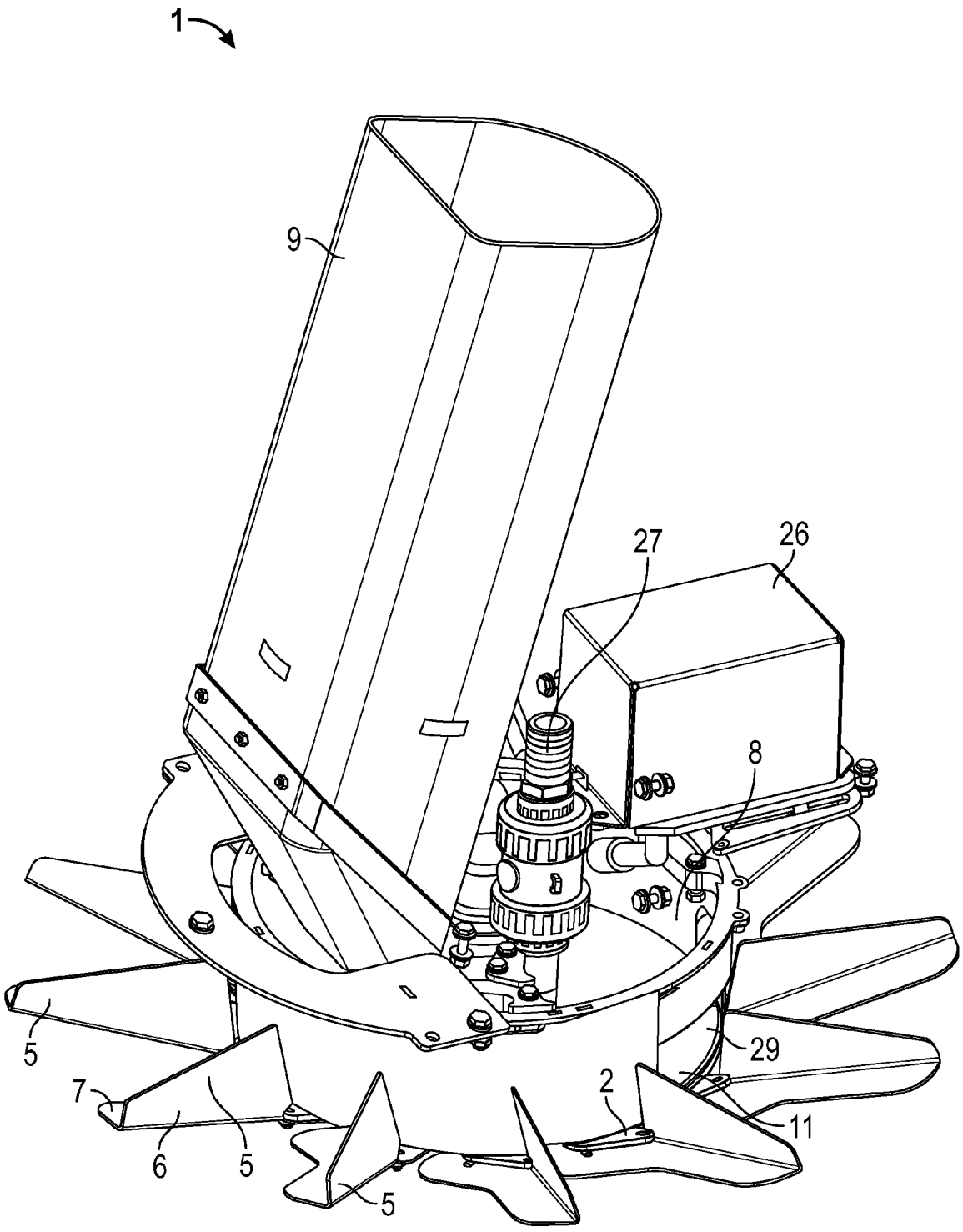


FIG. 1

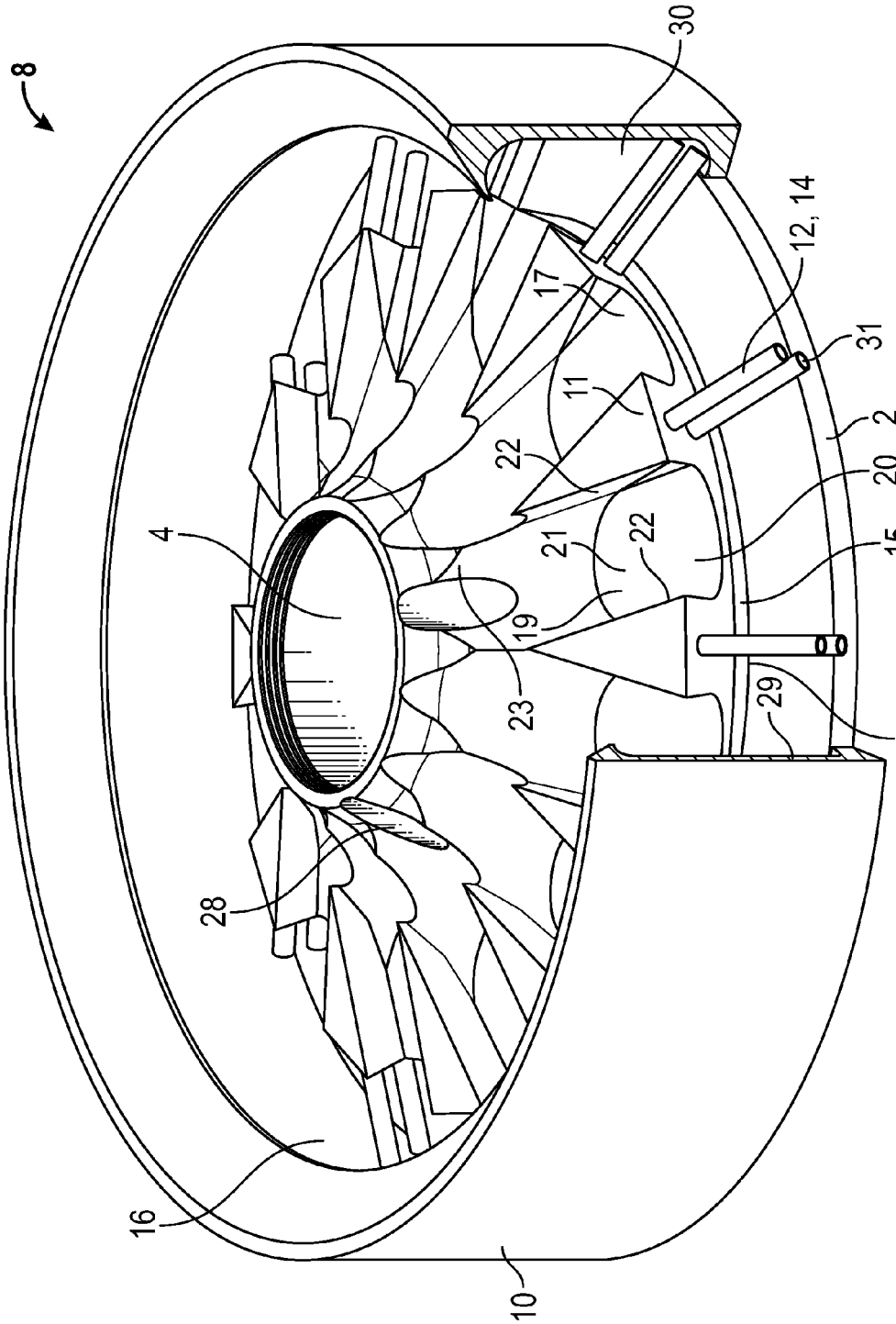


FIG. 2

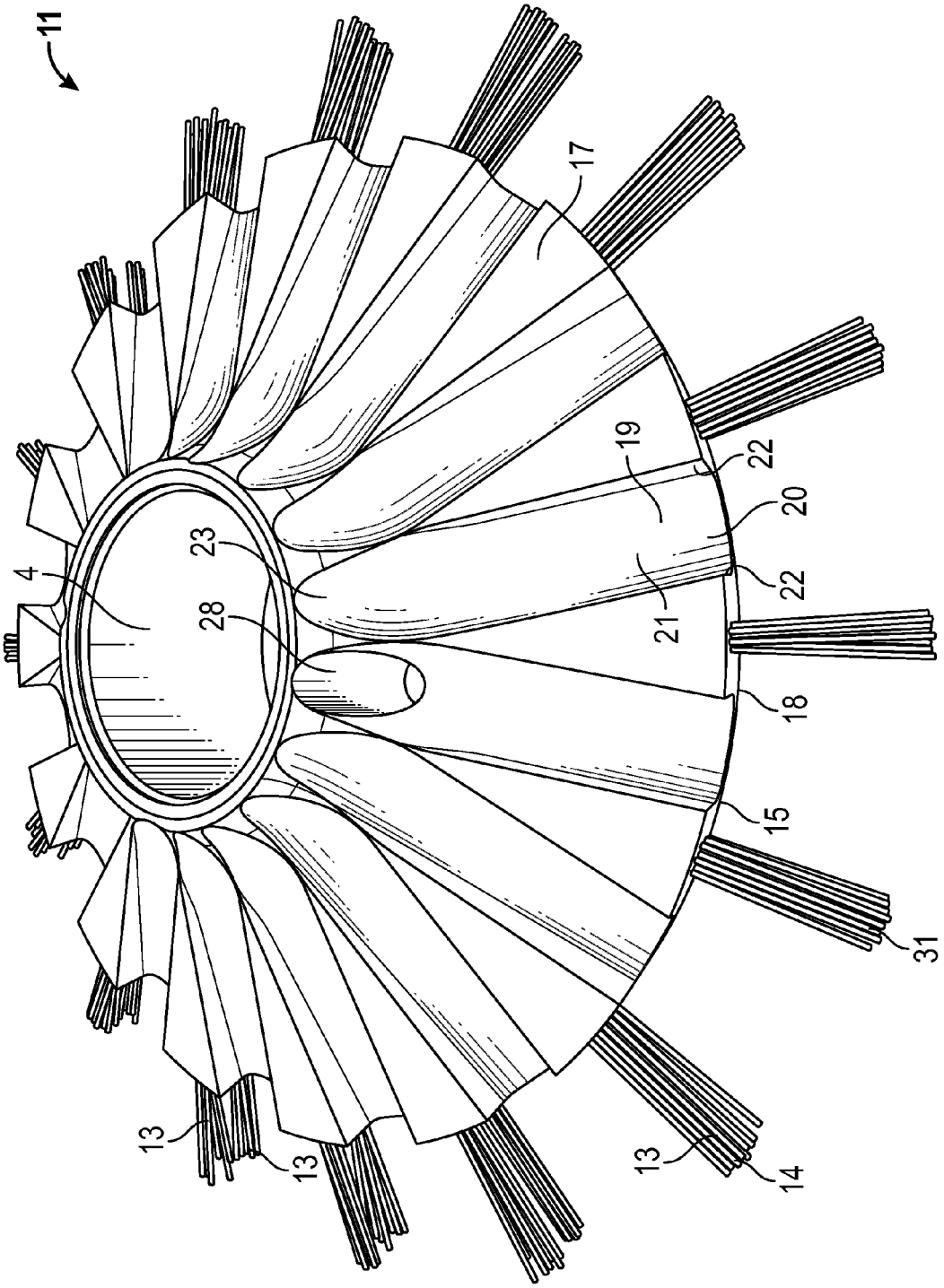


FIG. 3

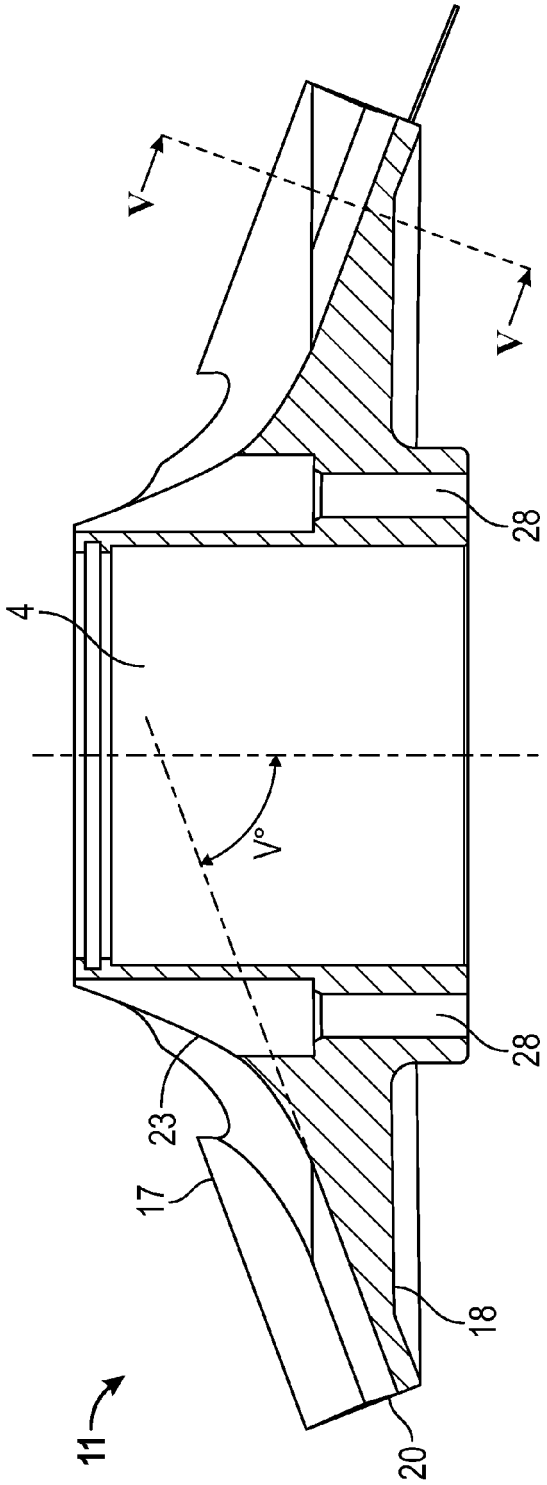


FIG. 4

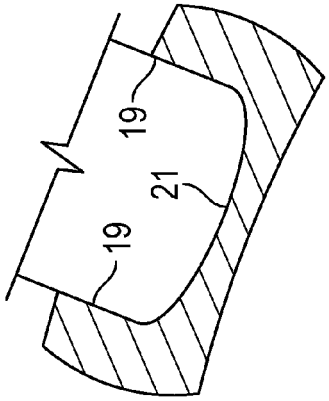


FIG. 5

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# EUROPEAN SEARCH REPORT

Application Number
EP 13 17 6628

## 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 | EP 1 634 997 A1 (KUGELMANN JOSEF [DE])<br>15 March 2006 (2006-03-15)<br>* column 3, lines 44-48, paragraph 31 *<br>----- | 1-3 | INV.<br>E01H10/00<br>E01C19/20 |
| A | DE 30 50 355 A1 (KUEPPER WILLY [DE])<br>21 October 1982 (1982-10-21)<br>* figure 2 *<br>----- | 1-15 | |

TECHNICAL FIELDS SEARCHED (IPC)

E01H
E01C

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 21 January 2014 | Saretta, Guido |

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 17 6628

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| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
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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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- EP 1670992 A **[0004]**