

(19)



(11)

EP 4 516 389 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
05.03.2025 Bulletin 2025/10

(51) International Patent Classification (IPC):
B01F 27/808^(2022.01) B01F 27/94^(2022.01)

(21) Application number: **24161265.4**

(52) Cooperative Patent Classification (CPC):
B01F 27/808; B01F 27/941

(22) Date of filing: **04.03.2024**

(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 ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

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(30) Priority: **30.08.2023 CN 202311112852**

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(54) **A MIXER AND STIRRING DEVICE**

(57) The present invention discloses a mixer and stirring device in the field of battery technology, comprising a guide cone 1, a blocking ring 3, and a plurality of stirring blocks 2. The blocking ring surrounds the guide cone and is located at the periphery of the guide cone. The stirring blocks are evenly distributed between the

guide cone and the blocking ring, with one end connected to the guide cone and the other end connected to the blocking ring. The present invention has the advantages of ensuring dispersing capability while improving kneading capability.

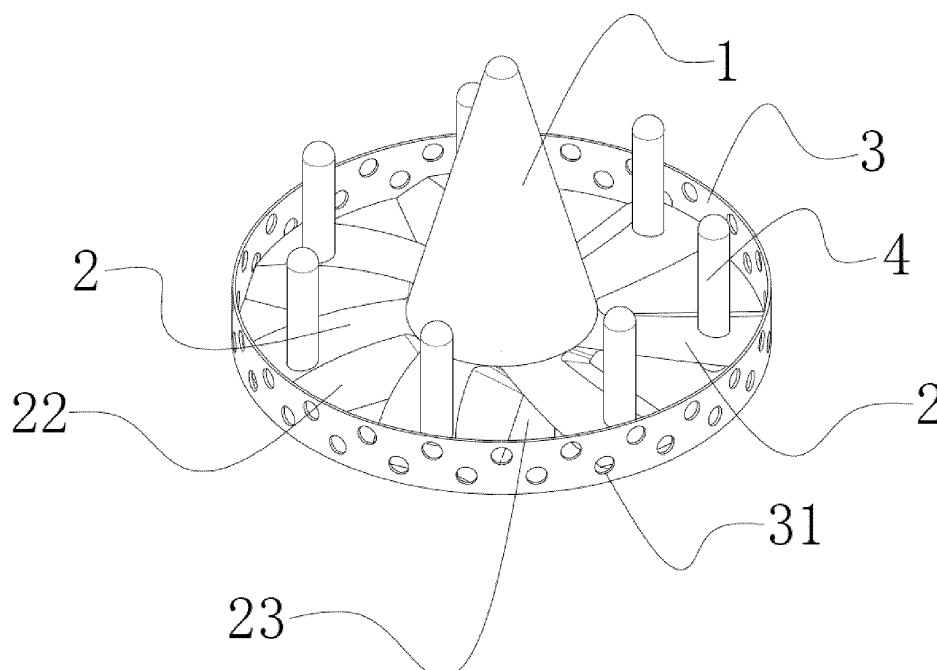


Figure 1

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Description

Technical Field

[0001] The present invention relates to the field of battery technology, and more particularly, to a mixer and stirring device.

Background Art

[0002] Slurry preparation is the first process in lithium battery production. The blending process has a greater than 30% impact on the quality of the product in the entire production process of lithium-ion batteries and is the most important link in the entire production process. Solid content is an important indicator for evaluating the slurry, which refers to the proportion of solid substances such as active material, conductive agent, and binder in the overall mass of the slurry. During the stirring process of battery slurry, the solid-liquid mixture usually requires two processes: mixing and dispersing. The mixing process is to quickly mix multiple substances, and after mixing, the mixed liquid is uniformly distributed with many solid agglomerates. Dispersing is accomplished by using high-speed rotating blades to cut the agglomerates, dividing the agglomerated substances into smaller particles, and finally achieving the output state where fine solid particles are suspended evenly in the liquid without settling. However, in the prior art, the existing mixer for slurry stirring has the problem of strong dispersing ability but weak kneading ability, resulting in the battery slurry not meeting the desired requirements.

Summary of the Invention

[0003] The present invention aims to solve one of the technical problems in the related art to a certain extent. To achieve the above objectives, the present invention provides a new type of mixer that has the advantages of ensuring dispersing ability while improving kneading ability.

[0004] To achieve the above objectives, the present invention adopts the following technical solution: A mixer, comprising a guide cone, a blocking ring, and a plurality of stirring blocks, wherein the blocking ring surrounds the guide cone and is located at the outer periphery of the guide cone, and the stirring blocks are evenly distributed between the guide cone and the blocking ring, with one end of the stirring blocks connected to the guide cone and the other end connected to the blocking ring.

[0005] During the stirring process of battery slurry, since the slurry is thrown out at high speeds, the amount of slurry directed to the kneading zone is limited, resulting in weak kneading ability. However, the technical solution provided by the present invention sets the blocking ring on the outer side of the stirring block, reducing the slurry being thrown radially, forcibly diverting the slurry to the kneading zone at the bottom of the container, thereby

enhancing the kneading effect and promoting the rapid fusion of powder and liquid, thereby shortening the entire slurry stirring time and improving production efficiency.

[0006] Optionally, the peripheral surface of the blocking ring is provided with a plurality of blocking ring holes; multiple blocking ring holes are distributed on multiple circumferences, and the multiple circumferences are spaced along the axial direction of the blocking ring; the blocking ring holes on the same circumference are evenly distributed, and the blocking ring holes on adjacent circumferences are alternately arranged.

[0007] The barrier ring holes can prevent the occurrence of laminar flow layer in the slurry, which would affect the overall flowability of the slurry and prevent slurry deposition.

[0008] Optionally, the stirrer also includes at least one dispersing column, and at least one stirring block is provided with an installation hole, and the dispersing column is fixed to the stirring block through the installation hole.

[0009] Optionally, both ends of the dispersing column extend from the stirring block, with the length of extension on the same side as the guide cone being greater than the length of extension on the opposite side.

[0010] The battery slurry is stirred by the dispersing column, forced to be rapidly thrown towards the inner wall of the mixing tank. Due to the lower speed in the intermediate region close to the central axis, the mixed liquid in the upper part of the stirring space is inevitably pushed down and fills the intermediate region, thus increasing the flowability of the battery slurry in the stirring space and promoting rapid blending of the components in the battery slurry.

[0011] Optionally, on the same side of the guide cone, the height of the barrier ring exceeds the height of the stirring block but does not exceed half of the length of the dispersing column extension. Optionally, the installation hole is located between the barrier ring and the guide cone.

[0012] The height of the barrier ring is lower than half the height of the dispersing column, which not only plays a drainage role but also reduces the impact on the dispersing effect of the dispersing column.

[0013] Optionally, the number of dispersing columns is the same as the number of stirring blocks, and each stirring block is provided with one dispersing column.

[0014] Setting a dispersing column on each stirring block maximizes the dispersing effect.

[0015] Optionally, the stirring block has opposing positive flow surfaces and reverse flow surfaces, with the reverse flow surface facing the direction of rotation of the stirring block. The positive flow surfaces and reverse flow surfaces are not parallel to the vertical plane, and the reverse flow surfaces of the stirring blocks and neighboring stirring blocks form guide channels. Optionally, the position where the stirring blocks are connected to the guide cone is located in the circumferential direction of the bottom surface of the guide cone.

[0016] Optionally, the stirrer further includes a shaft, the shaft being concentric with the guide cone, one end of the shaft being connected to the bottom surface of the guide cone, and the other end extending to the opposite side of the guide cone.

[0017] When the stirring block rotates, a portion of the battery slurry is cut by the positive flow surface and pushed towards the bottom of the mixing space, which promotes the flow of the battery slurry. The reverse flow surface drains the battery slurry passing through the guide channel. In addition, the guide channels are open radially, allowing trapped bubbles in the battery slurry to be discharged radially and avoiding the formation of closed cavities in the guide channels that would result in a large amount of residual bubbles.

[0018] Meanwhile, this invention also provides a stirring device including a mixing tank, where the mixing tank forms a mixing space, and the stirring device further includes any of the above-mentioned stirrers, which is arranged at the bottom of the mixing space.

[0019] The beneficial effects of the stirring device provided by the present invention are similar to those of the stirrer described above and will not be repeated here.

[0020] These features and advantages of the present invention will be further disclosed in the following specific embodiments and accompanying drawings. The best embodiment or means of the present invention will be described in detail in conjunction with the drawings, but it is not a limitation on the technical solution of the present invention. Additionally, the features, elements, and components appearing in the following text and drawings may have multiple instances and have been labeled with different symbols or numbers for ease of representation, but all represent the same or similar structures or functions.

Illustrated with reference

[0021] The following description of the invention is further illustrated with reference to the accompanying drawings:

Figure 1 is a stereoscopic schematic diagram of an embodiment of the present invention;

Figure 2 is a sectional view of an embodiment of the present invention;

Figure 3 is a top view of an embodiment of the present invention;

Figure 4 is a top view of an embodiment of the present invention;

Figure 5 is a structural schematic diagram of the stirring device provided in an embodiment of the present invention;

Figures 6 to 8 are fluid simulation diagrams of a conventional mixer;

Figures 9 to 12 are fluid simulation diagrams of the embodiment of the present invention without a blocking ring hole;

Figures 13 to 16 are fluid simulation diagrams of the embodiment of the present invention with a blocking ring hole.

[0022] In the drawings, 1- deflector cone, 2- stirring block, 21- positive deflector surface, 22- reverse deflector surface, 23- deflector channel, 24- installation hole, 3- blocking ring, 31- blocking ring hole, 4- dispersing column, 5- shaft, 6-stirring tank, 7-baffle.

Detailed Description

[0023] The specific embodiments of the present invention will be described in detail below. The exemplary embodiments shown in the drawings are intended to explain the invention and should not be construed as limiting the invention.

[0024] In the present specification, the terms "one embodiment," "an embodiment," or "an example" mean that one or more specific features, structures, or characteristics described in conjunction with the embodiment can be included in at least one embodiment disclosed in the present patent application. The phrase "in one embodiment" does not necessarily refer to the same embodiment wherever it appears in the specification.

Embodiment:

[0025] As shown in FIGS. 1 and 2, the present embodiment provides a mixer for stirring battery slurry.

[0026] The mixer includes a deflector cone 1, a shaft 5, a blocking ring 3, and several stirring blocks 2 and dispersing columns 4.

[0027] The shaft 5 is concentric with the deflector cone 1 and integrally formed with the deflector cone 1. One end of the shaft 5 is connected to the bottom surface of the deflector cone 1, and the other end extends to the opposite side of the deflector cone 1. An external torque is applied to the shaft 5 to rotate the mixer.

[0028] The stirring blocks 2 are evenly distributed circumferentially between the deflector cone 1 and the blocking ring 3. One end of the stirring block 2 is connected to the deflector cone 1 and is located at a circumferential position of the bottom surface of the deflector cone 1. The other end is connected to the blocking ring 3. During the stirring process, the battery slurry is thrown out at high speed, and therefore, the slurry flowing into the squeezing and kneading zone is limited, resulting in weak kneading ability. However, the technical solution provided by the present invention solves this problem by setting the blocking ring 3 on the outer side of the stirring block 2, which reduces the slurry thrown out radially and forces the slurry to flow into the squeezing and kneading zone at the bottom of the container, thereby enhancing the kneading effect and promoting rapid fusion of powder and liquid, thereby shortening the stirring time of the entire slurry and improving production efficiency.

[0029] At the same time, the peripheral surface of the blocking ring 3 is provided with several blocking ring holes 31, which can prevent the formation of stagnant layers in the slurry and affect the overall flowability of the slurry, thereby avoiding the deposition of the slurry.

[0030] In this embodiment, the specific manner in which the blocking ring holes 31 are set is not limited. As an optional embodiment, multiple blocking ring holes 31 can be uniformly distributed on the blocking ring 3.

[0031] As another optional embodiment, as shown in FIG. 1, multiple blocking ring holes 31 are distributed on multiple circumferences, and the multiple circumferences are spaced along the axial direction of the blocking ring 3. The number of blocking ring holes 31 set on the same circumference is uniform, and the blocking ring holes 31 on adjacent circumferences are alternately set. To facilitate the flow of the slurry, optionally, the number of blocking ring holes 31 on different circumferences is the same.

[0032] In the embodiment shown in FIG. 1, multiple blocking ring holes 31 are distributed on two circumferences, and the number of blocking ring holes 31 set on the two circumferences is the same.

[0033] The stirring blocks 2 are connected to the deflector cone 1 at circumferential positions of the bottom surface of the deflector cone 1, and are evenly distributed in the circumferential direction. The stirring blocks 2 have positive deflector surfaces 21 and reverse deflector surfaces 22 facing each other, and the reverse deflector surfaces 22 face the direction of rotation of the stirring blocks 2. The positive deflector surfaces 21 and the reverse deflector surfaces 22 are not parallel to the vertical plane, and the reverse deflector surfaces 22 of the stirring blocks 2 and the adjacent reverse deflector surfaces 22 form deflector channels 23.

[0034] When the stirring blocks 2 rotate, the positive deflector surfaces 21 cut a portion of the battery slurry and push it to the bottom of the stirring space, promoting the flow of the battery slurry; the reverse deflector surfaces 22 drain the battery slurry that passes through the deflector channels 23. In addition, the deflector channels 23 are open in the radial direction, allowing any air bubbles trapped in the battery slurry to be discharged radially, without forming a closed cavity inside the deflector channels 23 which can lead to the presence of a large amount of bubble residues.

[0035] As shown in FIGS. 3 and 4, the stirring blocks 2 are provided with installation holes 24, which are located between the blocking ring 3 and the deflector cone 1. In this embodiment, the installation holes 24 penetrate through the stirring blocks 2, and the dispersing columns 4 are fixed to the stirring blocks 2 through the installation holes 24. The installation method can be interference fit or threaded fit, and is not limited in this regard. The number of dispersing columns 4 is equal to that of the stirring blocks 2, and each stirring block 2 is equipped with one dispersing column 4, which maximizes the dispersing effect. The two ends of the dispersing columns 4

extend out of the stirring blocks 2, and the length of extension on the same side as the deflector cone 1 is greater than that on the opposite side of the deflector cone 1.

[0036] The battery slurry is stirred by the dispersing columns 4 and forced to be thrown towards the inner wall of the stirring tank at high speed. The speed is lower in the intermediate area of the stirring blocks 2 on the side closer to the central axis, so the mixed liquid in the upper part of the stirring space surely lowers and fills the intermediate area. This increases the fluidity of the battery slurry in the stirring space, promotes rapid mixing of various components of the battery slurry.

[0037] In this embodiment, there is no specific limitation on the length of dispersing column 4. In the embodiment shown in FIG. 2, the length of dispersing column 4 extending from stirring block 2 is about half the height of deflector cone.

[0038] At the same time, on the same side of deflector cone 1, baffle ring 3 is higher than the height of stirring block 2 but does not exceed half the length of dispersing column 4. This allows baffle ring 3 to drain while minimizing its impact on the dispersing effect of dispersing column 4.

[0039] In this embodiment, there is also no specific limitation on the number of stirring blocks 2, and the number of stirring blocks 2 and dispersing columns 4 can be set according to the specific application scenario. As an optional embodiment, the mixer can have 5 to 9 stirring blocks. In the specific embodiment shown in FIG. 3, the mixer has 7 stirring blocks and 7 dispersing columns.

[0040] Furthermore, this embodiment also provides a mixing device as shown in FIG. 5, which includes a mixing tank 6 forming a mixing space. The mixing device further includes the aforementioned mixer set at the bottom of the mixing space.

[0041] As mentioned above, during the mixing process of the battery slurry in the mixing device, the baffle ring 3 on the outer side of the stirring block 2 reduces the radial slinging of the slurry, forcing the slurry to drain to the compression kneading zone at the bottom of the container. This enhances the kneading effect, promotes rapid fusion of the powders and liquids, shortens the mixing time of the slurry, and improves production efficiency.

[0042] As an optional embodiment, the mixing device may also include at least one flow disturbance plate 7, which is set on the inner wall of the mixing tank 6 and extends in the vertical direction of the mixing tank 6.

[0043] The flow disturbance plate 7 prevents the mixed slurry from flowing radially along the circumference of the mixing tank 6, enhances the upward and downward rolling of the slurry, increases the degree of mixing, and improves the mixing effect.

[0044] As shown in FIG. 6 to FIG. 8, fluid simulation diagrams from the prior art show that most of the fluid is slung out from the upper part of the stirring block 2. Due to the high-speed slinging of the slurry caused by dispersing

columns 4, the amount of slurry drained to the compression kneading zone is limited, resulting in weak kneading capability of the mixer. Therefore, in this embodiment, a baffle ring 3 is added to the outer circle of the stirring block 2. After adding the baffle ring 3, as shown in FIG. 9 to FIG. 12, most of the fluid flows from the compression kneading zone at the bottom of the container where the slurry is mixed.

[0045] To avoid the occurrence of a stagnant flow layer, a plurality of baffle ring holes 31 are evenly distributed on the circumferential surface of the baffle ring 3. After adding the baffle ring holes 31, as shown in FIG. 13 to FIG. 16, most of the fluid still flows from the compression kneading zone at the bottom of the container where the slurry is mixed, and the kneading effect is not affected, while avoiding the occurrence of the stagnant flow layer.

[0046] The above is only a specific embodiment of the present invention, but the scope of the present invention is not limited to this. Those skilled in the art should understand that the present invention includes but is not limited to the content described in the accompanying drawings and the specific embodiments mentioned above. Any modification that does not depart from the functions and structural principles of the present invention will be included in the scope of the claims.

Claims

1. A mixer, comprising a guide cone, a blocking ring, and a plurality of stirring blocks, **characterized in that** the blocking ring surrounds the guide cone and is located at the periphery of the guide cone, and the stirring blocks are evenly distributed between the guide cone and the blocking ring, with one end of the stirring blocks connected to the guide cone and the other end connected to the blocking ring.
 2. The mixer according to claim 1, **characterized in that** the peripheral surface of the blocking ring is provided with a plurality of blocking ring holes; multiple blocking ring holes are distributed on multiple circumferences, and the multiple circumferences are spaced along the axial direction of the blocking ring; the blocking ring holes on the same circumference are evenly distributed, and the blocking ring holes on adjacent circumferences are alternately arranged.
 3. The mixer according to claim 1 or 2, **characterized in that** the mixer further comprises at least one dispersing column, and at least one of the stirring blocks is provided with an installation hole, and the dispersing column is fixed to the stirring block through the installation hole.
 4. The mixer according to claim 3, **characterized in that** both ends of the dispersing column extend out of the stirring block, and the extension length on the
5. The mixer according to claim 4, **characterized in that** on the same side of the guide cone, the blocking ring is higher than the height of the stirring block, but does not exceed half of the extension length of the dispersing column.
 6. The mixer according to claim 3, **characterized in that** the installation hole is located between the blocking ring and the guide cone.
 7. The mixer according to claim 3, **characterized in that** the number of dispersing columns is the same as the number of stirring blocks, and each stirring block is provided with one dispersing column.
 8. The mixer according to claim 1 or 2, **characterized in that** the stirring block has opposite positive flow surfaces and reverse flow surfaces, with the reverse flow surfaces facing the direction of rotation of the stirring block, and the positive flow surfaces and reverse flow surfaces are not parallel to the vertical plane, and the reverse flow surface of each stirring block and the reverse flow surface of the adjacent stirring block form a flow channel.
 9. The mixer according to claim 1 or 2, **characterized in that** the position where the stirring block is connected to the guide cone is located along the circumference of the bottom surface of the guide cone.
 10. The mixer according to claim 1 or 2, **characterized in that** the mixer further comprises a rotating shaft, the rotating shaft being concentric with the guide cone, with one end connected to the bottom surface of the guide cone and the other end extending towards the opposite side of the guide cone.
 11. A stirring device comprising a stirring tank forming a stirring space, **characterized in that** the stirring device further comprises any one of the mixers according to any of claims 1 to 10, and the mixer is arranged at the bottom of the stirring space.

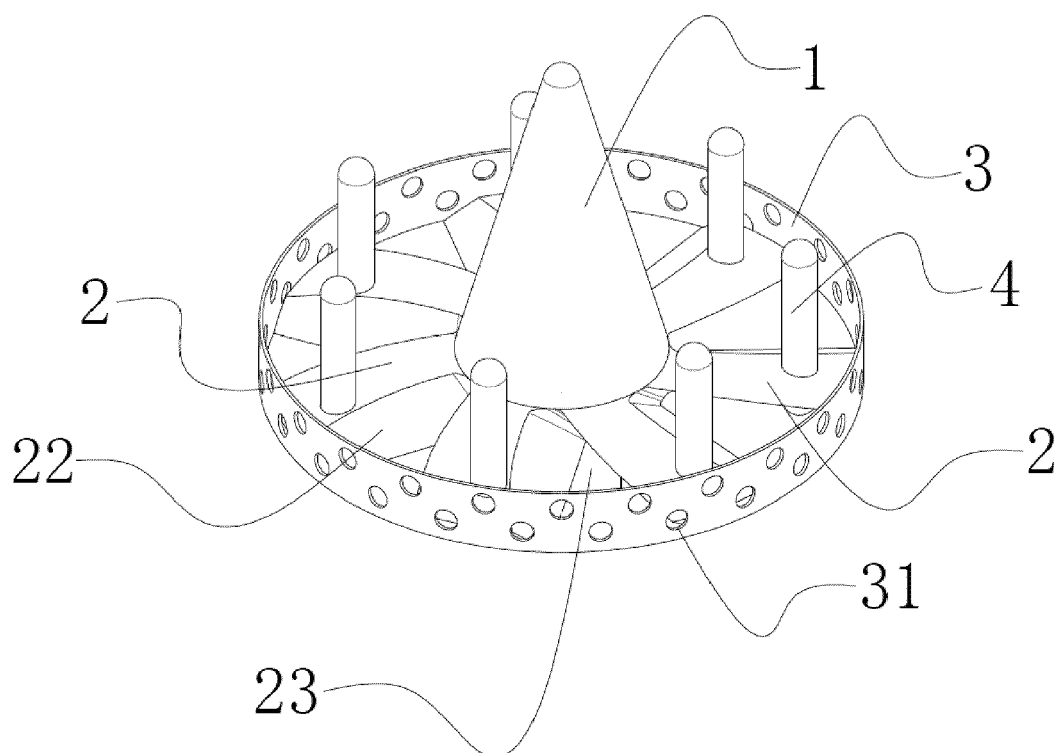


Figure 1

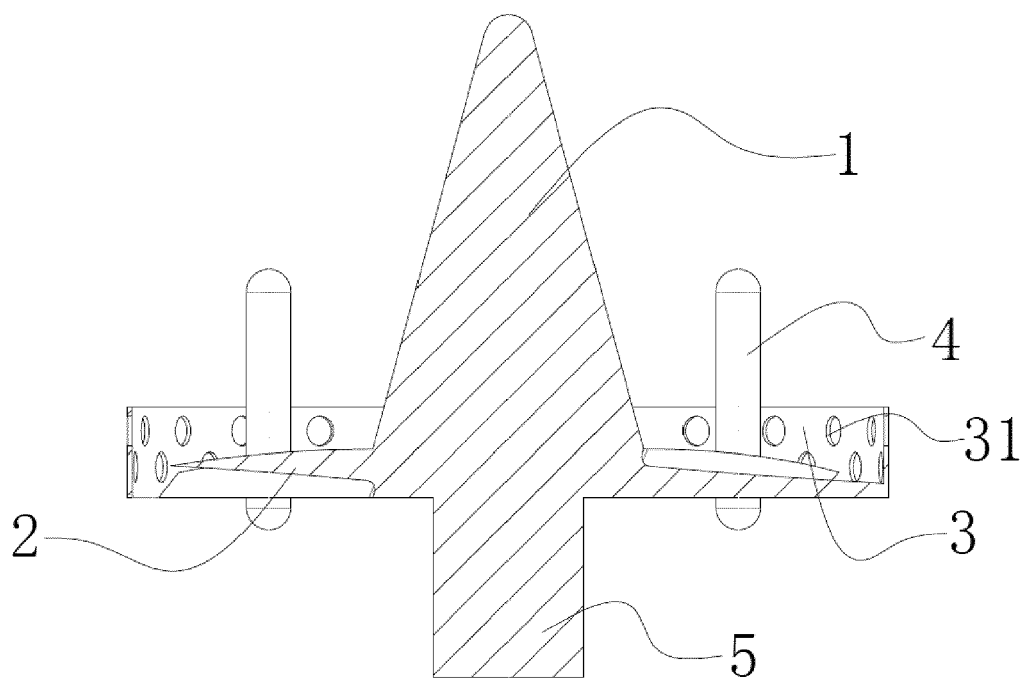


Figure 2

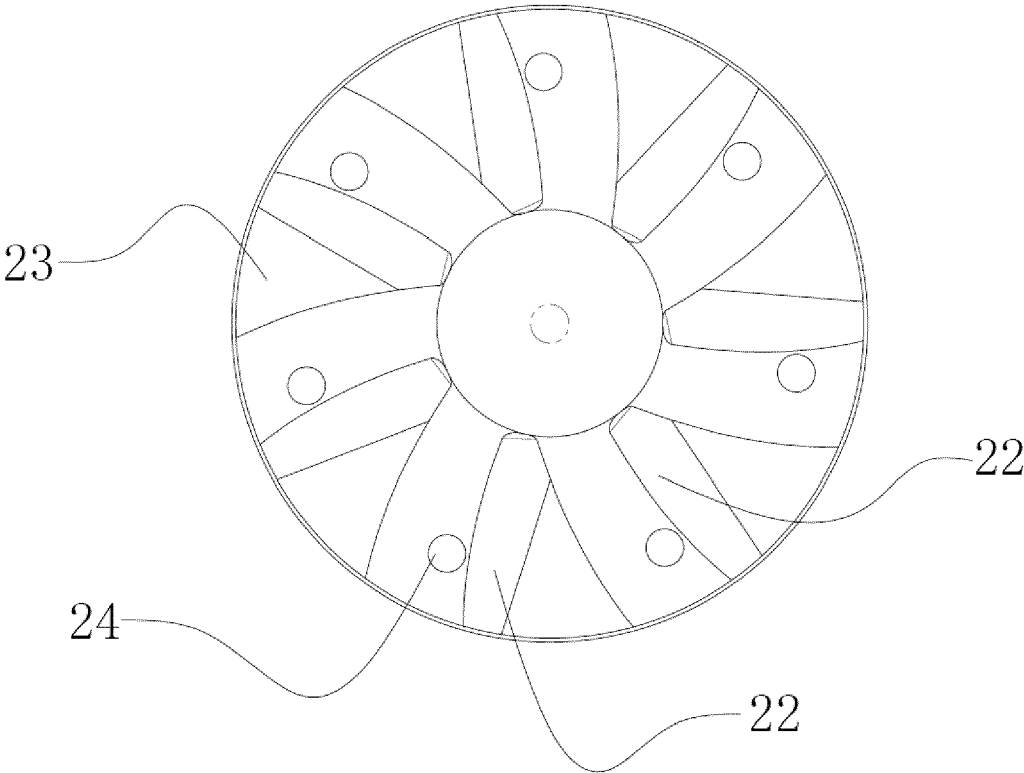


Figure 3

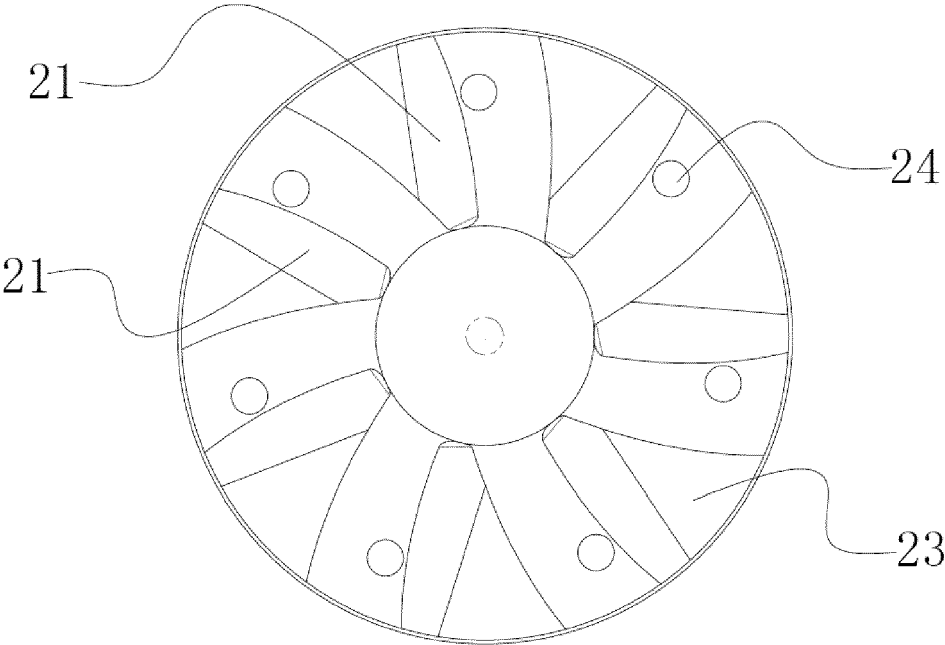


Figure 4

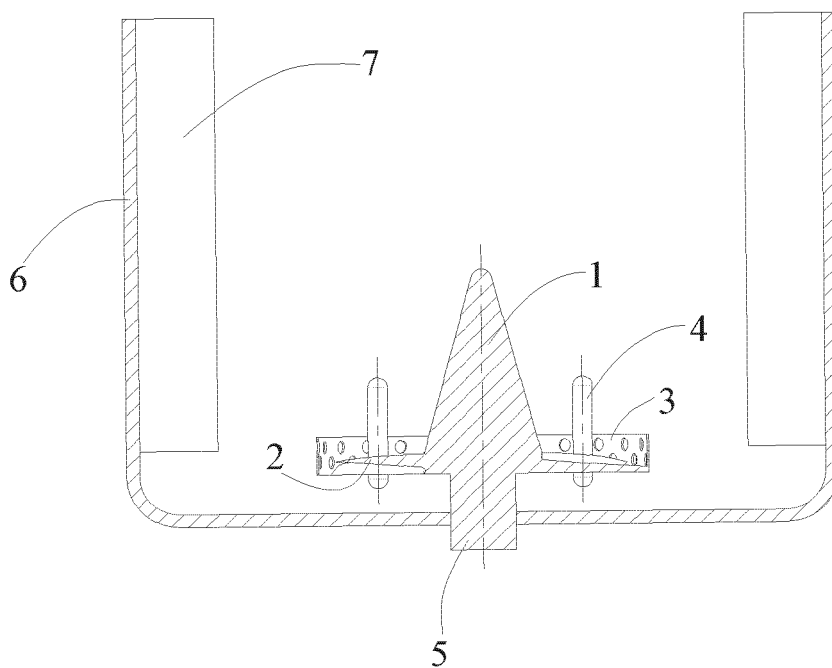


Figure 5

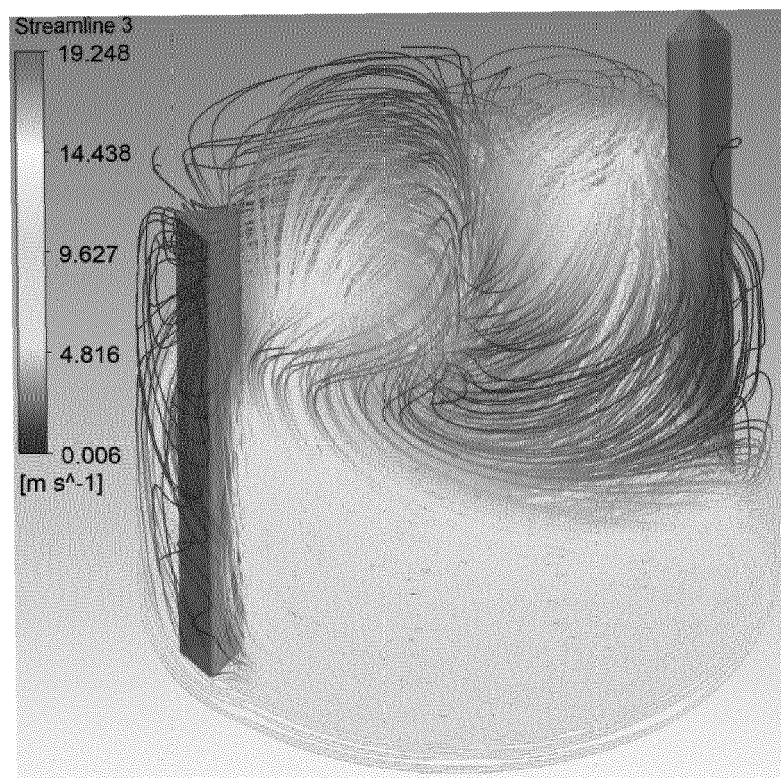


Figure 6

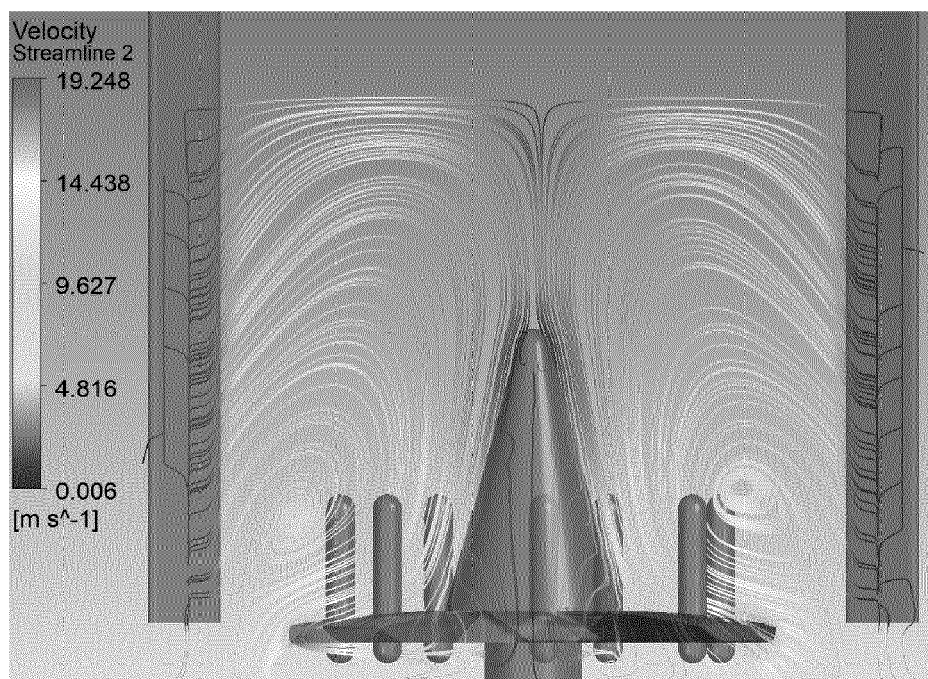


Figure 7

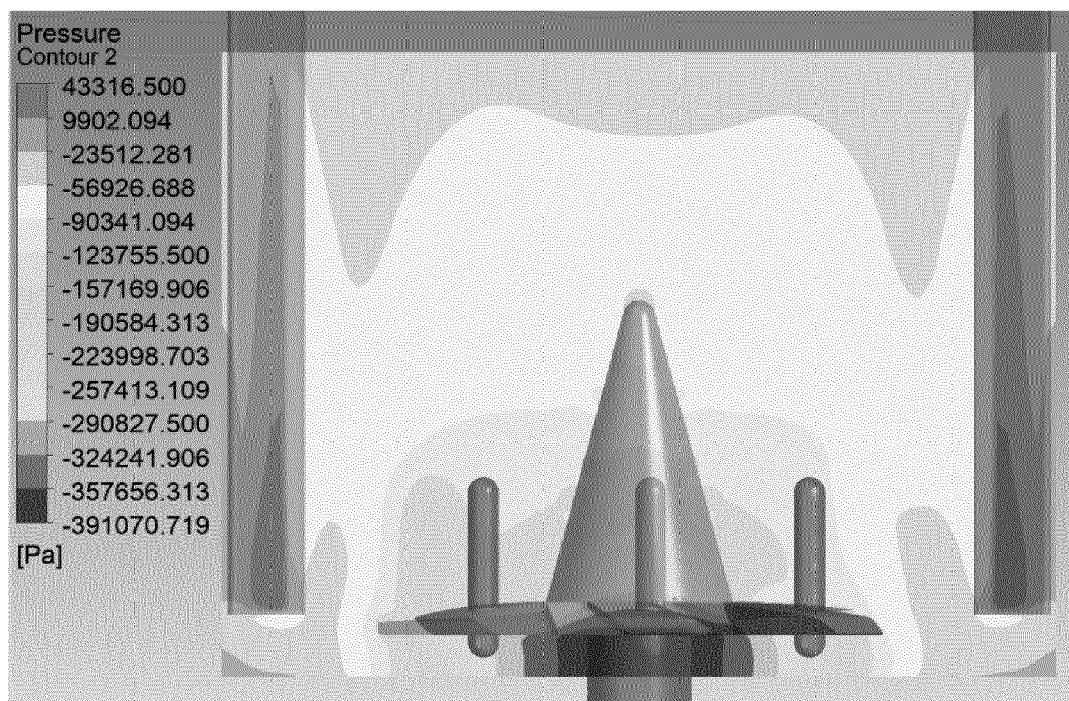


Figure 8

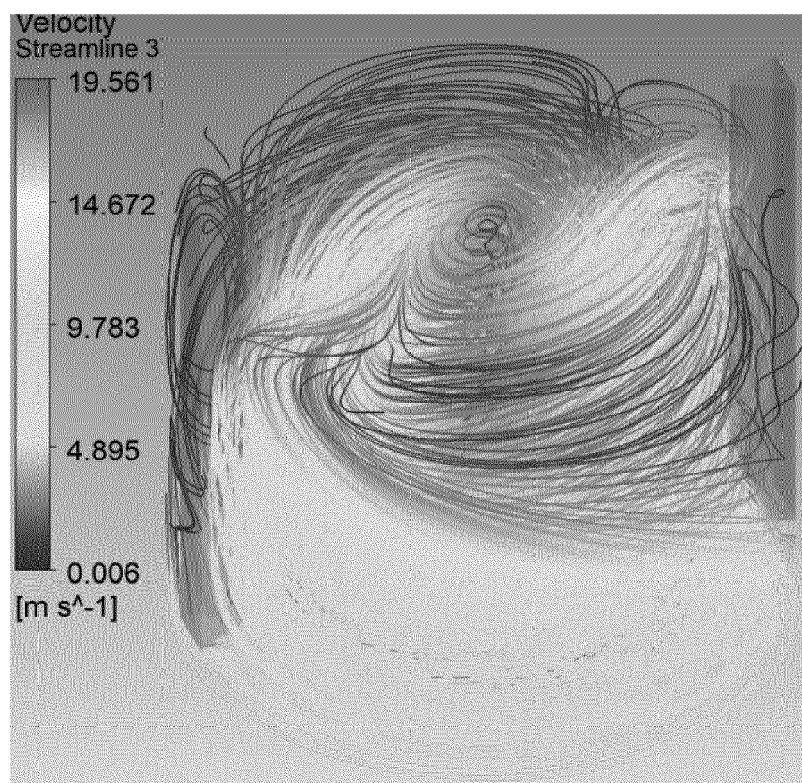


Figure 9

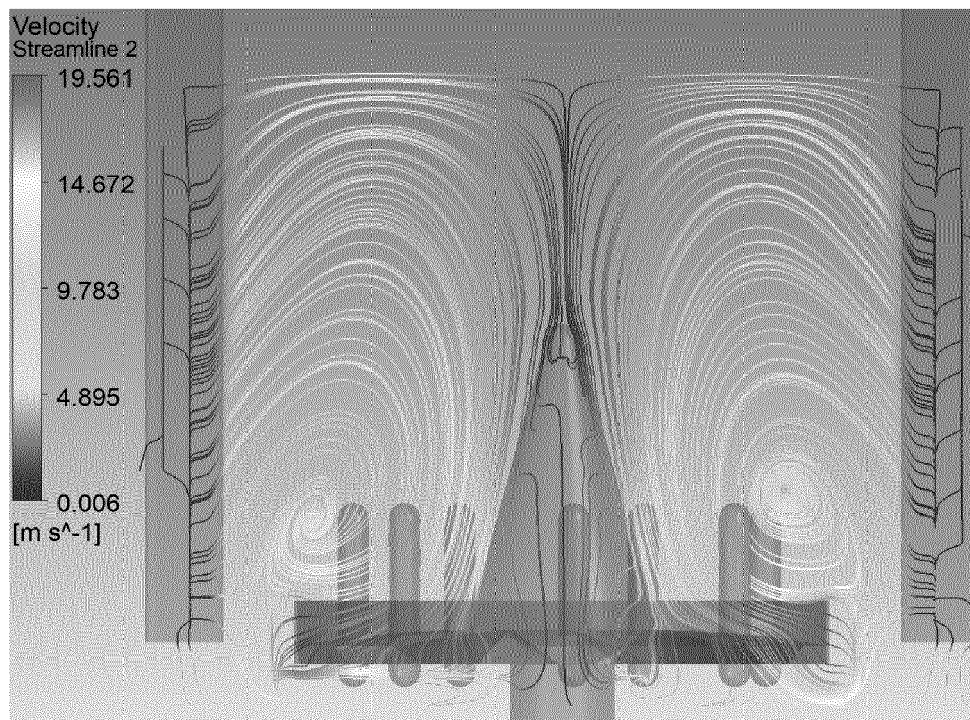


Figure 10

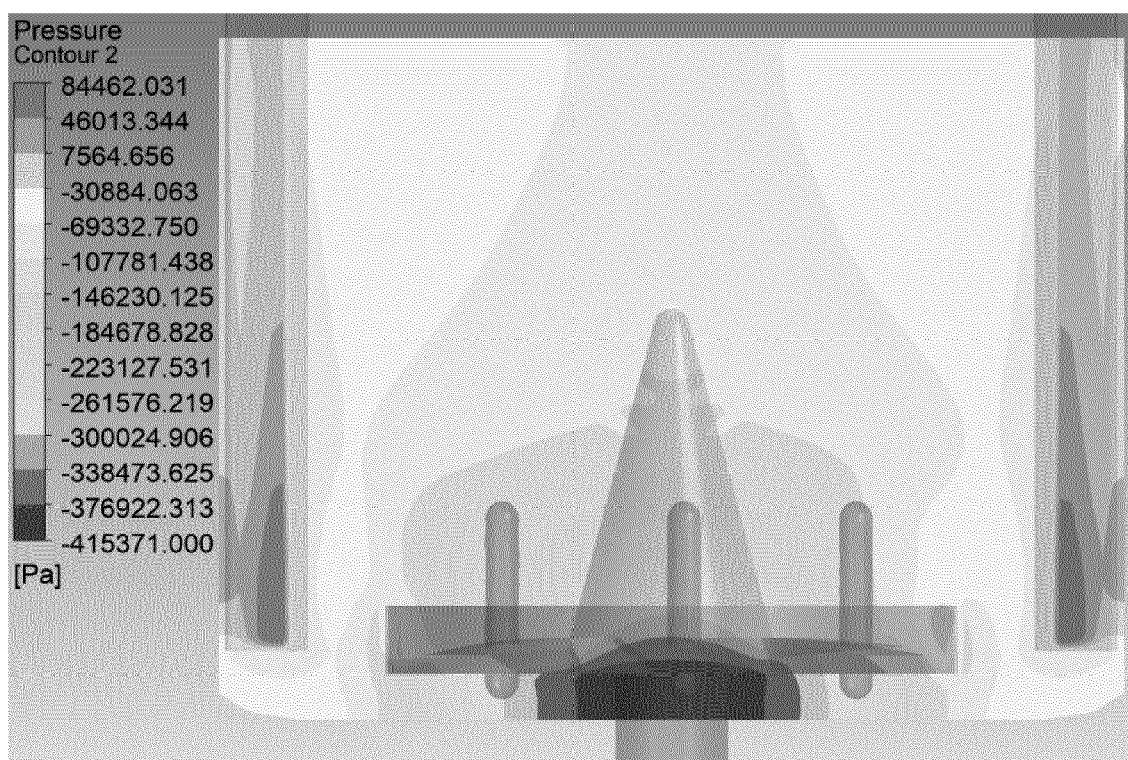


Figure 11

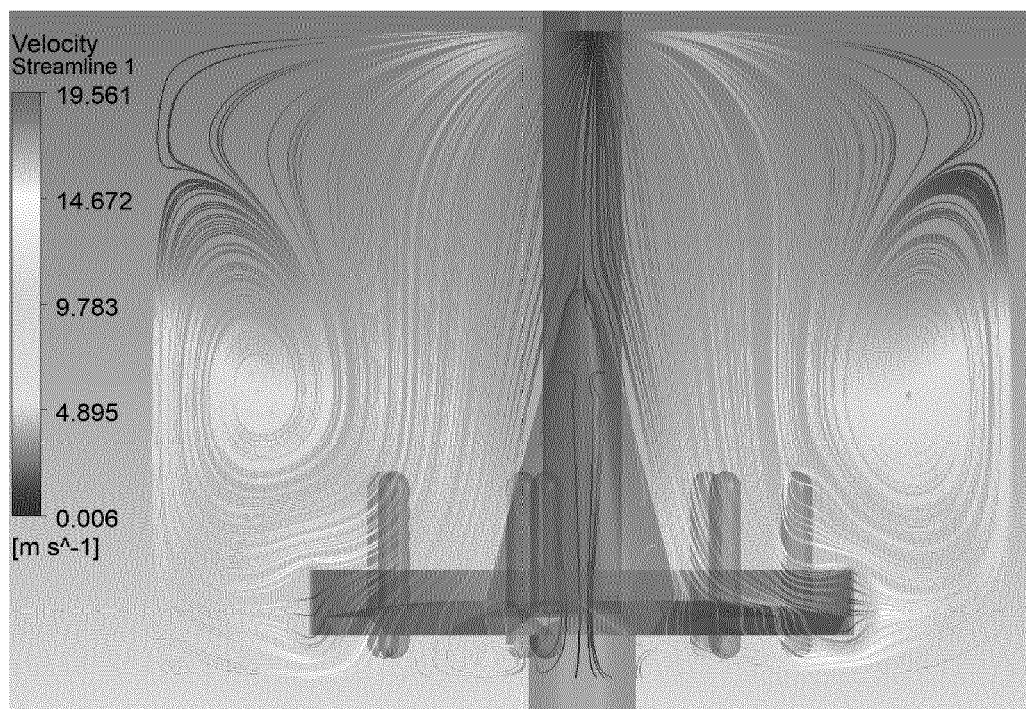


Figure 12

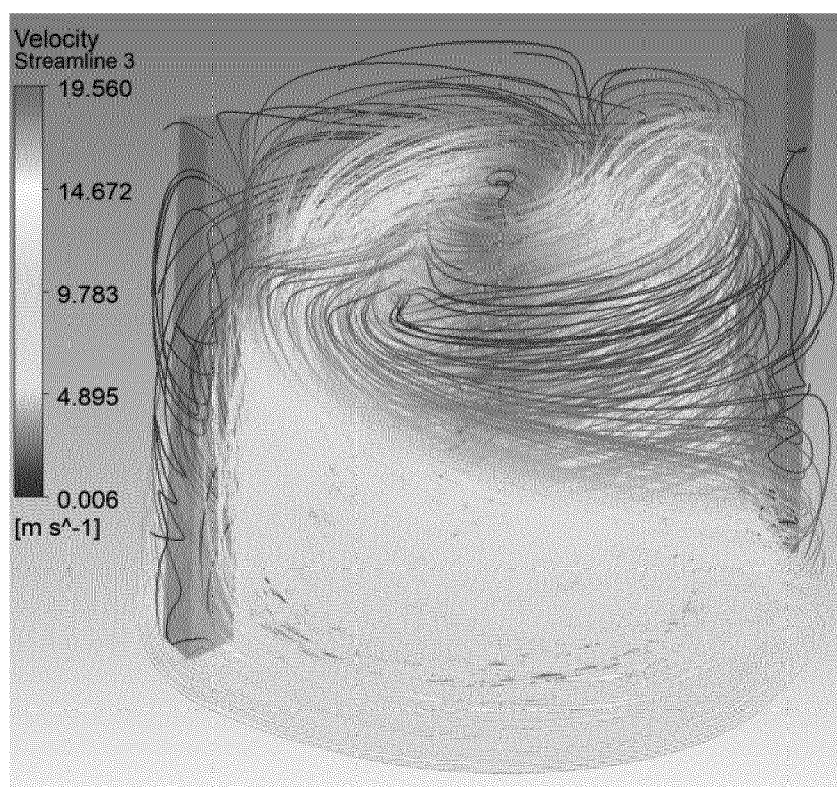


Figure 13

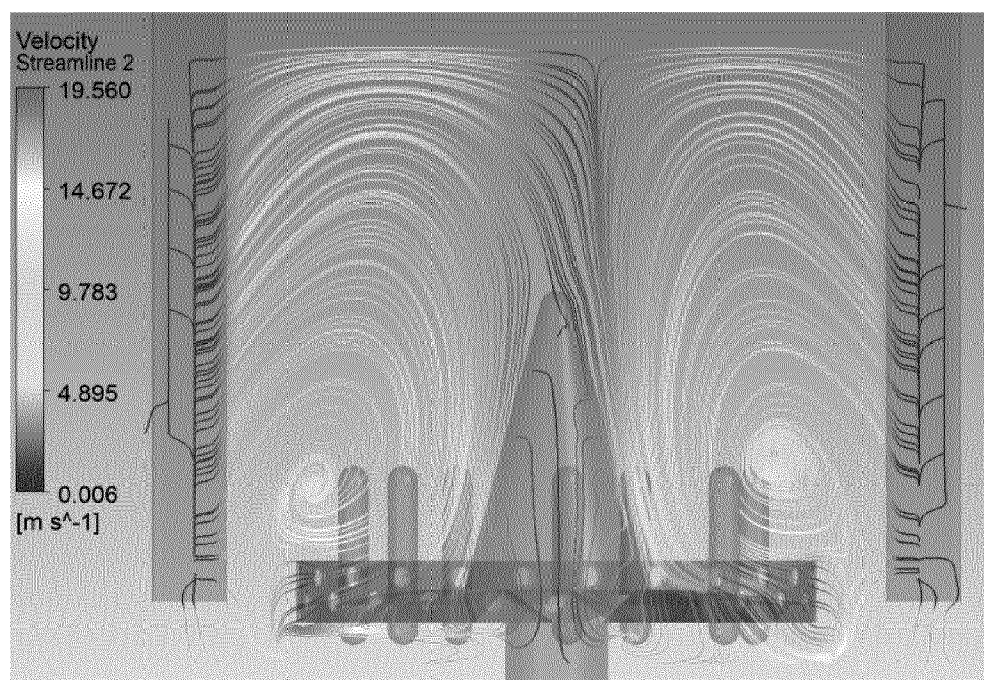


Figure 14

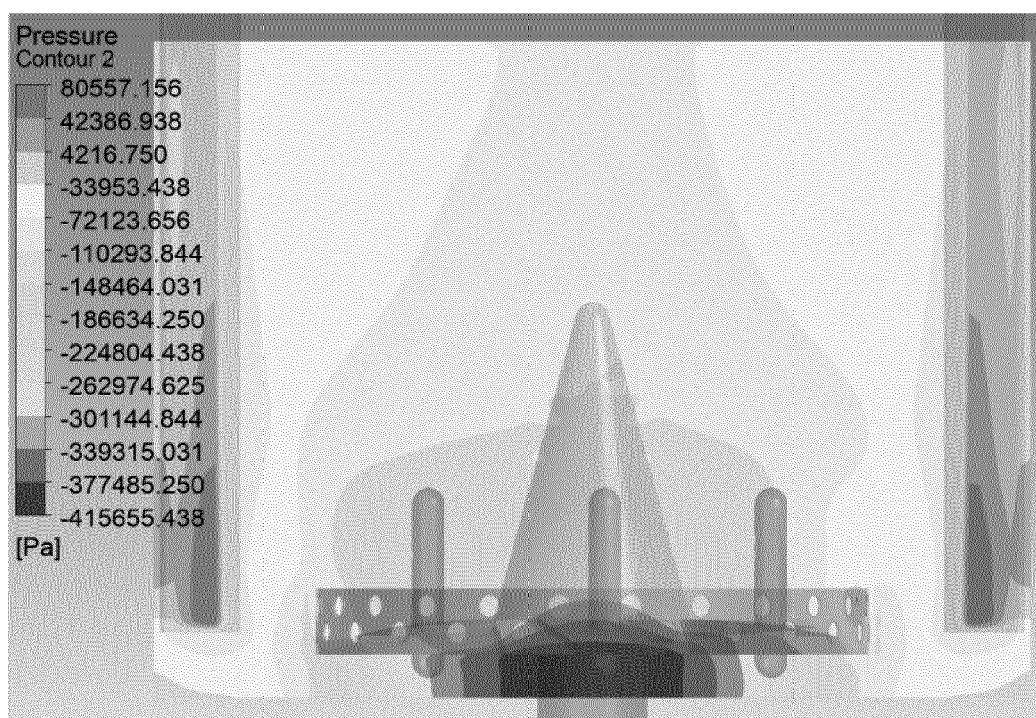


Figure 15

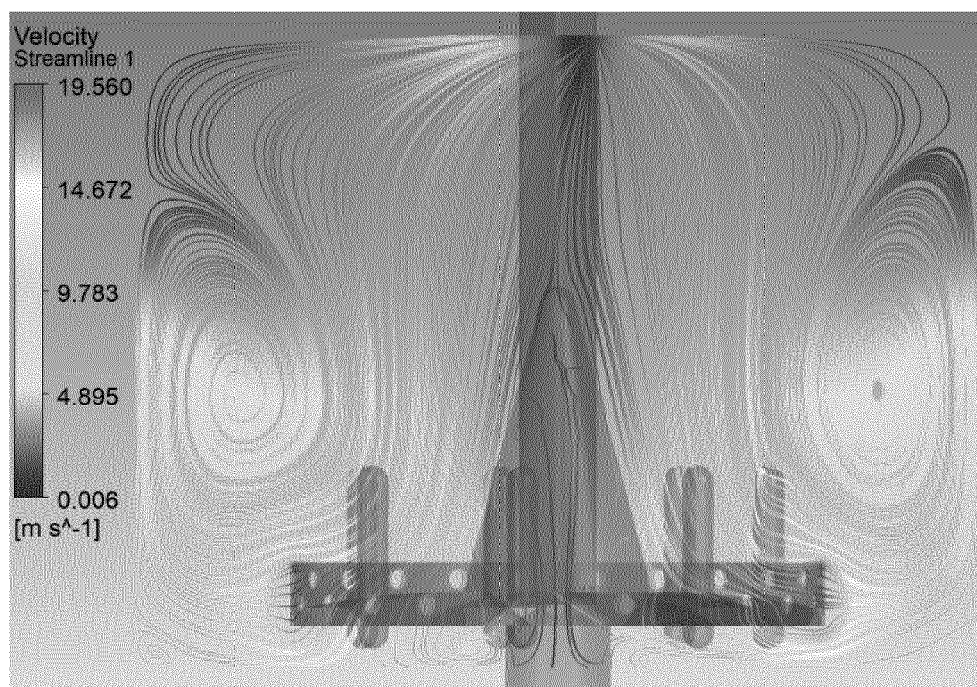


Figure 16



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Application Number

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Place of search		Date of completion of the search	Examiner
The Hague		27 August 2024	Krasenbrink, B
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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