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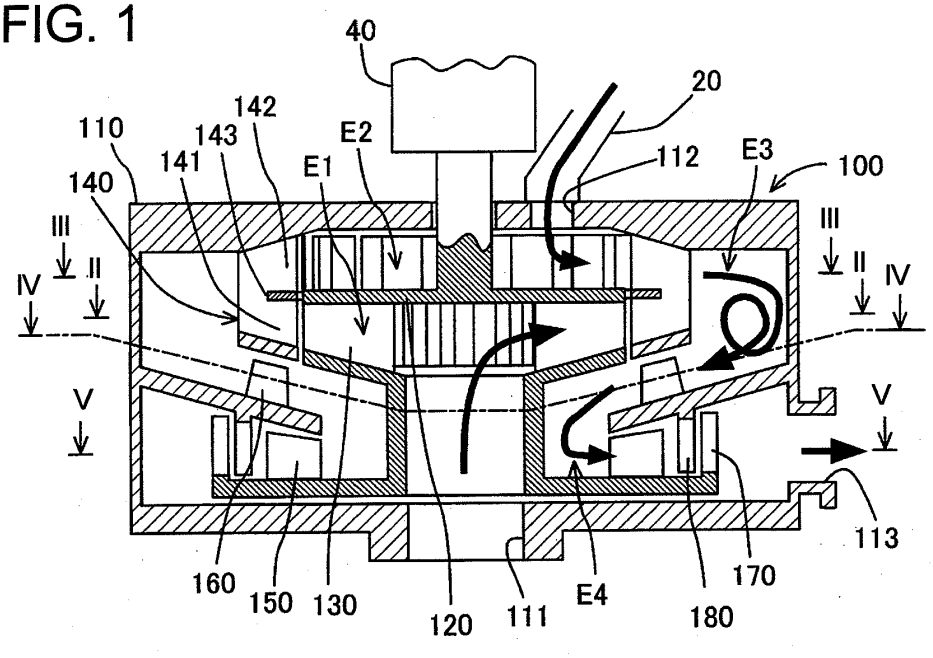
(54) Mixing and dispersing device

(57) A mixing and dispersing device is provided with ante-mixing rotary vanes (130) and post-mixing rotary vanes (150). The ante-mixing rotary vanes (130) are rotatably arranged in a fluidity material side area (E1) and send fluidity material drawn from a radial inside thereof to a first-stage mixing area (E3) being radially outside of a partition plate (120) and induce powder material in a powder side area (E2) to the first-stage mixing area (E3). The post-mixing rotary vanes (150) are arranged in a second-stage mixing area (E4) that is on a downstream side of the first-stage mixing area (E3) and that differs from the first-stage mixing area (E3) in an axial direction, and disperse mixed material of the fluidity material and the powder material flowing from the first-stage mixing area (E3) to the second-stage mixing area (E4) to send out the mixed material to a discharge port (113) being radially outside thereof.

FIG. 1



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Description

INCORPORATION BY REFERENCE

[0001] This application is based on and claims priority under 35 U.S.C. 119 with respect to Japanese patent application No. 2011-283053 filed on December 26, 2011, the entire content of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention:

[0002] The present invention relates to a mixing and dispersing device for mixing fluidity material and powder material and for dispersing the mixture.

Discussion of the Related Art:

[0003] In recent years, lithium-ion rechargeable batteries have been applied to hybrid vehicles, electric vehicles and the like. Electrodes of the lithium-ion rechargeable batteries are formed by applying slurry of active material to a base material made of aluminum foil or the like and by baking the base material. This manufacturing method is described in, for example, JP2010-033786 A and the like.

[0004] The slurry of active material is made by mixing powder of active material in fluid and by dispersing the mixture. Devices described in JP4458536 B and JP2011-52638 A are applicable as a device for mixing and dispersing fluid and powder.

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide a mixing and dispersing device having a dispersing capability being higher than those of the prior art devices.

[0006] According to the present invention in a first aspect, there is provided a mixing and dispersing device for mixing fluidity material and powder material and for dispersing the mixture, and the devices comprises a partition plate dividing a fluidity material side area on an inlet port side for the fluidity material and a powder side area on an inlet port side for the powder material; ante-mixing rotary vanes that are arranged rotatably in the fluidity material side area and that send the fluidity material drawn from a radial inside thereof to a first-stage mixing area being radially outside of the partition plate and induce the powder material in the powder side area to the first-stage mixing area; and post-mixing rotary vanes that are arranged in a second-stage mixing area being on a downstream side of the first-stage mixing area and differing from the first-stage mixing area in an axial direction and that disperse mixed material of the fluidity material and the powder material flowing from the first-stage mixing area to the second-stage mixing area and send out the mixed material to a discharge port being radially outside thereof.

[0007] With this construction, in the first-stage mixing area, the mixed material acts to flow radially outward from the ante-mixing rotary vanes. The first-stage mixing area and the second-stage mixing area are located at axially different positions. Thus, the mixed material in the first-stage mixing area changes in the flow direction to flow to the second-stage mixing area. The change in the flow direction causes vortexes to be generated in the mixed material, whereby the mixed material is dispersed. Accordingly, it can be realized to homogenize the fluidity material (mixed material) discharged from the discharge port.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

[0008] The foregoing and other objects and many of the attendant advantages of the present invention may readily be appreciated as the same becomes better understood by reference to the preferred embodiments of the present invention when considered in connection with the accompanying drawings, wherein like reference numerals designate the same or corresponding parts throughout several views, and in which:

Figure 1 is a longitudinal sectional view of a mixing and dispersing device in a first embodiment according to the present invention;
Figure 2 is a cross-sectional view of the device taken along the line II-II in Figure 1;
Figure 3 is a cross-sectional view of the device taken along the line III-III in Figure 1;
Figure 4 is a cross-sectional view of the device taken along the line IV-IV in Figure 1;
Figure 5 is a cross-sectional view of the device taken along the line V-V in Figure 1;
Figure 6 is a longitudinal sectional view of a mixing and dispersing device in a second embodiment according to the present invention;
Figure 7 is a cross-sectional view of the device taken along the line VII-VII in Figure 6;
Figure 8 is a cross-sectional view of the device taken along the line VIII-VIII in Figure 6; and
Figure 9 is a cross-sectional view of the device taken along the line IX-IX in Figure 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

(First Embodiment)

[0009] A mixing and dispersing device in the present embodiment constitutes a device for manufacturing electrodes (positive electrodes and negative electrodes) for lithium-ion rechargeable batteries, for example. Electrodes of the lithium-ion rechargeable batteries are

formed by applying slurry of active material to a base material made of aluminum foil, copper foil or the like and then by baking the base material. The mixing and dispersing device in the present embodiment is a device for manufacturing slurry of active material. Specifically, the slurry is manufactured by mixing metal powder of active material in liquid such as water or the like and by dispersing the mixture. Hereinafter, the slurry with the powder material mixed and dispersed therein is called "fluidity mixed material", and the liquid before having the powder material mixed therein is called "fluidity base material". Both of the fluidity mixed material and the fluidity base material have fluidity. However, the fluidity mixed material is made to be high in viscosity in comparison with the fluidity base material.

[0010] The mixing and dispersing device in the present embodiment will be described with reference to Figures 1-5. The mixing and dispersing device draws the fluidity base material from the bottom side in Figure 1 into a housing 110, draws the powder material from the upper side in Figure 1 into the housing 110, and generates fluidity mixed material by mixing and dispersing the fluidity base material and the powder material in the housing 110. Then, the device discharges the generated fluidity mixed material from the outer circumferential surface side of the housing 110 outward in a radial direction.

[0011] As shown in Figure 1, the mixing and dispersing device is provided with a device body 100, a powder hopper 20 containing the powder material of the active material therein, and a drive motor 40. The powder hopper 20 and the drive motor 40 are supported by the housing 110 of the device body 100.

[0012] The device body 100 is provided with the housing 110, a partition plate 120, ante-mixing rotary vanes 130, an inducing member 140, second-stage mixing area rotary vanes 150, baffle plates 160, a first annular dispersing member 170 and a second annular dispersing member 180.

[0013] The housing 110 takes a hollow disc shape. The housing 110 is formed at the center of a lower surface thereof with a fluidity material inlet port 111 for drawing the fluidity base material. The housing 110 is formed in the vicinity of the center on an upper surface thereof with a powder inlet port 112 which enables a powder material discharge end of the powder hopper 20 to be fitted therein for drawing the powder material form the powder hopper 20. Then, in the housing 110, the fluidity base material drawn from the fluidity material inlet port 111 and the powder material drawn from the powder inlet port 112 are mixed and dispersed to generate the fluidity mixed material. Further, a part of the outer circumferential surface of the housing 110 is formed with a discharge port 113 for discharging the fluidity mixed material generated in the housing 110.

[0014] The partition plate 120 takes a disc shape. The center portion of the partition plate 120 is fixed to an end portion of a rotational shaft of the drive motor 40. The partition plate 120 is arranged in the housing 110 rotatably about the center axis of the housing 110. The partition plate 120 divides the interior of the housing 110 around the center thereof in the vertical direction into an area E1 (fluidity material side area) on the fluidity material inlet port 111 side located on the lower side and an area E2 (powder side area) on the powder inlet port 112 side located on the upper side. The drive motor 40 is fixed on the upper surface side of the device body 100.

[0015] The ante-mixing rotary vanes 130 constituting an ante-mixing rotary impeller are provided at radially outside portions on the lower surface of the partition plate 120 and are plural in the circumferential direction. That is, the plurality of ante-mixing rotary vanes 130 rotate with the rotation of the partition plate 120. The ante-mixing rotary vanes 130 operate as pump vanes that send out radially outward the fluidity base material drawn from the fluidity material inlet port 111 residing at the radial inside thereof. The respective ante-mixing rotary vanes 130 are formed to deviate or shift their phases in an opposite direction to the rotational direction of the ante-mixing rotary vanes 130 as they go in the radially outward directions. As viewed in Figure 2, since the rotational direction of the ante-mixing rotary vanes 130 is clockwise, the phases of the respective ante-mixing rotary vanes 130 are shifted toward the counterclockwise side as they go radially outward.

[0016] The inducing member 140 is arranged radially outside of the partition plate 120 (i.e., on the downstream side of the partition plate 120 and the ante-mixing rotary vanes 130) and is fixed to the housing 110. The inducing member 140 is provided with a plurality of fluidity material guide passages 141 that speed up the fluidity base material sent from the ante-mixing rotary vanes 130 and send out the fluidity base material to a first-stage mixing area E3 being on the further radially outer side. The fluidity material guide passages 141 are formed to deviate or shift their phases in the rotational direction of the ante-mixing rotary vanes 130 as they go radially outward. That is, the ante-mixing rotary vanes 130 and the fluidity material guide passages 141 of the inducing member 140 serve as a diffuser pump. Each fluidity material guide passage 141 is formed to decrease the flow passage cross section as it goes radially outward. By decreasing the flow passage cross section of each fluidity material guide passage 141 in the downstream direction, it is possible to further speed up the flow of the fluidity base material.

[0017] Further, the inducing member 140 is provided with a plurality of powder guide passages 142 for guiding the powder material in the powder side area E2 toward the first-stage mixing area E3 located radially outside. The powder guide passages 142 are formed by a partition portion 143 on at least the radial inner side independently of the fluidity material guide passages 141. However, the powder guide passages 142 are in communication at the radially outer sides thereof with the fluidity material guide passages 141. That is, with the flow of the fluidity base material in the first-stage mixing area E3 located radially

outside of the fluidity material guide passages 141, it is possible to induce the powder material in the powder side area E2 to the first-stage mixing area E3 through the powder guide passages 142.

[0018] The powder guide passages 142 are formed to extend in the same direction as the fluidity material guide passages 141 do and are formed to deviate or shift their phases in the rotational direction of the ante-mixing rotary vanes 130 as they go radially outward. Further, each powder guide passage 142 is formed to decrease in fluid passage cross section as it goes radially outward. By forming the fluidity material guide passages 141 and the powder guide passages 142 like this, it can be realized to further effectively induce the powder material in the powder side area E2 to the first-stage mixing area E3. Further, by decreasing the flow passage cross section of each powder guide passage 142 in the downstream direction, it becomes easier to induce the powder material to the first-stage mixing area E3.

[0019] The second-stage mixing area rotary vanes 150 (post-mixing rotary vanes) constituting a post-mixing rotary impeller are arranged in a second-stage mixing area E4 that is on the downstream side of the first-stage mixing area E3 and that differs from the first-stage mixing area E3 in the axial direction, and are provided to be plural in the circumferential direction. The plurality of second-stage mixing area rotary vanes 150 are fixed to be one body or united with the ante-mixing rotary vanes 130. That is, with the rotation of the ante-mixing rotary vanes 130, the second-stage mixing area rotary vanes 150 rotate relative to the housing 110. A flow passage extending from the first-stage mixing area E3 to the second-stage mixing area E4 is formed to be slanted downward as it goes radially inward, and then, to go back radially outward (i.e., to make an almost U-turn). Further, the discharge port 113 is formed at a radial outside portion in the second-stage mixing area E4.

[0020] That is, the second-stage mixing area rotary vanes 150 have a function of drawing the fluidity mixed material in the first-stage mixing area E3 to the second-stage mixing area E4. Further, the second-stage mixing area rotary vanes 150 have functions of dispersing the fluidity mixed material flowing from the first-stage mixing area E3 to the second-stage mixing area E4 and of sending out the fluidity mixed material to the discharge port 113. The second-stage mixing area rotary vanes 150 are formed to deviate or shift their phases in the opposite direction to the rotational direction of the second-stage mixing area rotary vanes 150 as they go radially outward. As viewed in Figure 5, since the rotational direction of the second-stage mixing area rotary vanes 150 is clockwise, the phases of the respective second-stage mixing area rotary vanes 150 are shifted toward the counterclockwise side as they go radially outward.

[0021] The baffle plates 160 are fixed to the housing 110 on the flow passage between the first-stage mixing area E3 and the second-stage mixing area rotary vanes 150 and have a function of baffling the flow of the fluidity mixed material. For example, the baffle plates 160 are formed like plates extending in the radial directions.

[0022] The first annular dispersing member 170 takes a cylindrical shape, is arranged radially outside of the second-stage mixing area rotary vanes 150, and is fixed to be one body or united with the second-stage mixing area rotary vanes 150. That is, with the rotation of the second-stage mixing area rotary vanes 150, the first annular dispersing member 170 rotates relative to the housing 110. The first annular dispersing member 170 has a plurality of first protruding teeth in the circumferential direction that protrude upward in the axial direction (in the direction orthogonal to the flow direction of the fluidity mixed material).

[0023] The second annular dispersing member 180 takes a cylindrical shape, is arranged radially outside of the second-stage mixing area rotary vanes 150 and is fixed to the housing 110. The second annular dispersing member 180 is arranged to face the radially inner side (i.e., the internal surface) of the first annular dispersing member 170 and is arranged with a gap in the radial directions between itself and the first annular dispersing member 170 to enable the same to rotate relative thereto.

[0024] The second annular dispersing member 180 has a plurality of second protruding teeth in the circumferential direction that protrude downward in the axial direction (i.e., in the opposite direction to the protruding direction of the first protruding teeth of the first annular dispersing member 170). Accordingly, when rotating relatively, the first annular dispersing member 170 and the second annular dispersing member 180 mix and disperse the fluidity mixed material sent out radially outward by the second-stage mixing area rotary vanes 150.

[0025] Description will then be made regarding the operation of the mixing and dispersing device of the construction as described above. When the drive motor 40 is operated, the partition plate 120, the ante-mixing rotary vanes 130, the second-stage mixing area rotary vanes 150 and the first annular dispersing member 170 are rotated relative to the housing 110. On the other hand, the inducing member 140, the baffle plates 160 and the second annular dispersing member 180 are not rotated because of being fixed to the housing 110.

[0026] With the rotation of the ante-mixing rotary vanes 130, the ante-mixing rotary vanes 130 and the inducing member 140 operate as a diffuser pump, and the fluidity base material is drawn from the fluidity material inlet port 111 to the fluidity material side area E1. The drawn fluidity base material passes through the ante-mixing rotary vanes 130 and the fluidity material guide passages 141 and is sent out to the first mixing area E3. At this time, the flow of the fluidity base material from the fluidity material side area E1 to the first-stage mixing area E3 causes the powder material to be drawn from the powder inlet port 112 to the powder side area E2. The drawn powder material passes through the powder guide passages 142 and is induced to the first-stage mixing area E3.

[0027] Then, by the pumping action of the sec-

ond-stage mixing area rotary vanes 150, the fluidity mixed material in the first-stage mixing area E3 is made to flow to the second-stage mixing area E4. The second-stage mixing area rotary vanes 150 are arranged at the positions that are on the downstream side of the first-stage mixing area E3 and that differ from the position of the first-stage mixing area E3 in the axial direction. Thus, when the fluidity mixed material flows from the first-stage mixing area E3 toward the second-stage mixing area rotary vanes 150, it may occur that vortexes are generated in the fluidity mixed material. Even if the vortexes are generated, the generation of the vortexes effectively acts for dispersion but makes a cause to lower the flow velocity in the flow direction. However, the provision of the baffle plates 160 enables the fluidity mixed material to flow reliably and smoothly to the second-stage mixing area E4.

[0028] Further, the first annular dispersing member 170 and the second annular dispersing member 180 are arranged on the downstream side of the second-stage mixing area E4. Accordingly, the fluidity mixed material sent out radially outward by the second-stage mixing area rotary vanes 150 is further mixed and is dispersed by the shearing force that is produced by the protruding teeth of the respective members. As a result, the dispersed fluidity mixed material is discharged from the discharge port 113. In this manner, the fluidity mixed material is generated.

[0029] As described above, it can be realized to homogenize the fluidity mixed material by the mixing and dispersing operations of the ante-mixing rotary vanes 130 and the inducing member 140, by the mixing and dispersing operations of the second-stage mixing area rotary vanes 150 and by the mixing and dispersing operations of the first annular dispersing member 170 and the second annular dispersing member 180.

(Second Embodiment)

[0030] A mixing and dispersing device in the present embodiment will be described with reference to Figures 6 to 9. In the mixing and dispersing device in the present embodiment, the same constructions as those of the mixing and dispersing device in the first embodiment will be given the same reference numerals, and the description of the same constructions will be omitted.

[0031] A device body 200 is provided with the housing 110, the partition plate 120, the ante-mixing rotary vanes 130, the inducing member 140, first-stage mixing area rotary vanes 210, second-stage mixing area rotary vanes 220, and backflow preventing slit member 230.

[0032] The first-stage mixing area rotary vanes 210 constituting a first-stage mixing area rotary impeller are provided radially outside of the inducing member 140 and are plural in the circumferential direction. The plurality of first-stage mixing area rotary vanes 210 are fixed to be one body or united with the ante-mixing rotary vanes 130. That is, with the rotation of the ante-mixing rotary vanes 130, the first-stage mixing area rotary vanes 210 rotate relative to the housing 110. Then, the first-stage mixing area rotary vanes 210 further send out the powder material and the fluidity base material sent out radially outward from the inducing member 140, to the first-stage mixing area E3 being radially outside thereof.

[0033] The first-stage mixing area rotary vanes 210 are formed to deviate or shift their phases in the opposite direction to the rotational direction of the first-stage mixing area rotary vanes 210 as they go radially outward. As viewed in Figures 7 and 8, since the rotational direction of the first-stage mixing area rotary vanes 210 is clockwise, the phases of the respective first-stage mixing area rotary vanes 210 are shifted toward the counterclockwise side as they go radially outward.

[0034] The second-stage mixing area rotary vanes 220 (post-mixing rotary vanes) constituting a post-mixing rotary impeller are arranged in the second-stage mixing area E4 that is on the downstream side of the first-stage mixing area E3 and that differs from the first-stage mixing area E3 in the axial direction, and are provided to be plural in the circumferential direction. The plurality of second-stage mixing area rotary vanes 220 are fixed to be one body or united with the ante-mixing rotary vanes 130. That is, with the rotation of the ante-mixing rotary vanes 130, the second-stage mixing area rotary vanes 220 rotate relative to the housing 110. The flow passage extending from the first-stage mixing area E3 to the second-stage mixing area E4 is directed in the axial direction, and the discharge port 113 is formed at an outside portion in a radial direction of the second-stage mixing area E4.

[0035] Then, the second-stage mixing area rotary vanes 220 are arranged radially inside in the second-stage mixing area E4. The second-stage mixing area rotary vanes 220 are formed to extend radially (in radial directions). Accordingly, the second-stage mixing area rotary vanes 220 operate to agitate the fluidity mixed material moved from the first-stage mixing area E3, by the radially outer portions thereof and to generate vortexes in the fluidity mixed material. By this operation, the fluidity mixed material is dispersed further. Then, the second-stage mixing area rotary vanes 220 send out the dispersed fluidity mixed material to the discharge port 113 by acting as a delivery machine.

[0036] As shown in Figures 7 and 8, the backflow preventing slit member 230 is arranged at the boundary between the first-stage mixing area E3 and the second-stage mixing area E4 and has a plurality of protruding teeth that protrude in the radially outward directions. That is, slits are formed between the respectively adjacent protruding teeth that adjoin in the circumferential direction. The backflow preventing slit member 230 is fixed to be one body or united with the first-stage mixing area rotary vanes 210 and rotates together with the first-stage mixing area rotary vanes 210.

[0037] The backflow preventing slit member 230 has a function of making the fluidity mixed material flow reliably to the discharge port 113 without allowing the fluidity mixed material to flow back to the first-stage mixing area

E3 when vortexes are generated in the fluidity mixed material in the second-stage mixing area E4. Further, the backflow preventing slit member 230 also has another function of dispersing the fluidity mixed material flowing from the first-stage mixing area E3 to the second-stage mixing area E4. Accordingly, by the backflow preventing slit member 230, it can be realized to reliably discharge the more effectively dispersed fluidity mixed material from the discharge port 113.

[0038] Various features and many of the attendant advantages in the foregoing embodiments will be summarized as follows:

[0039] As the feature in the first aspect, in the mixing and dispensing device in the foregoing first and second embodiments typically shown in Figures 1 and 6, in the first-stage mixing area E3, the mixed material acts to flow radially outward from the ante-mixing rotary vanes 130. The first-stage mixing area E3 and the second-stage mixing area E4 are located at axially different positions. Thus, the mixed material in the first-stage mixing area E3 changes in the flow direction to flow to the second-stage mixing area E4. The change in the flow direction causes vortexes to be generated in the mixed material, whereby the mixed material is dispersed. Accordingly, it can be realized to homogenize the fluidity material (mixed material) discharged from the discharge port 113.

[0040] As the feature in a second aspect, in the mixing and dispensing device in the foregoing first embodiment typically shown in Figures 1 and 5, the first annular dispersing member 170 is provided bodily with the post-mixing rotary vanes 150 radially outside of the post-mixing rotary vanes 150, and the second annular dispersing member 180 is arranged radially outside of the post-mixing rotary impeller 150 to be rotatable relative to the first annular dispersing member 170 and to radially face the first annular dispersing member 170 and disperses the mixed material between itself and the first annular dispersing member 170. Therefore, the mixed material sent by the post-mixing rotary vanes 150 can be dispersed more effectively by the first annular dispensing member 170 and the second annular dispensing member 180.

[0041] As the feature in a third aspect, in the mixing and dispensing device in the foregoing first embodiment typically shown in Figures 1 and 4, the plurality of baffle plates 160 are provided on the flow passage between the first-stage mixing area E3 and the post-mixing rotary vanes 150 and that baffle the flow of the mixed materials. The post-mixing rotary vanes 150 are arranged at the positions that are on the downstream side of the first-stage mixing area E3 and that differ from the position of the first-stage mixing area E3 in the axial direction. Thus, when the mixed material flows from the first-stage mixing area E3 toward the post-mixing rotary vanes 150, it may occur that vortexes are generated in the mixed material. The generation of the vortexes effectively acts for dispersion but makes a cause to lower the flow velocity of the mixed material in the flow direction. Thus, by providing the baffle plates 160, it is possible to make the mixed material flow reliably and smoothly to the post-mixing rotary vanes 150.

(Supplementary Notes)

[0042] The present invention may be practiced as the mixing and dispensing device with the following additional features.

[0043] The mixing and dispensing device in the first aspect, wherein an additional feature resides in that the flow passage extending from the first-stage mixing area E3 to the second-stage mixing area E4 is directed to slant downward in the radial inward direction.

[0044] The mixing and dispensing device in the second aspect, wherein another additional feature resides in that the flow passage extending from the first-stage mixing area E3 to the second-stage mixing area E4 is directed to slant downward in the radial inward direction and that the first and second annular dispersing members 170 and 180 are concentrically arranged to cross or traverse a flow passage that connects the second-stage mixing area E4 to the discharge port 113.

[0045] The mixing and dispensing device in the second aspect, wherein still another additional feature resides in that the flow passage extending from the first-stage mixing area E3 to the second-stage mixing area E4 is directed to slant downward in the radial inward direction and that the baffle plates 160 are arranged on the downward slanted flow passage.

[0046] The mixing and dispensing device in the first aspect, wherein a further additional feature resides in that the flow passage extending from the first-stage mixing area E3 to the second-stage mixing area E4 is directed downward in the axial direction.

[0047] The mixing and dispensing device in the first aspect, wherein a still further additional feature resides in that the flow passage extending from the first-stage mixing area E3 to the second-stage mixing area E4 is directed downward in the axial direction and that the backflow preventing slit member 230 is provided at the boundary between the first-stage mixing area E3 and the second-stage mixing area E4.

[0048] The mixing and dispensing device in the first aspect, wherein a yet further additional feature resides in that the flow passage extending from the first-stage mixing area E3 to the second-stage mixing area E4 is directed downward in the axial direction and that the backflow preventing slit member 230 is provided at the boundary between the first-stage mixing area E3 and the second-stage mixing area E4 and is provided with slits between a plurality of protruding portions which protrude radially outward.

[0049] Obviously, further numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the present invention may be practiced otherwise than as specifically described herein.

[0050] A mixing and dispersing device is provided with ante-mixing rotary vanes (130) and post-mixing rotary vanes (150). The ante-mixing rotary vanes (130) are rotatably arranged in a fluidity material side area (E1) and send fluidity material drawn from a radial inside thereof to a first-stage mixing area (E3) being radially outside of a partition plate (120) and induce powder material in a powder side area (E2) to the first-stage mixing area (E3). The post-mixing rotary vanes (150) are arranged in a second-stage mixing area (E4) that is on a downstream side of the first-stage mixing area (E3) and that differs from the first-stage mixing area (E3) in an axial direction, and disperse mixed material of the fluidity material and the powder material flowing from the first-stage mixing area (E3) to the second-stage mixing area (E4) to send out the mixed material to a discharge port (113) being radially outside thereof.

Claims

1. A mixing and dispersing device for mixing fluidity material and powder material and for dispersing the mixture, comprising:

   a partition plate (120) dividing a fluidity material side area (E1) on an inlet port (111) side for fluidity material and a powder side area (E2) on an inlet port (112) side for powder material;
   ante-mixing rotary vanes (130) that are arranged rotatably in the fluidity material side area (E1) and that send the fluidity material drawn from a radial inside thereof to a first-stage mixing area (E3) being radially outside of the partition plate (120) and induce the powder material in the powder side area (E2) to the first-stage mixing area (E3); and
   post-mixing rotary vanes (150) that are arranged in a second-stage mixing area (E4) being on a downstream side of the first-stage mixing area (E3) and differing from the first-stage mixing area (E3) in an axial direction and that disperse mixed material of the fluidity material and the powder material flowing from the first-stage mixing area (E3) to the second-stage mixing area (E4) and send out the mixed material to a discharge port (113) being radially outside thereof.

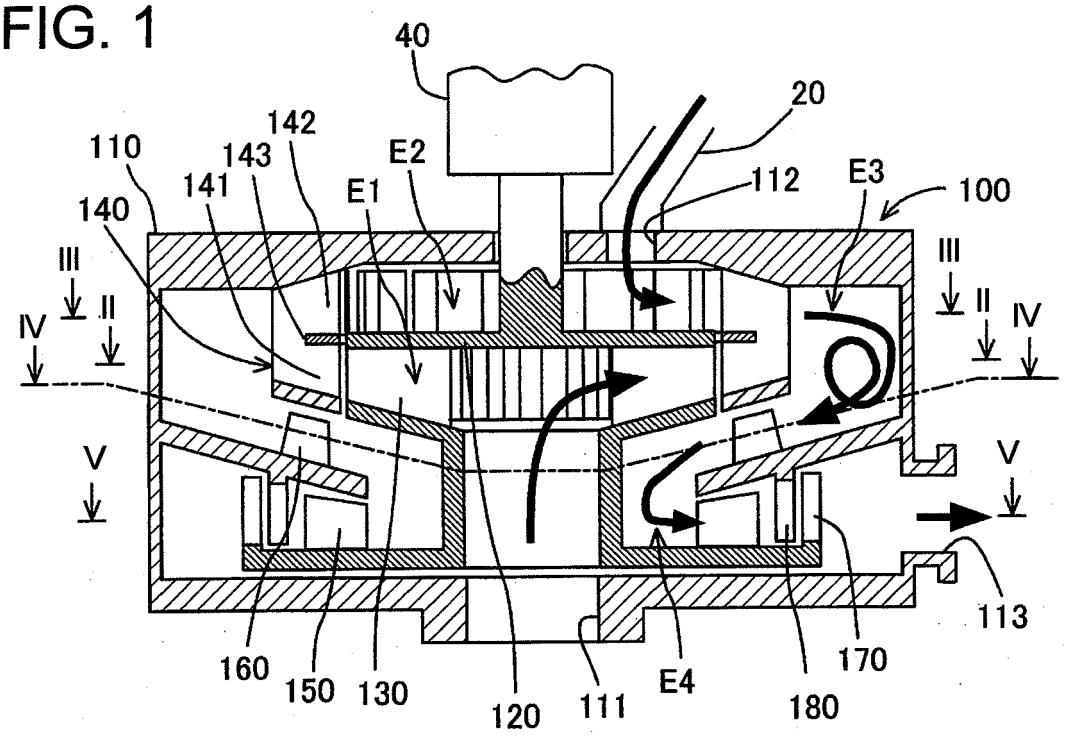
2. The mixing and dispersing device in Claim 1, further comprising:

   a first annular dispersing member (170) provided bodily with the post-mixing rotary vanes (150) radially outside of the post-mixing rotary vanes (150); and
   a second annular dispersing member (180) that is arranged radially outside of the post-mixing rotary vanes (150) to be rotatable relative to the first annular dispersing member (170) and to radially face the first annular dispersing member (170) and that disperses the mixed material between the first and second annular dispersing members (170, 180).

3. The mixing and dispersing device in Claim 1 or 2, further comprising:

   a plurality of baffle plates (160) that are provided on a flow passage between the first-stage mixing area (E3) and the post-mixing rotary vanes (150) and that baffle the flow of the mixed material.

FIG. 1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E4
180
170

FIG. 2

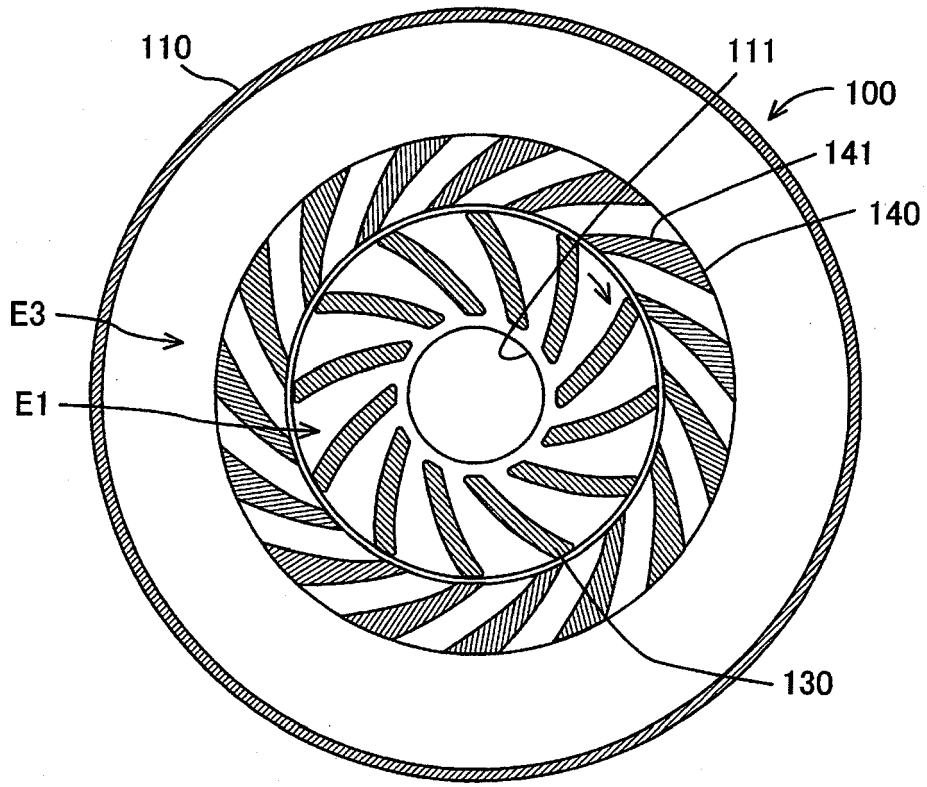


FIG. 3

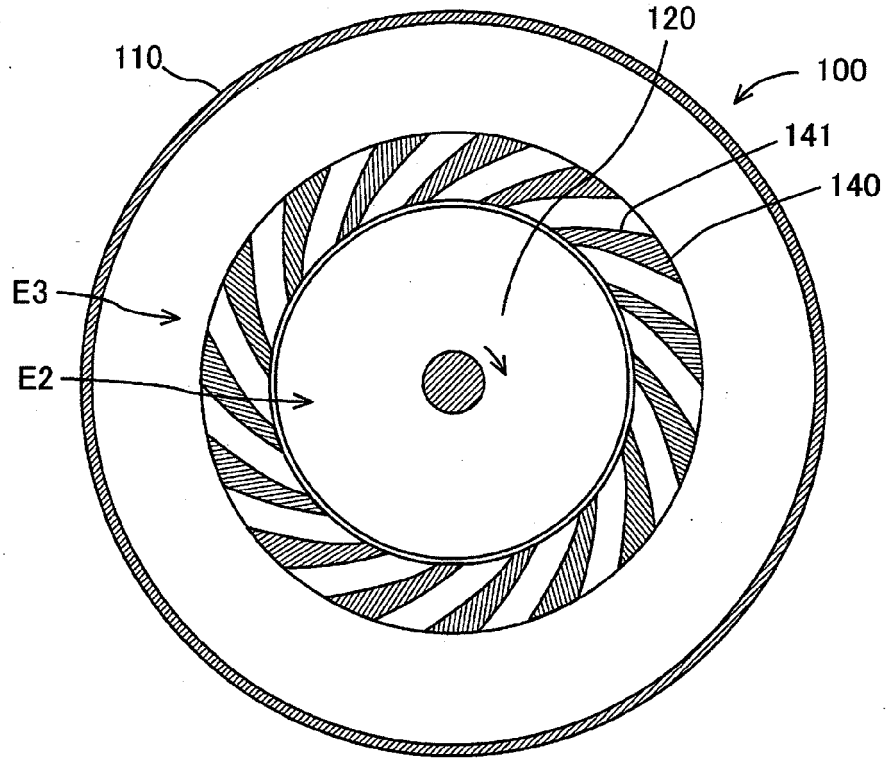


FIG. 4

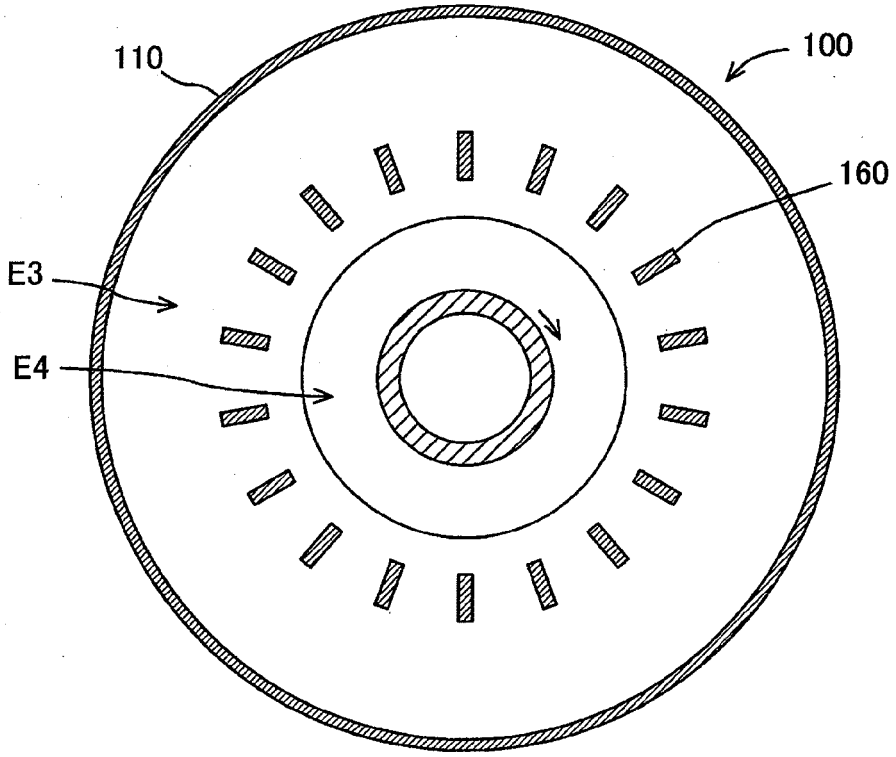


FIG. 5

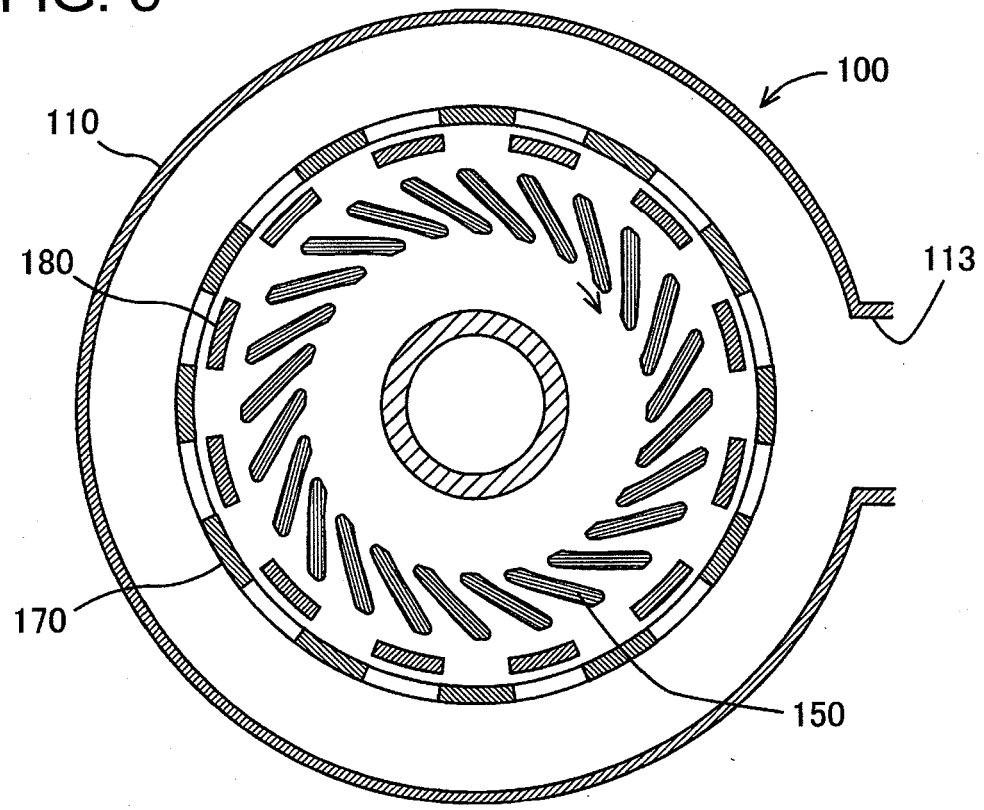
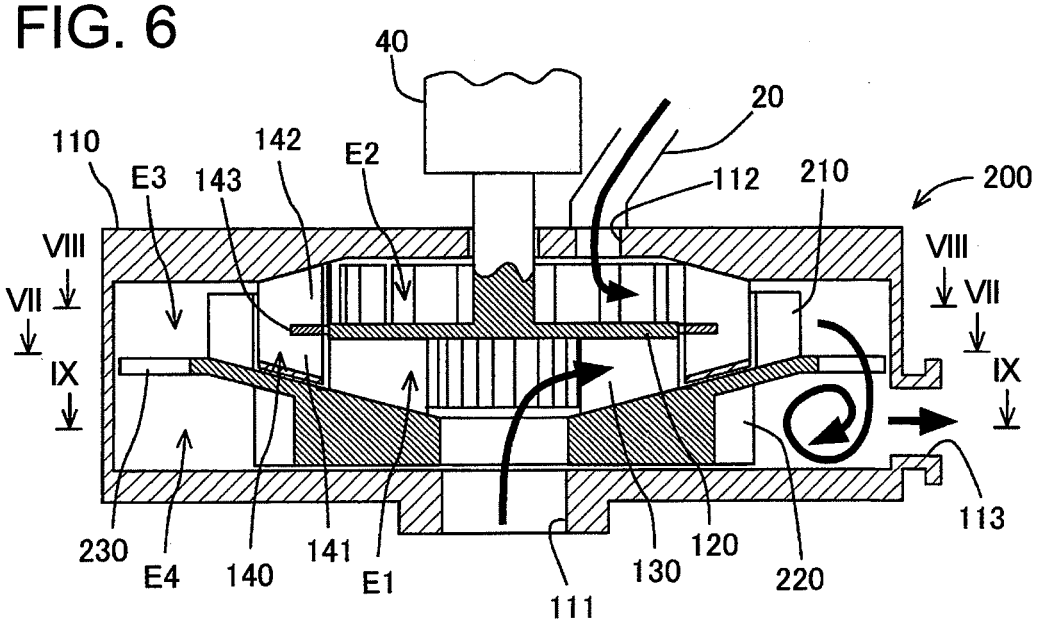

100
110
180
113
170
150

FIG. 6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20
110
142
E2
E3
143
112
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VIII
VII
IX
VIII
VII
IX
230
E4
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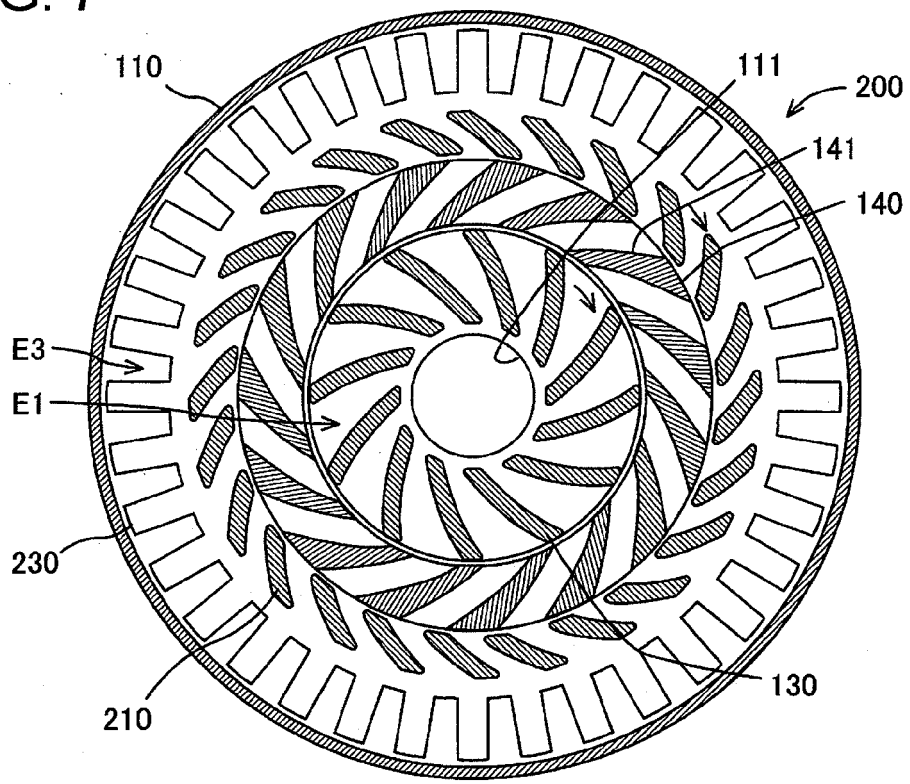
141
E1
111
130
120
220
113

FIG. 7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111
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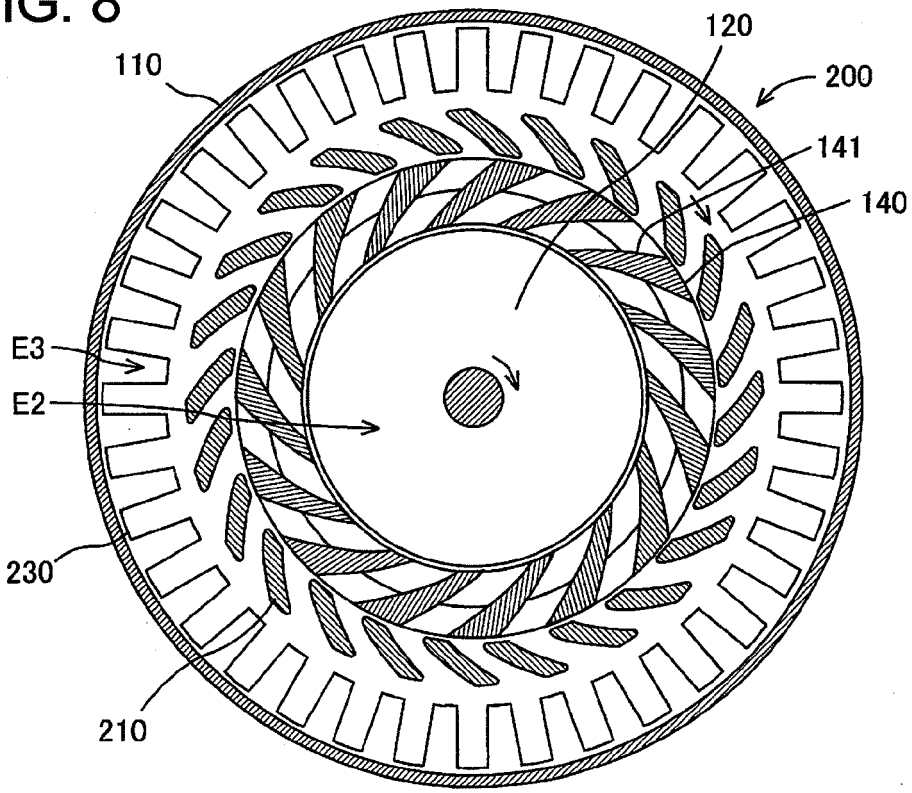
E3
E1
230
210
130

FIG. 8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E3
E2
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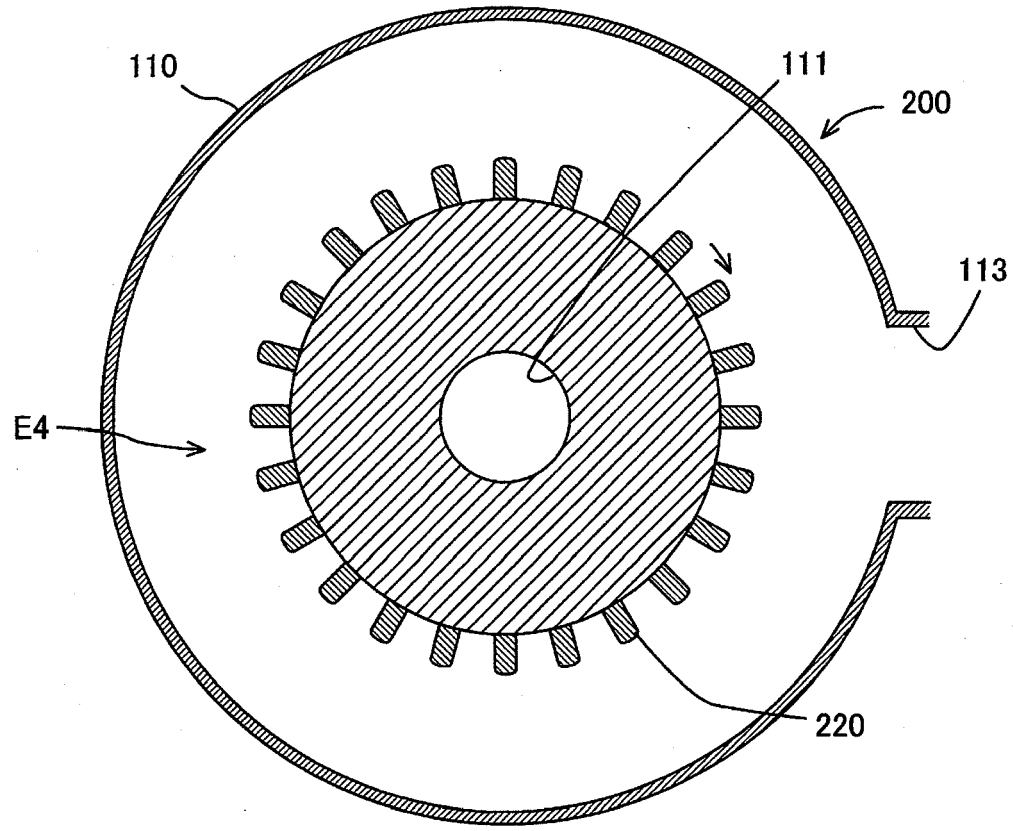
210

FIG. 9



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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 April 2013	Real Cabrera, Rafael

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