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(54) **AIR DISPERSER FOR A SPRAY DRYER AND A METHOD FOR ADJUSTING AN AIR DISPERSER**

LUFTDISPERSER FÜR EINEN SPRÜHTROCKNER UND VERFAHREN ZUR EINSTELLUNG EINES LUFTDISPERSERS

DIFFUSEUR D'AIR POUR UN SÉCHEUR PAR PULVÉRISATION ET PROCÉDÉ DE RÉGLAGE D'UN DIFFUSEUR D'AIR

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Description

[0001] The present invention relates to a spray dryer comprising an air disperser for a spray dryer, comprising a centre constituting a longitudinal axis defining an axial direction and a radial direction extending substantially perpendicularly to said axial direction, and a wall, a space being defined by the centre and the wall of the air disperser, a plurality of guide vanes being provided in said space, an adjustment device being provided for adjustment of the angular position of the guide vanes about at least one axis parallel to said radial direction, the adjustment device including remote operating means.

[0002] In a spray dryer, an air disperser is utilized for introducing the drying air from an air inlet, which may be radial or tangential, into the drying chamber. Traditionally, the air disperser is mounted in the ceiling of the drying chamber. The drying air is brought into contact with the feed, i.e. the liquid being atomized into droplets, by one or more nozzles or other forms of atomizer, such as a rotary atomizer. The drying air enters the drying chamber via the air disperser. For a number of reasons, it is important to obtain a suitable flow of drying air, e.g. to have a more uniform drying of the droplets. Hence, it is the purpose of the air disperser to allow for an optimum distribution of drying air in order to obtain a suitable downward flow of drying air in the drying chamber of the spray dryer.

[0003] In the air dispersers known today it may be difficult to obtain an optimum flow of the drying air. These difficulties may be due to the ducting construction upstream of the supply pipe for the drying air, but may also be the result of the design of the air disperser itself. If the drying air does not flow in an optimum manner in the air disperser, then neither the flow of drying air will be properly distributed at the point where the drying air and the droplets are brought together. Consequently, a nonuniform drying process will be performed resulting in for example formation of deposits on the wall inside of the drying chamber, production of a product of less quality and a reduced capacity.

[0004] For many years it has been known to incorporate guide vanes in air dispersers in order to improve the distribution of drying air. For example in US 4,227,896 (Niro) a gas distribution device for the supply of a processing gas to an atomizing chamber is described, said device containing two sets of guide vanes positioned opposite to each other in order to obtain a more uniform downwards directed flow of the drying air. This design aims at a certain rotational flow, which is advantageous in some applications.

[0005] Also perforated plates have been used in such air dispersers in order to avoid turbulence in the air flow and hence to obtain a more uniform distribution of the air (see for example FR 1.289.817 (Niro)). However, the use of such perforated plates may cause difficulties in respect of keeping the perforated plates clean. Especially, when the spray dryer is to be used in the food or pharmaceutical industry the sanitary aspects of the production design are very important.

[0006] A further air disperser is disclosed in Applicant's published international application No. WO 2007/071238. The design of the air disperser disclosed herein makes it possible to reduce deposits on the inside of the walls of the drying chamber, and the drying capacity as well as the drying economy is markedly improved. In the air disperser described in this document, the guide vanes distribute the incoming drying air. Furthermore, as a result of the particular distribution of the guide vanes, the guide vanes and the entire air disperser are easy to keep clean and, consequently, such a design is very suitable for use in the food industry as well as in the pharmaceutical industry. Additionally, the pressure drop in the air disperser is lower than the pressure drop in known air dispersers and, hence, the energy consumption is markedly decreased in comparison to known air dispersers.

[0007] Further attempts at obtaining a suitable flow include the use of adjustable dampers for directing the drying air inwardly towards the center of the drying chamber in order to avoid contact of the product with the walls and hence reduce deposition on the walls.

[0008] Prior art air dispersers using guide vanes have the drawback that it is necessary to bring the spray dryer to a standstill in order to adjust the position of the guide vanes in order to optimize a process or to adjust to different processing conditions in dependence of for instance the liquid feed to be atomized, e.g. if changing the product to be dried. Such adjustment, using workforce and tools, is time-consuming and entails long downtimes.

[0009] In document WO 99/27316 A1, a spray dryer corresponding to the preamble of claim 1 is described, which alleviates a number of the disadvantages mentioned in the above.

[0010] It is an object of the invention to provide an air disperser for a spray dryer having an improved performance by enabling a more flexible and efficient adjustment, and in a technically robust manner.

[0011] In one aspect of the invention this is achieved by the provision of an air disperser for a spray dryer of the kind mentioned in the introduction, which is furthermore characterized by the features of the characterizing portion of claim 1.

[0012] By the adjustment device of the air disperser according to the invention, it is possible to introduce and to adjust a flow pattern including a swirling component of the jet or stream of drying air, instead of allowing the drying air to be directed substantially in the axial direction or in a fixed swirling manner. The swirling feature has shown to have a stabilizing effect on the drying process taking place in the spray dryer. Furthermore, the remote actuation of the adjustment device entails that the guide vanes may be inclined, i.e. brought to a suitable angled position, from outside the spray dryer without intervention into the air disperser. In turn, this means that adjustment

of the spray dryer, for instance from one feed to another, or in case the characteristics of the feed alters over time, may be performed with only a short change-over time in the operation of the spray dryer. This is particularly advantageous, as different feeds may need different flow patterns. By the easily adjustable arrangement of the invention, the intended flow pattern may be controlled precisely. A particularly robust design is achieved, and furthermore, a particularly flexible operation of the spray dryer is provided.

[0013] The remote adjustment of the guide vanes may additionally take place about at least one axis parallel to said axial direction.

[0014] In a further embodiment, which provides for a very reliable mechanical adjustment of the inclination of the guide vanes, the remote operating means of the adjustment device include a lever extending from a position outside a wall of the spray dryer through a part-circumferential slit in the spray dryer wall, said lever being adapted to be actuated to transfer a rotating movement about the radially extending axis to each of the guide vanes by movement of the lever in the slit.

[0015] In a further embodiment, the adjustment device includes a ring-shaped element arranged concentrically relative to said centre and connected to each of the guide vanes. This facilitates adjustment of the entire set of guide vanes, as operation from the outside by means of a single or only a few remote operating means such as for instance a lever. In addition to the eased adjustment, it is also made sure that all guide vanes assume the same inclined position, as all guide vanes are moved simultaneously. Advantageously, the ring-shaped element is secured to an inner ring surrounding the centre.

[0016] In order to secure an optimum flow pattern, which combines a swirling motion and a downward component, it is important that the guide vanes cover substantially most of the radius, i.e. the distance between the centre and the wall. However, movement of the guide vanes themselves during adjustment must of course be possible, without the risk of damaging the parts of the air disperser. Preferably, the second portion has a width slightly smaller than that of the first portion. In this manner, it is possible to have the first portion extend throughout the distance between the centre and the wall, and still provide for sufficient room for movement during adjustment.

[0017] Correspondingly, the dimensions of the first portion and the second portion of each guide vane should be optimised relative to each other in order to achieve the flow pattern aimed at. As the second portion of the preferred embodiment has the function of directing the swirl to a larger extent than the first portion, the height of the second portion is advantageously larger than that of the first portion, preferably two to five times larger.

[0018] In a similar manner, the dimensions of the second portion itself should be optimised, and preferably, the ratio between the width and the height of the second portion lies in the interval 1:2 to 20:1, preferably1:1 to 4:1.

[0019] The inclination of the guide vanes of the air disperser may in principle be adjusted to any suitable angle relative to the axial direction in the preferred embodiment, i.e. about a radially extending axis, by means of the remote operating means. However, in practice the angular position of the guide vanes is adapted to be adjustable within an angle interval of 0 to 45 degrees, preferably 0 to 22 degrees, and most preferably 0 to 15 degrees. Even small inclinations may have a significant effect on the flow pattern.

[0020] In a further development of this alternative embodiment, the second portion and the third portion are adapted to be adjusted in mutually opposite directions.

[0021] In another aspect of the invention, a method for adjusting an air disperser is provided, comprising the steps according to claim 11.

[0022] Preferably, the adjustment of the angular position of the guide vanes is performed in dependence on the liquid feed to be atomized.

[0023] By the term "air disperser" as used herein is meant any disperser supplied with a drying gas to be used in the spray dryer. A skilled person will know that air is often used as the drying gas when the liquid to be atomized is an aqueous solution, while an inert gas is more likely used, when the liquid to be atomized is a non-aqueous solution. Consequently, the term "drying air" covers all types of drying gas, which may be used in the spray drying process. Additionally, the term "spray drying" should be interpreted as embracing any process including drying, cooling and conditioning of a feed. In the following, the invention will be described in further detail by means of the following description of preferred embodiments and with reference to the drawings, in which

Fig. 1 shows a perspective view of an air disperser for a spray dryer not forming an embodiment of the invention;

Fig. 2 shows a view from another angle of the air disperser shown in Fig. 1;

Fig. 3 shows a perspective view of an air disperser for a spray dryer in an embodiment of the invention;

Fig. 4 shows a view from another angle of the air disperser shown in Fig. 3; and

Figs 5a to 5c show schematic side views of embodiments of the air disperser according to the invention in various positions in a spray dryer.

Fig. 1 and 2 show an air disperser 1 for a spray dryer represented by a cylindrical duct wall 2. The air disperser 1 is connected to an air inlet 10, (see fig. 5), which may be a straight air inlet, or a radial inlet, or a tangential inlet. A centre 3 extends centrally in the air disperser 1, the centre 3 having a longitudinal axis defining an axial direction a and a radial direction r extending substantially perpendicularly to said axial direction a. The air disperser 1 has a wall 4, and a space is defined by the outer side of the centre 3 and the wall 4 of the air disperser 1. In the space between centre 3 and wall 4 of the air disperser 1, a plurality

of guide vanes generally designated 5 is provided. In the embodiment shown, there are eight guide vanes 5 substantially evenly distributed in the circumferential direction. The space between the wall 4 and the external duct wall 2 is preferably filled with insulating material (not shown).

[0024] The centre 3 may include, in a manner known *per se,* feeding means leading to atomization means. The air disperser 1 may for instance be mounted above the ceiling of the drying chamber of the spray dryer. Depending on i.a. the size of the drying chamber, there may be more than one, e.g. three, such air dispersers mounted in the ceiling of the drying chamber. Drying air entering the air disperser from the air inlet is directed into a downward flow of drying air into the drying chamber. Other configurations of the air disperser relatively to the drying chamber are conceivable, cf. in this regard Figs 5a to 5c.

[0025] In the air disperser shown in Fig. 1, each guide vane 5 comprises a first portion 51 positioned substantially vertically in the axial direction a and extending between the centre 3 and the wall 4 substantially on the radius between the centre 3 and the wall 4 of the air disperser. The first portion 51 is firmly connected to the centre 3 and the wall 4 in any suitable manner, for instance by means of welding or riveting.

[0026] A second portion 52 of the guide vane 5 is positioned below, seen in the axial direction, the first portion 51. The second portion 52 has a width, i.e. an extension in the radial direction, which is slightly smaller than that of the first portion, such that the edges facing the centre 3 and the wall 4, respectively, are positioned at a distance from the respective one of centre 3 and wall 4. The height, i.e. the dimension of the second portion 52 in the axial direction, is preferably larger than that of the first portion, and may for instance be two to five times larger. The ratio between the width and the height of the second portion may for instance lie in the interval 1:2 to 20:1, and is preferably from 1:1 to 4:1. The second portion 52 is connected to the first portion 51 at the facing edges of the first and second portions in a rotatable manner, such that the position of the second portion 52 may be adjusted relative to that of the first portion 51. The angle interval may in principle be any interval from substantially in parallel with the first portion 51, i.e. 0 degrees, to perpendicular to the first portion 51, i.e. 90 degrees, However, in practice, the angle interval may be 0 to 45 degrees, preferably 0 to 22 degrees, and most preferably 0 to 15 degrees. The second portion 52 may be positioned either to form an angle in the clockwise or the counter-clockwise direction, or in one direction only.

[0027] The connection between the first portion 51 and the second portion 52 at the facing edges, i.e. the lower edge of the first portion 51 and the upper edge of the second portion 52, may be any rotatable or hinge connection conceivable to the person skilled in the art. The connection could be substantially continuous along the facing edges, or be provided at certain locations only along the facing edges, for instance near the end edges only. The connection should be sufficiently robust to withstand the forces to which the guide vanes of an air disperser in a spray dryer are exposed to.

[0028] The adjustment of the anglular position of the second portion 52 relative to the first portion 51 takes place in a remote manner, i.e. from a location outside the air disperser 1 itself, for instance as indicated outside the external duct wall 2. This is made possible by the remote operating means of the adjustment device. Consequently, the adjustment does not necessitate intervention into the air disperser, and hence, operation of the spray dryer needs not to be stopped. In the embodiment shown, the adjustment device include a lever 6 which extends from outside the external duct wall 2, through a slit 7 extending in the circumferential direction of the external duct wall 2, to a ring-shaped element 8 arranged concentrically relative to the centre 3. For reasons of clarity, the slit 7 is shown at one position in Fig. 2 only. In turn, the ring-shaped element 8 is connected to each of the guide vanes 5, at the lower edge of each second portion 52. Furthermore, the ring-shaped element 8 is secured to an inner ring 81 surrounding the centre 3 by means of a number of spikes 82.

[0029] When adjustment of the guide vanes 5 is desired, the lever 6 is activated from the outside, i.e. remotely, and moved from its end position in the slit 7 in the clockwise direction. Simultaneously, the second portions 52 of the guide vanes 5 are moved from their initial position corresponding to a substantially vertical position, in which each second portion 52 is substantially paralllel to the first portion 51, to an inclined or angled position corresponding to the distance travelled by the lever 6 in the slit 7. Depending on the length of the slit 7 in the circumferential direction, the guide vanes 5 may be angled to a lesser or larger degree. It is of course also conceivable to provide the slit 7 itself or othe parts of the adjustment device with arrestment means, such that the position of the lever 6 may be locked. Hence, by means of the adjustment device adjustment of the angular position of the guide vanes about an axis or two or more axes, in the preferred embodiment shown parallel to the radial direction is made possible by means of the remote operating means. The remote adjustment may be performed manually according to a scale, but is preferably done by means of a motor automatically adjusting the guide vanes angle setting according to a set value from the spray dryer control system.

[0030] The flow in the air disperser 1 is thus adjusted in accordance with the angled position of the guide vanes and assumes a different pattern than is the case with fixed guide vanes extending in parallel with the axial direction only. Preferably, the adjustment of the angular position of the guide vanes about the radially extending axis is performed in dependence on the liquid feed to be atomized. This makes it possible to adjust the swirl of the drying air, and thus to control the flow pattern in a very efficient manner.

[0031] Referring now to Figs 3 and 4, an embodiment of the air disperser according to the invention will be described in detail.

[0032] Fig. 3 and 4 show a preferred embodiment of an air disperser 101 for a spray dryer represented by a cylindrical duct wall 102. The air disperser 101 is connected to an air inlet, which is not shown in the Figures of the drawings, but which may be a radial air inlet or a tangential inlet. A centre 103 extends centrally in the air disperser 101, the centre 103 having a longitudinal axis defining an axial direction a and a radial direction r extending substantially perpendicularly to said axial direction a. The air disperser 101 has a wall 104, and a space is defined by the outer side of the centre 103 and the wall 104 of the air disperser 101. In the space between centre 103 and wall 104 of the air disperser 101, a plurality of guide vanes generally designated 105 is provided. In the embodiment shown, there are eight guide vanes 105 substantially evenly distributed in the circumferential direction. The space between the wall 4 and the external duct wall 2 is preferably filled with insulating material (not shown).

[0033] The centre 103 may include, in a manner known *per se,* feeding means leading to atomization means. The air disperser 101 may for instance be mounted above the ceiling of the drying chamber of the spray dryer. Depending on i.a. the size of the drying chamber, there may be more than one, e.g. three, such air dispersers mounted in the ceiling of the drying chamber. Drying air entering the air disperser from the air inlet is directed into a downward flow of drying air into the drying chamber. Other configurations of the air disperser relatively to the drying chamber are conceivable, cf. in this regard Figs 5a to 5c.

[0034] In the air disperser shown in Fig. 3, each guide vane 105 comprises a first portion 151 positioned substantially vertically in the axial direction a and extending between the centre 103 and the wall 104 substantially on the radius between the centre 103 and the wall 104 of the air disperser. The first portion 151 is firmly connected to the centre 103 and the wall 104 in any suitable manner, for instance by means of welding or riveting.

[0035] In the design, at least some of the guide vanes 105 comprise a first portion 151, a second portion 152 and a third portion 153. In the embodiment shown in Figs 3 and 4, all guide vanes 105 are provided with three portions.

[0036] A second portion 152 of the guide vane 105 is positioned below, seen in the axial direction, the first portion 151. The second portion 152 and the third portion 153, in the embodiment shown, each has a width, i.e. an extension in the radial direction, which is slightly smaller than half of that of the first portion 151, such that the edges facing the centre 103 and the wall 104, respectively, are positioned at a distance from the respective one of centre 103 and wall 104. The height, i.e. the dimension of the second portion 152 in the axial direction, is preferably larger than that of the first portion 151, and may for instance be two to five times larger. The ratio between the width and the height of the second portion may for instance be from 1:4 to 10:1, preferably 1:2 to 2:1. The second portion 152 and the third portion 153 is each connected to the first portion 151 at the facing edges of the first and second portions, and the first and third portions, in a rotatable manner, such that the position of the second portion 152 and the third portion 153 may be adjusted relative to that of the first portion 151. The angle interval may in principle be any interval from substantially in parallel with the first portion 151, i.e. 0 degrees, to perpendicular to the first portion 151, i.e. 90 degrees, However, in practice, the angle interval may be 0 to 45 degrees, preferably 0 to 22 degrees, and most preferably 0 to 15 degrees. The second portion 152 may be positioned either to form an angle in the clockwise or the counter-clockwise direction, or in one direction only. Likewise, the third portion 153 may be positioned either to form an angle in the counter-clockwise or the clockwise direction, or in one direction only.

[0037] The connection between the first portion 151 and the second portion 152, and between the first portion 151 and the third portion 153, at the facing edges, i.e. the lower edge of the first portion 151 and the upper edge of the each of the second portion 152 and the third portion 153, may be any rotatable or hinge connection conceivable to the person skilled in the art. The connection could be substantially continuous along the facing edges, or be provided at certain locations only along the facing edges, for instance near the end edges only. The connection should be sufficiently robust the withstand the forces to which the guide vanes of an air disperser in a spray dryer are exposed to.

[0038] The adjustment of the anglular position of the second portion 152 and the third portion 153 relative to the first portion 151 takes place in a remote manner, i.e. from a location outside the air disperser 101 itself, for instance as indicated outside the duct wall 102. This is made possible by the remote operating means of the adjustment device. Consequently, the adjustment does not necessitate intervention into the air disperser, and hence, operation of the spray dryer needs not to be stopped. In the embodiment shown, the adjustment means include a lever 106 which extends from outside the duct wall 102, through a slit 107 extending in the circumferential direction of the duct wall 102, to a ring-shaped element 108 arranged concentrically relative to the centre 103. For reasons of clarity, the slit 107 is shown at one position in Fig. 3 only. In turn, the ring-shaped element 108 is connected to each of the guide vanes 105, at the lower edge of each second portion 152. Furthermore, the ring-shaped element 108 is secured to an inner ring 181 surrounding the centre 103 by means of a number of spikes 182.

[0039] It is to be understood that there is a counterpart adjustment device is provided for operation of the third portions 153 of the guide vanes 105. For instance, such an adjustment device may also include a lever cooperating with a slit, and with a ring-shaped element posi-

tioned outside, in the radial direction, or the ring-shaped element 108 of the adjustment device for the second portions 152. In the following, only adjustment of the second portion 152 will be described,

[0040] When adjustment of the guide vanes 105 is desired, the lever 106, and its counterpart for the third portions 153, is each activated from the outside, i.e. remotely, and moved from its end position in the slit 107 in the clockwise direction. Simultaneously, the second portions 152 of the guide vanes 105 are moved from their initial position corresponding to a substantially vertical position, in which each second portion 152 is substantially paralllel to the first portion 151, to an inclined or angled position corresponding to the distance travelled by the lever 106 in the slit 107. Depending on the length of the slit 107 in the circumferential direction, the second portions 152 of the guide vanes 105 may be angled to a lesser or larger degree. It is of course also conceivable to provide the slit 107 itself or othe parts of the adjustment means with arrestment elements, such that the position of the lever 106 may be locked. Hence, by means of the adjustment device adjustment of the angular position of the guide vanes about an axis parallel to the radial direction is made possible by means of the remote operating means.

[0041] The flow in the air disperser 101 is thus adjusted in accordance with the angled position of the guide vanes and assumes a different pattern than is the case with fixed guide vanes extending in parallel with the axial direction only. Preferably, the adjustment of the angular position of the guide vanes about the radially extending axis is performed in dependence on the liquid feed to be atomized. This makes it possible to adjust the swirl of the drying air, and thus to control the flow pattern in a very efficient manner.

[0042] In the design, of which one preferred embodiment is shown in Figs 3 and 4, there are a number of possibilities for optimum use of the guide vanes 105:

[0043] First, the guide vanes 105 may be utilized in substance as described in connection with the first preferred embodiment shown in Figs 1 and 2. In this case, the second portion 152 and the third portion 153 are inclined in the same direction, i.e. either clockwise or counter-clockwise. For instance, they may be inclined to the same angle, i.e. such that the second portion 152 and the third portion 153 are substantially parallel to each other. In this case, the second portion 152 and the third portion 153 form an almost coherent surface corresponding in substance to one plate-shaped guide vane portion.

[0044] Second, the second portion 152 and the third portion 153 guide vanes 105 may be positioned such that they are inclined in mutually opposite directions, i.e. one of the second and third portions in the clockwise direction, and the other in the counter-clockwise direction. The flow in the air disperser 101 is thus adjusted in accordance with the angled position of the guide vanes and assumes a different pattern than is the case with fixed guide vanes extending in parallel with the axial direction only, or if there is only one surface angled to with respect to another. As a consequence, a multidirection air swirl is created. Surprisingly, this has turned out to have a number of unexpected positive effects: The amount of the axial air velocity was reduced. Furthermore, the multidirection air swirl had a dampening effect on the rotation of air in the drying chamber. As a further effect, it turned out that droplets were more effectively retained in the jet of drying air. This second possibility of inclining the second portion and the third portion in different directions is not dependent on having an adjustment device including remote operating means. The second possibility is equally applicable to guide vanes having fixed second and third portions, and to adjustment devices not being operable from the outside, but which require intervention into the air disperser.

[0045] The air disperser according to the invention may be positioned at various locations in the spray dryer, and there may be more than one air disperser in one spray dryer. One example is shown in Fig. 5a, in which the air disperser 1 is positioned above the drying chamber 11 of a spray dryer. Atomizing means are provided in the form of nozzles 12 directed towards the centre of the drying chamber. Alternatively and as shown in Fig. 5b, the air disperser 1 is built into the ceiling 11a of the drying chamber and combined with atomizing means in the form of a rotary atomizer 22. In a third configuration, the air disperser 1 is formed as an integrated part of the drying chamber 11, and the atomizing means are provided as one or more nozzles 32 supplied from a nozzle lance system. The nozzle lance may extend through the centre of the air disperser, or outside the air disperser.

[0046] The invention should not be regarded as being limited to the embodiment shown and described in the above but various modifications and combinations of features may be carried out without departing from the scope of the following claims.

Claims

1. A spray dryer comprising an air disperser (1; 101) for a spray dryer, comprising a centre (3; 103) having a longitudinal axis defining an axial direction (a) and a radial direction (r) extending substantially perpendicularly to said axial direction, and a wall (4; 104), a space being defined by the centre (3; 103) and the wall (4; 104) of the air disperser (1; 101), a plurality of guide vanes (5; 105) being provided in said space, an adjustment device (6, 7, 8; 106, 107, 108) being provided for adjustment of the angular position of the guide vanes (5; 105) about at least one axis parallel to said radial direction (r), the adjustment device including remote operating means, **characterized in that** each guide vane (5) comprises a first portion (51; 151) in use positioned substantially vertically in the axial direction (a) substantially on the radius between the centre (3; 103) and the wall (4; 104) of the air disperser, and a second portion (52; 152) of the

guide vane (5; 105) is positioned below the first portion (51; 151), seen in the axial direction, and that at least some of the guide vanes (105) comprise a first portion (151), a second portion (152) and a third portion (153), the second portion (52; 152) and the third portion (153) each being connected to the first portion (51; 151) at the facing edges of the first and second portions and the first and third portions in a rotatable manner, such that the position of the second portion (52; 152) and the third portion (153) may be adjusted relative to that of the first portion (51; 151) about the radially extending axis.

2. A spray dryer according to claim 1, wherein said adjustment device is provided for adjustment of the angular position of the guide vanes about at least one axis parallel to said axial direction (a).

3. A spray dryer according to claim 1 or 2, wherein the remote operating means of the adjustment device include a lever (6; 106) extending from a position outside a duct wall (2; 102) of the air disperser through a part-circumferential slit (7; 107) in the wall (2; 102), said lever (6; 106) being adapted to be actuated to transfer a rotating movement about the radially extending axis to each of the guide vanes (5; 105) by movement of the lever (6; 106) in the slit (7; 107).

4. A spray dryer according to any one of the preceding claims, wherein the adjustment device includes a ring-shaped element (8; 108) arranged concentrically relative to said centre (3; 103) and connected to each of the guide vanes (5; 105).

5. A spray dryer according to claim 4, wherein the ring-shaped element (8; 108) is secured to an inner ring (81; 181) surrounding the centre (3; 103).

6. A spray dryer according to any one of the preceding claims,
wherein the second portion (52; 152) has a width, i.e. the dimension of the vane in the radial direction, slightly smaller than that of the first portion (51; 151).

7. A spray dryer according to any one of the preceding claims, wherein the height, i.e. the dimension in the axial direction, of the second portion (52; 152) is larger than that of the first portion (51; 151), preferably two to five times larger.

8. A spray dryer according to claims 6 and 7, wherein the ratio between the width and the height of the second portion (52; 152) lies in the interval 1:2 to 20:1, preferably 1:1 to 4:1.

9. A spray dryer according to any one of the preceding claims, wherein the angular position of the guide vanes (5; 105) is adapted to be adjustable within an angle interval of 0 to 45 degrees, preferably 0 to 22 degrees, and most preferably 0 to 15 degrees.

10. A spray dryer according to any one of the preceding claims, wherein the second portion (152) and the third portion (153) are adapted to be adjusted in mutually opposite directions.

11. A method for adjusting an air disperser of a spray dryer according to any one of claims 1 to 10, comprising the following steps:

providing a space in the air disperser between a centre having a longitudinal axis defining an axial direction and a radial direction extending substantially perpendicularly to said axial direction, and a wall,
providing a plurality of guide vanes in said space,
providing each guide vane with a first portion, and a second portion,
providing at least some of the guide vanes with a first portion, a second portion and a third portion,
providing an adjustment device for adjustment of the angular position of the guide vanes about at least one axis parallel to said radial direction, and operating said adjustment device by means of remote operating means.

12. A method according to claim 11, wherein the adjustment of the guide vanes is carried out about at least one axis parallel to said axial direction.

13. The method of claim 11 or 12, whereby the adjustment of the angular position of the guide vanes is performed in dependence on a liquid feed to be atomized.

Patentansprüche

1. Sprühtrockner umfassend einen Luftdispergator (1; 101) für einen Sprühtrockner, umfassend
ein Zentrum (3; 103) mit einer Längsachse, die eine axiale Richtung (a) und eine, sich zur axialen Richtung im Wesentlichen rechtwinklig ausdehnende radiale Richtung (r) definiert, und
eine Wand (4; 104), wobei ein Raum vom Zentrum (3; 103) und der Wand (4; 104) des Luftdispergators (1; 101) definiert wird, wobei
eine Vielzahl von Leitschaufeln (5; 105) in dem Raum bereitgestellt wird,
eine Einstelleinrichtung (6, 7, 8; 106, 107, 108), die bereitgestellt wird, um die Winkellage der Leitschaufeln (5; 105) um zumindest eine Achse parallel zu der radialen Richtung (r) einzustellen, wobei die Ein-

stelleinrichtung fernbedienbare Betriebsmittel umfasst,
dadurch gekennzeichnet dass,
jede Leitschaufel (5) ein erstes, in Verwendung im Wesentlichen vertikal in der axialen Richtung (a), im Wesentlichen auf dem Radius zwischen dem Zentrum (3; 103) und der Wand (4; 104) des Luftdispergators ausgerichtetes Teil (51; 151) umfasst, und
ein zweites Teil (52; 152) der Leitschaufel (5; 105) unterhalb des ersten Teils (51; 151), in axialer Richtung betrachtet, angeordnet ist, und dass zumindest einige der Leitschaufeln (105) ein erstes Teil (151), ein zweites Teil (152) und ein drittes Teil (153) umfassen, wobei das zweite Teil (52; 152) und das dritte Teil (153) jeweils an den Stirnkanten (1) des ersten Teils und zweiten Teils, und des ersten Teils und dritten Teils, in einer drehbaren Weise mit dem ersten Teil (51; 151) verbunden ist, so dass die Ausrichtung des zweiten Teils (52; 152) und des dritten Teils (153) relativ, um die sich radial erstreckende Achse, zur Ausrichtung des ersten Teils eingestellt werden kann.

2. Sprühtrockner nach Anspruch 1, wobei die Einstelleinrichtung dazu eingerichtet ist, die Winkellage der Leitschaufeln um zumindest eine Achse parallel zu der axialen Richtung (a) einzustellen.

3. Sprühtrockner nach einem der Ansprüche 1 oder 2, wobei das fernbedienbare Betriebsmittel der Einstelleinrichtung einen Hebel (6; 106) umfasst, der sich von einer Position außerhalb der Kanalwand (2; 102) des Luftdispergators durch einen teil-umfänglichen Schlitz (7; 107) in der Wand (2; 102) erstreckt, wobei der Hebel (6; 106) dazu eingerichtet ist betätigt zu werden, um eine Rotationsbewegung um die sich radial erstreckende Achse zu jeder der Leitschaufeln (5; 105) zu übertragen durch Bewegung des Hebels (6; 106) im Schlitz (7; 107).

4. Sprühtrockner nach einem der vorhergehenden Ansprüche, wobei die Einstelleinrichtung ein ringförmiges Element (8; 108) umfasst, dass konzentrisch um das genannte Zentrum (3; 103) angeordnet und mit jeder Leitschaufel (5; 105) verbunden ist.

5. Sprühtrockner nach Anspruch 4, wobei das ringförmige Element (8; 108) zu einem, dass Zentrum (3; 103) umgebenden, inneren Ring (81; 181) gesichert ist.

6. Sprühtrockner nach einem der vorhergehenden Ansprüche, wobei das zweite Teil (52; 152) eine etwas kleinere Breite, d.h. die Dimension der Schaufel in radialer Richtung, als das erste Teil (51; 151) aufweist.

7. Sprühtrockner nach einem der vorhergehenden Ansprüche, wobei die Höhe, d.h. die Dimension in axialer Richtung, des zweiten Teils (52; 152) größer ist, als die des ersten Teils (51; 151), bevorzugt 2 - 5 mal so groß.

8. Sprühtrockner nach einem der Ansprüche 6 oder 7, wobei das Verhältnis zwischen der Breite und der Höhe des zweiten Teils (52; 152) in einem Intervall zwischen 1:2 bis 20:1, und bevorzugt zwischen 1:1 and 4:1 liegt.

9. Sprühtrockner nach einem der vorhergehenden Ansprüche, wobei die Winkellage der Leitschaufeln (5; 105) dazu eingerichtet ist in einem Winkelbereich von 0 bis 45 Grad, bevorzugt von 0 bis 22 Grad und besonders bevorzug von 0 bis 15 Grad einstellbar zu sein.

10. Sprühtrockner nach einem der vorhergehenden Ansprüche, wobei das zweite Teil (152) und das dritte Teil (153) dazu eingerichtet sind, in einander entgegengesetzten Richtungen einstellbar zu sein.

11. Verfahren zur Einstellung eines Luftdispergators eines Sprühtrockners nach einem der Ansprüche 1 bis 10, umfassend die folgenden Schritte:

Bereitstellen eines Raums im Luftdispergator zwischen einem Zentrum mit einer Längsachse, die eine axiale Richtung und eine, sich zur axialen Richtung im Wesentlichen rechtwinklig ausdehnende radiale Richtung definiert, und einer Wand,
Bereitstellen einer Vielzahl von Leitschaufeln in diesem Raum,
Ausstatten jeder Leitschaufel mit einem ersten Teil, und einem zweiten Teil,
Ausstatten zumindest einiger Leitschaufeln mit einem ersten Teil, einem zweiten Teil, und einem dritten Teil,
Bereitstellen einer Einstelleinrichtung zum Einstellen der Winkellage der Leitschaufeln um zumindest eine Achse parallel zu der genannten radialen Richtung, und
bedienen der genannten Einstelleinrichtung mit Mitteln fernbedienbarer Betriebsmittel.

12. Verfahren nach Anspruch 11, wobei das Einstellen der Leitschaufeln zumindest um eine Achse parallel zur axialen Richtung ausgeführt wird.

13. Verfahren nach einem der Ansprüche 11 oder 12 wobei die Einstellung der Winkellage der Leitschaufeln in Abhängigkeit der Zufuhr einer zu zerstäubenden Flüssigkeit ausgeführt wird.

Revendications

1. Sécheur par pulvérisation comprenant un diffuseur d'air (1 ; 101) pour un sécheur par pulvérisation, comprenant un centre (3 ; 103) qui a un axe longitudinal définissant une direction axiale (a) et une direction radiale (r) qui s'étend globalement perpendiculairement à la direction axiale, et une paroi (4 ; 104), un espace étant défini par le centre (3 ; 103) et la paroi (4 ; 104) du diffuseur d'air (1 ; 101), plusieurs ailettes de guidage (5 ; 105) étant prévues dans ledit espace, un dispositif de réglage (6, 7, 8 ; 106, 107, 108) étant prévu pour un réglage de la position angulaire des ailettes de guidage (5 ; 105) sur au moins un axe parallèle à la direction radiale (r), le dispositif de réglage comprenant des moyens d'actionnement à distance, **caractérisé en ce que** chaque ailette de guidage (5) comprend une première partie (51 ; 151) qui, lors de l'utilisation, est placée globalement verticalement dans la direction axiale (a) globalement sur le rayon entre le centre (3 ; 103) et la paroi (4 ; 104) du diffuseur d'air, et une deuxième partie (52 ; 152) de l'ailette de guidage (5 ; 105) est placée au-dessous de la première partie (51 ; 151), vue dans la direction axiale, et **en ce que** quelques-unes au moins des ailettes de guidage (105) comprennent une première partie (151), une deuxième partie (152) et une troisième partie (153), la deuxième partie (52 ; 152) et la troisième partie (153) étant reliées chacune de manière pivotante à la première partie (51 ; 151) au niveau des bords qui se font face des première et deuxième parties et des première et troisième parties, de telle sorte que la position de la deuxième partie (51 ; 152) et de la troisième partie (153) peut être réglée par rapport à celle de la première partie (51 ; 151) sur l'axe qui s'étend radialement.

2. Sécheur par pulvérisation selon la revendication 1, étant précisé que le dispositif de réglage est prévu pour le réglage de la position angulaire des ailettes de guidage sur au moins un axe parallèle à la direction axiale (a).

3. Sécheur par pulvérisation selon la revendication 1 ou 2, étant précisé que les moyens de manoeuvre à distance du dispositif de réglage comprennent un levier (6 ; 106) qui s'étend à partir d'une position située à l'extérieur d'une paroi de conduit (2 ; 102) du diffuseur d'air et qui traverse une fente en partie circonférentielle (7 ; 107) de la paroi (2 ; 102), ledit levier (6 ; 106) étant apte à être actionné pour transmettre un mouvement de pivotement, sur l'axe s'étendant radialement, à chacune des ailettes de guidage (5 ; 105) grâce au mouvement du levier (6 ; 106) dans la fente (7 ; 107).

4. Sécheur par pulvérisation selon l'une quelconque des revendications précédentes, étant précisé que le dispositif de réglage comprend un élément annulaire (8 ; 108) qui est disposé de manière concentrique par rapport au centre (3 ; 103) et qui est relié à chacune des ailettes de guidage (5 ; 105).

5. Sécheur par pulvérisation selon la revendication 4, étant précisé que l'élément annulaire (8 ; 108) est fixé à un anneau intérieur (81 ; 181) qui entoure le centre (3 ; 103).

6. Sécheur par pulvérisation selon l'une quelconque des revendications précédentes, étant précisé que la deuxième partie (52 ; 152) présente une largeur, c'est-à-dire une dimension de l'ailette dans la direction radiale, qui est légèrement inférieure à celle de la première partie (51 ; 151).

7. Sécheur par pulvérisation selon l'une quelconque des revendications précédentes, étant précisé que la hauteur, c'est-à-dire la dimension dans la direction axiale, de la deuxième partie (52 ; 152) est supérieure à celle de la première partie (51 ; 151), de préférence deux à cinq fois supérieure.

8. Sécheur par pulvérisation selon les revendications 6 et 7, étant précisé que le rapport entre la largeur et la hauteur de la deuxième partie (52 ; 152) est situé dans l'intervalle de 1:2 à 20:1, de préférence de 1:1 à 4:1.

9. Sécheur par pulvérisation selon l'une quelconque des revendications précédentes, étant précisé que la position angulaire des ailettes de guidage (5 ; 105) est apte à être réglable à l'intérieur d'un intervalle d'angle de 0 à 45 degrés, de préférence de 0 à 22 degrés, et plus spécialement de 0 à 15 degrés.

10. Sécheur par pulvérisation selon l'une quelconque des revendications précédentes, étant précisé que la deuxième partie (152) et la troisième partie (153) sont aptes à être réglées dans des directions mutuellement opposées.

11. Procédé de réglage d'un diffuseur d'air d'un sécheur par pulvérisation selon l'une quelconque des revendications 1 à 10, comprenant les étapes suivantes, qui consistent :

    à prévoir un espace, dans le diffuseur d'air, entre un centre qui a un axe longitudinal définissant une direction axiale et une direction radiale qui s'étend globalement perpendiculairement à la direction axiale, et une paroi,
    à prévoir plusieurs ailettes de guidage dans ledit espace,
    à doter chaque ailette de guidage d'une première partie et d'une deuxième partie,

à doter quelques-unes au moins des ailettes de guidage d'une première partie, d'une deuxième partie et d'une troisième partie,
à prévoir un dispositif de réglage pour régler la position angulaire des ailettes de guidage sur au moins un axe parallèle à la direction radiale, et à manoeuvrer le dispositif de réglage à l'aide de moyens de manoeuvre à distance.

12. Procédé selon la revendication 11, étant précisé que le réglage des ailettes de guidage est réalisé sur au moins un axe parallèle à la direction axiale.

13. Procédé selon la revendication 11 ou 12, grâce auquel le réglage de la position angulaire des ailettes de guidage est réalisé en fonction d'une amenée de liquide à pulvériser.

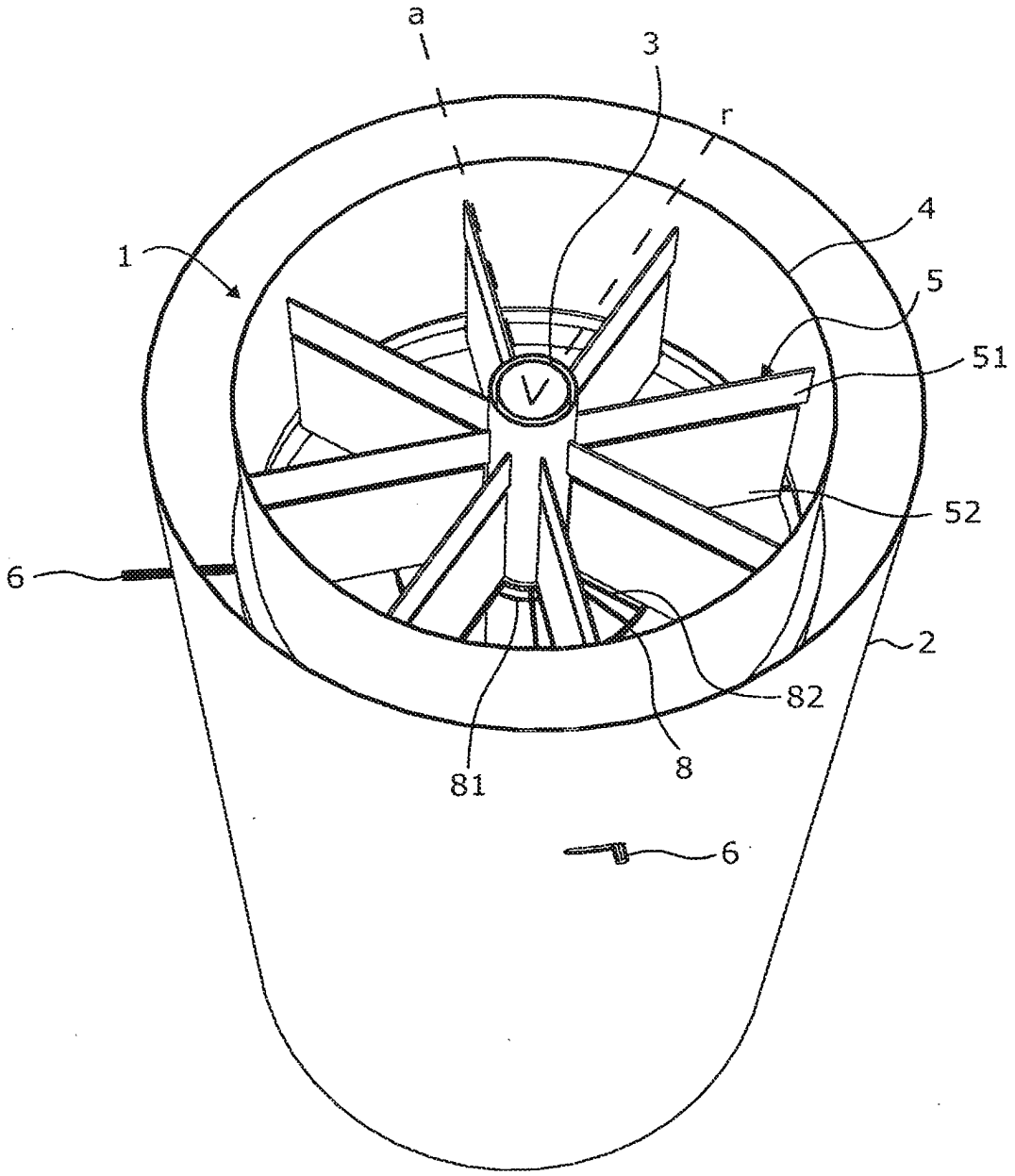


Fig. 1

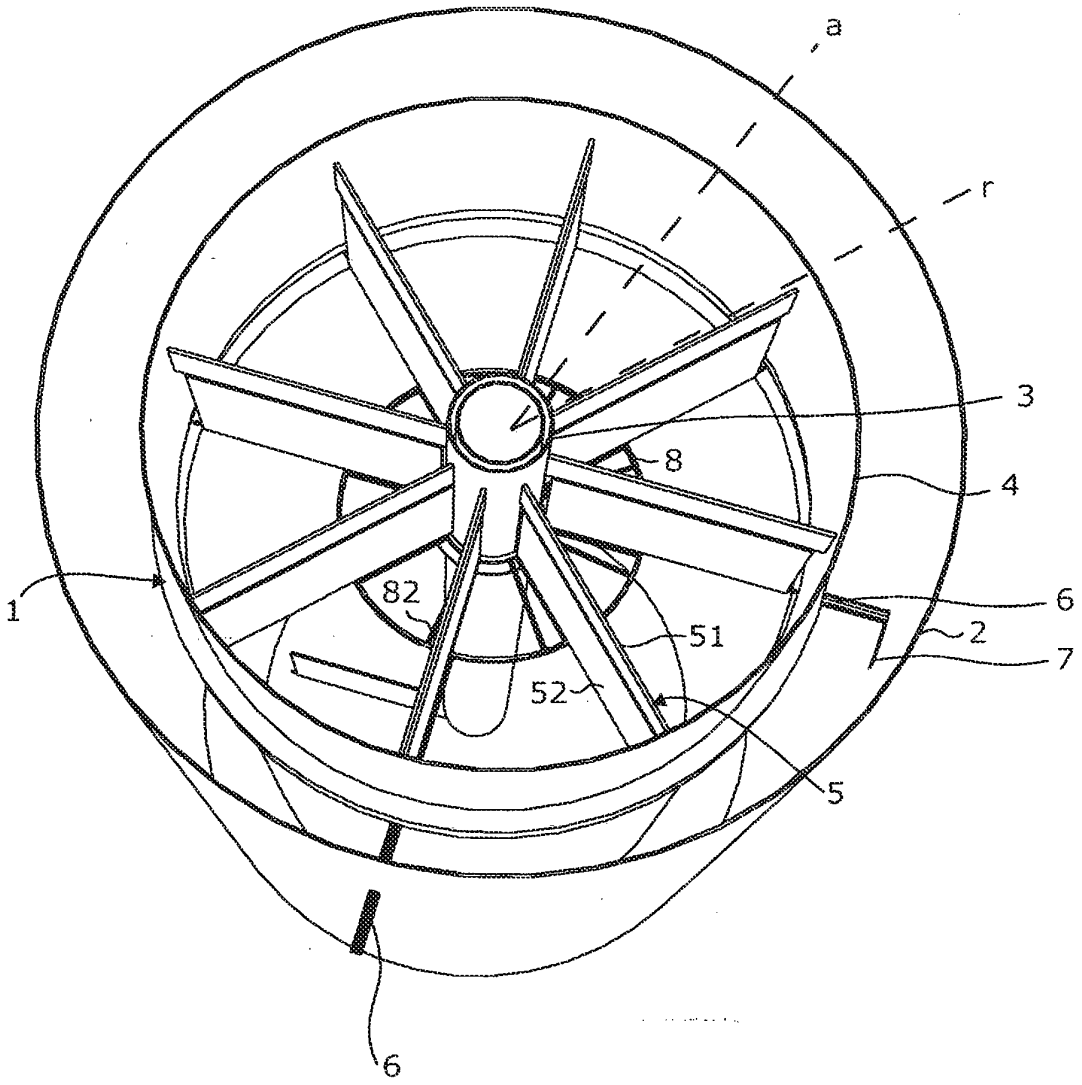


Fig. 2

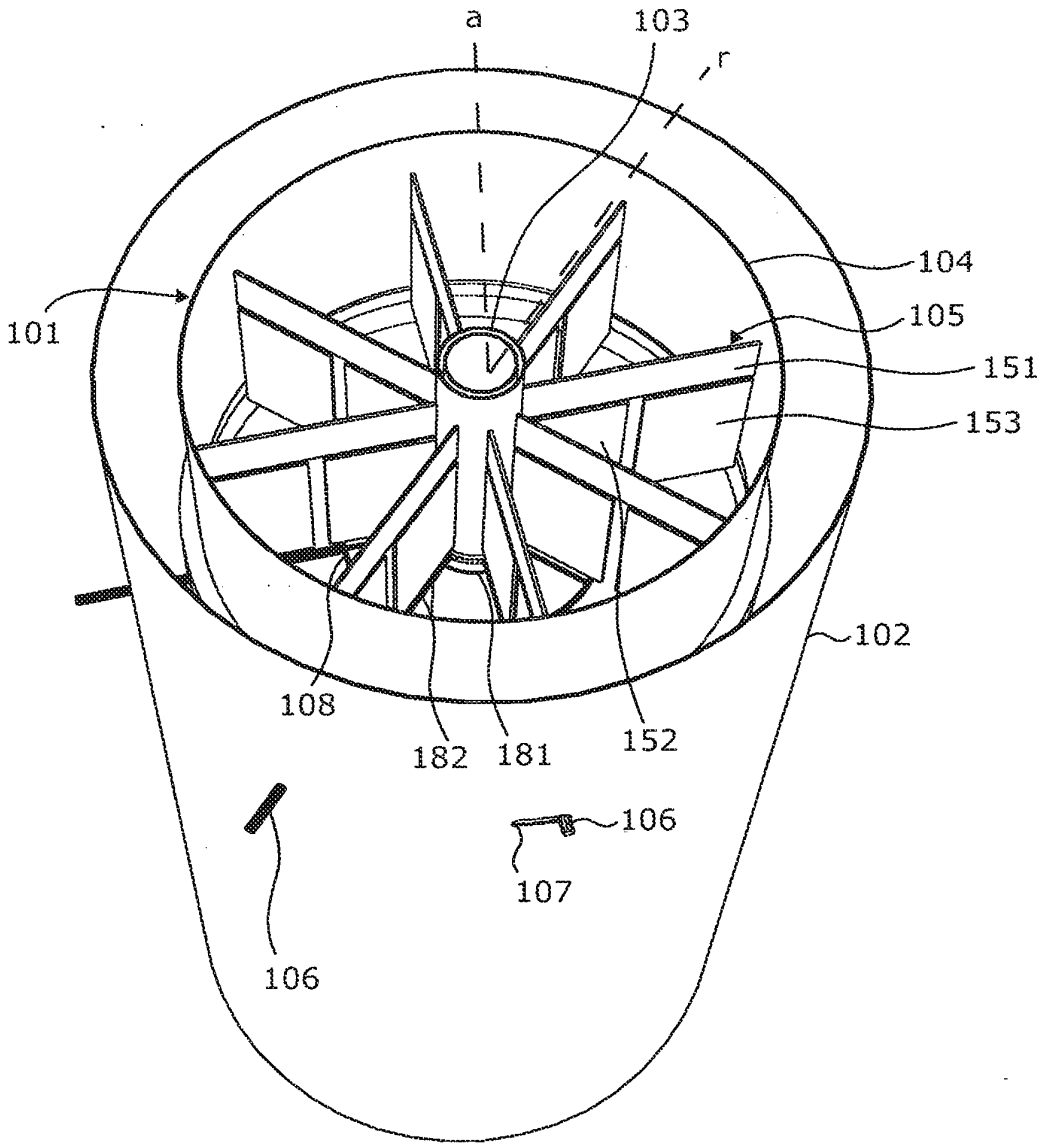


Fig. 3

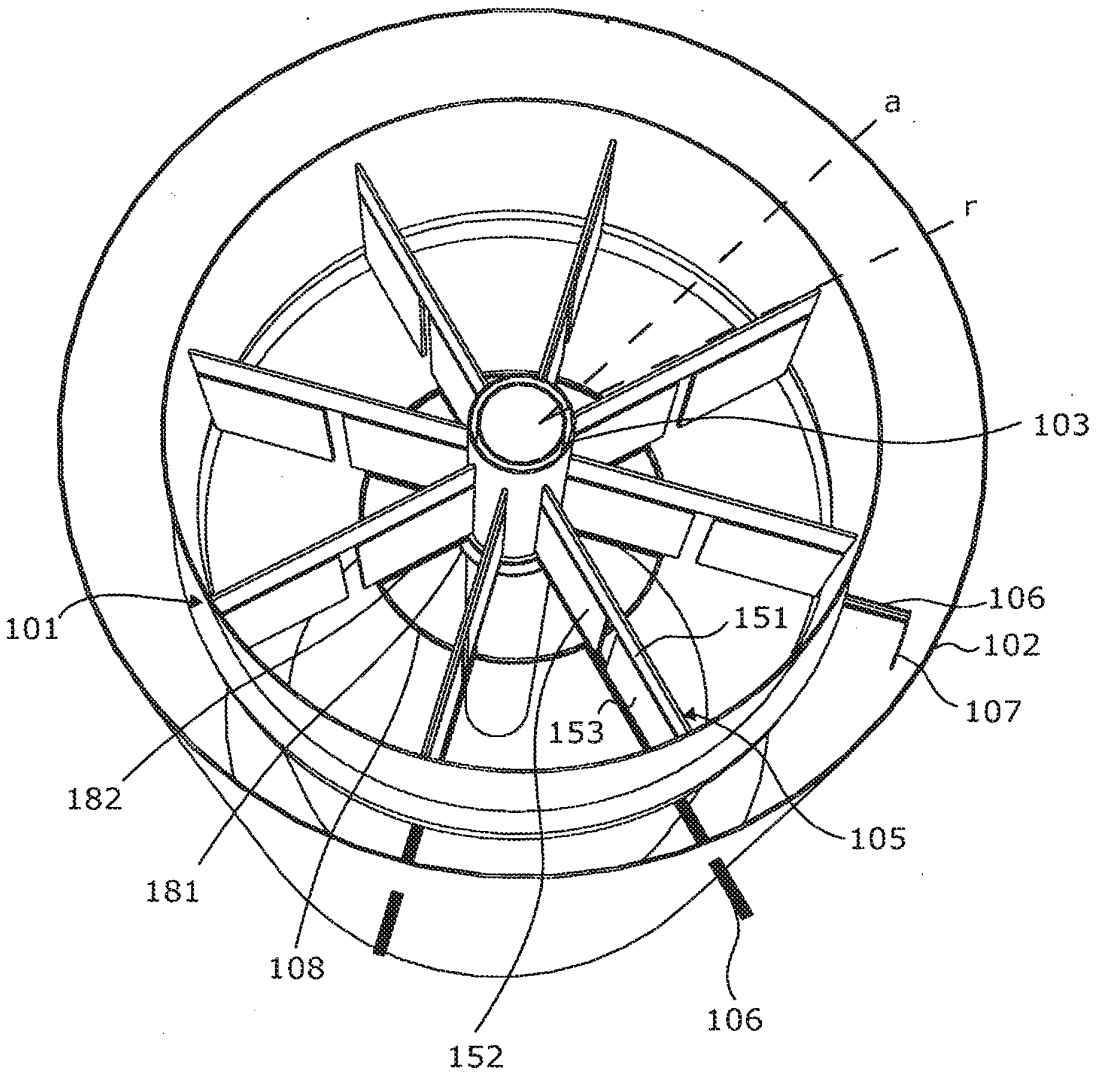


Fig. 4

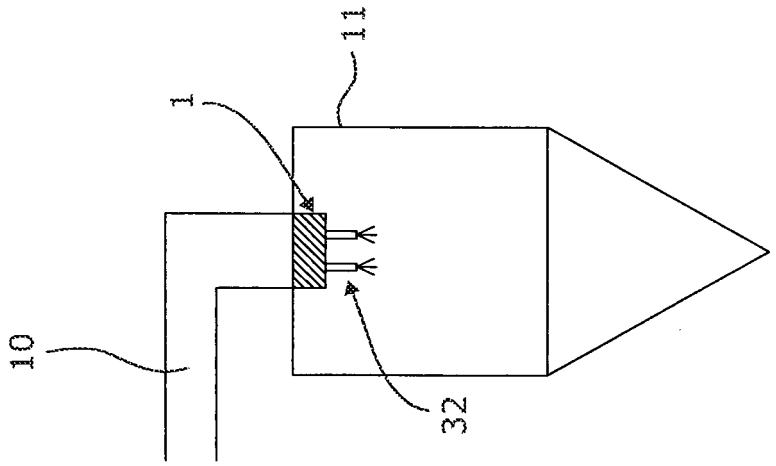


Fig. 5c

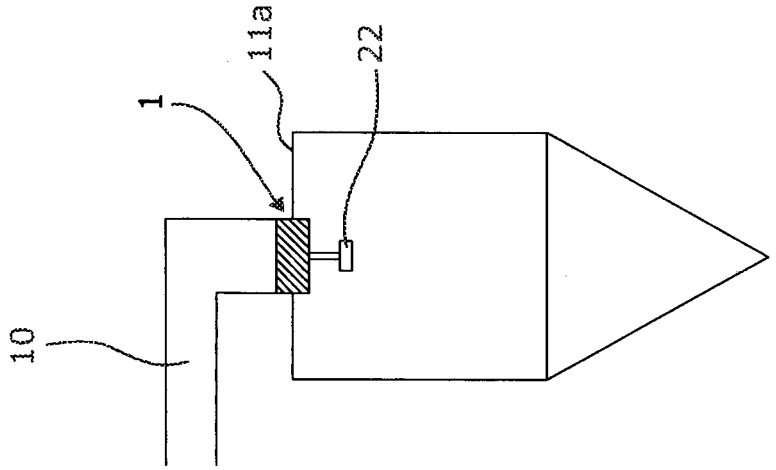


Fig. 5b

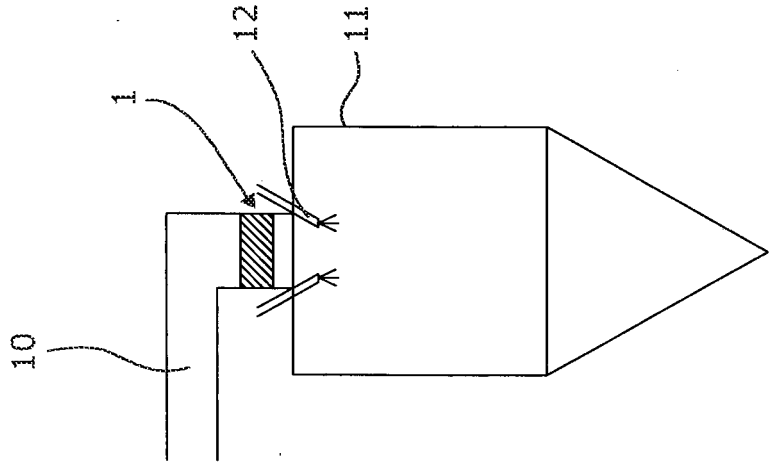


Fig. 5a

REFERENCES CITED IN THE DESCRIPTION

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