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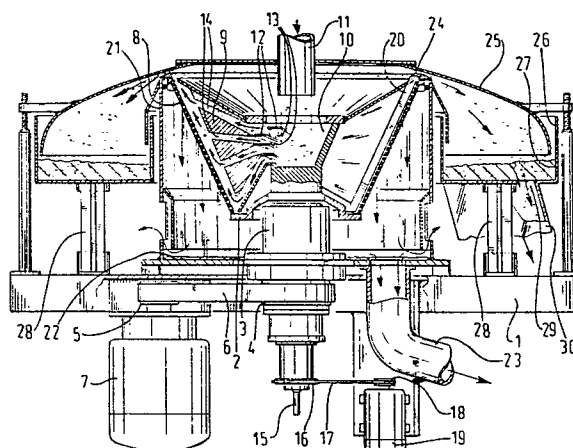
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54 **Continuously working centrifuge.**

57 Continuously working centrifuge for separating a mixture of solids and of a liquid, with a centrifugal drum (2), with supply means for the mixture to be separated and with discharge means for conveying the solids along the wall (8) of the drum to a discharge rim (24) of the drum the solids also under influence of the centrifugal force passing the rim (24) of the drum (2) and leaving the drum (2), wherein at least around the discharge region of the drum (2) a collecting wall (25) for the solids is arranged, the portion of said collecting wall (25) lying in the region of the plane through the discharge rim (24) of the drum (2) making in the points of intersection of the tangents to the discharge rim (24) and the wall (25), a small angle with the relevant tangents.



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Continuously working centrifuge

The invention relates to a continuously working centrifuge for separating a mixture of solids and of a liquid, with a centrifugal drum, with supply means for the mixture to be separated and with discharge means for conveying the solids
5 along the wall of the drum to a discharge rim of the drum, the solids also under influence of the centrifugal force passing the rim of the drum and leaving the drum.

In such a centrifuge the solids leaving the drum have at the moment of passing the discharge rim of the drum an
10 absolute velocity which is the same as the circumferential velocity of said discharge rim. The direction of the discharge solids corresponds with the direction of the tangent to the discharge rim in the point of discharge. In the case that the solids consist of crystals, for example sugar crystals, there
15 is the problem that the crystals can easily be damaged as result of collisions with the wall of the casing of the centrifugal and as a result of collisions of the solids with each other. These damages cause a decrease in quality,

whereas moreover as a result of the fracture of the crystals powdered material will easily cause incrustations on the collecting wall of the casing of the centrifuge, so that as a result of the collision of the solids with these incrustated wall the risk of crystal fracture will increase.

It is an aim of the invention to provide a centrifuge in which the risk of crystal fracture is considerably decreased.

According to the invention at least around the discharge region of the drum a collecting wall for the solids is arranged, the portion of said collecting wall lying in the region of the plane through the discharge rim of the drum making in the points of intersection of the tangents to the discharge rim and the wall, a small angle with the relevant tangents. Owing to this measure the effect of collision of the solids against the wall is very small and the solids are led along the wall, so that they lose their velocity by friction and by resistance offered by the surrounding air,

According to the invention the collecting wall in the region of the plane through the discharge rim of the drum is lying in the immediate vicinity of the discharge rim. When the wall is arranged as near to the discharge rim of the drum as possible, a solid moving tangentially in relation to the discharge rim will deviate only a little from the tangent in the point of contact of that solid and the wall.

In a preferred embodiment according to the invention the collecting wall consists of a cylindrical wall lying coaxially with the drum,

The effect aimed at according to the invention can also be obtained if the portion of the collecting wall which is struck by the discharged solids is substantially perpendicular to the axis of the drum.

Owing to this measure also in the direction according to the axis of the centrifuge the solids gradually contact the wall, so that also in this direction only a small collision effect occurs and the solids are retarded well.

In a preferred embodiment the collecting wall can be in the shape of a surface of revolution, which in a section through the axis has a curved shape.

Further according to the invention the outer edge portion of the curved surface of revolution forms a transitional portion to a wall lying co-axially with the drum. The solids are led along a curved portion of the wall and at least 5 reach the portion lying co-axially with the drum, from which portion the solids can be easily removed in a direction parallel to the axis of the drum.

If, in the way described above, the collecting wall is lying near the discharge rim of the drum, moreover one 10 has the advantage that the solids which are reflected by the collecting wall deviate with their direction of movement only very little from the direction of movement of the solids just leaving the discharge rim and not being collected by the collecting wall.

15 In the case of intersecting paths of the solids the risk of collision and the effect of collision of the solids with each other is smaller than in the case that the collecting wall is lying in a greater distance of the discharge rim.

In the case of a collecting wall in the shape of a curved 20 surface of revolution with a following portion lying co-axially with the drum, one has the advantage that the deflection along the wall of the solids has for its result that the path of the solids along the wall has in two directions a screw like shape. So, the length of the path of the solids 25 is very much increased and the velocity of the solids will strongly diminish as a result of the friction along the wall as well as through the resistance of the surrounding air.

According to the invention in another embodiment the collecting wall is in the shape of a part of a conical sur- 30 face.

Further according to the invention the collecting wall is mounted by means of adjustable supports, such that the collecting ~~can~~ ^{wall} be adjusted in axial direction in relation to the centrifugal drum.

35 In the case that the collecting wall is attached by means of these supports for example to the frame of the centrifuge, the collecting wall can be adjusted easily in axial direction and so the place can be determined where the solids will contact the collecting wall.

According to the invention the collecting wall at its inner side is covered with a resilient layer. This will further diminish the risk of crystal fracture in the case of collisions. The resilient layer can form a whole or can
5 be composed of separate elements.

According to the invention in another embodiment the collecting wall at its inner side is smooth or provided with a layer repelling incrustation. Then the risk of incrustation is minimal.

10 According to the invention means can be provided for heating the collecting wall. By this measure can be prevented that condensation of moisture occurs. In the case of condensation of moisture one has the risk that an incrustation is formed, the removal of which is very difficult.

15 According to the invention at the lower end of the collecting wall conveying means for conveying the collected solids is provided. So, the collecting solids can be discharged continuously.

In a preferred embodiment according to the invention
20 the conveying means consists of a vibrating conveyor extending around the centrifugal drum. When such a conveyor is used, the risk that crystal fracture will occur during the conveying is minimal.

According to the invention the collecting wall can
25 be supported by a frame which is connected to the vibrating conveyor. In such a case the collecting wall also will be vibrated, which will diminish the risk of incrustation of crystals on the collecting wall further.

At last according to the invention the collecting wall
30 is fixed to a support which is mounted co-axially with the axis of the drum and is mounted for rotation in the same direction as the centrifugal drum, however, with a smaller velocity, such that the relative velocity of the solids in relation to the collecting wall is so small, that the risk
35 of fracture of the crystals is further diminished.

The invention will now be elucidated in the following description of some embodiments shown in the drawing.

In the drawing shows:

Fig.1 a centrifuge according to the invention partly in

a section through the axis,

fig. 2 schematically a view of the upper end of the drum, with the paths of some solids,

fig. 3 schematically a view from above and from the side with the velocity vectors of a solid colliding with collecting wall,

fig. 4 a sectional view of the centrifuge in another embodiment,

fig. 5 a sectional view corresponding with the structure of figure 1 in another embodiment.

The centrifuge shown in figure 1 consists of a frame 1 in which a centrifugal drum 2 is supported by means of a shaft 3. The drum 2 is driven through rope pullys 4 and 5 and a rope 6 by an electric motor 7. The drum has a conical seeve wall 8. Inside the drum 2 is arranged a distributing device 9 consisting of a conical cup 10 which rotates with a velocity which is differing somewhat from the velocity of the centrifugal drum. The mixture to be separated is centrally supplied to this cup through a pipe 11. The distribution device further has a number of vanes 12 between which ducts 13 are lying which adjoins ducts 14 which end on different heights of the wall 8.

By means of the vanes 12 the material in the cup 10 is divided in right amounts so that through the ducts 14 on every location in the drum the right amount can be supplied. The distribution device is driven by means of a planetary drive means which is arranged inside the shaft 3 and is not shown in particular. The drive shaft 15 of the drive means is driven by means of a pulley 16, a rope 17 and a pulley 18 by an electric motor 19. In the embodiment shown, the conical cup 10 has two distributing devices 9, one of these devices is shown on the left side. Just in advance of the distributing device is arranged a scraper 20. On the right side the scraper 20 is shown which is lying just in advance of the other distributing device and this scraper scrapes the solids which are deposited by the first mentioned distributing device. The mixture which is supplied and in this case consists of a sugar massecuite, is supplied through ducts 13 between the vanes 12 and through the ducts 14 to the seeve wall 8. The

sugar is resting on the sieve wall 8 and the liquid is thrown to the outside through the wall 8 and is collected inside the centrifugal casing 21. The liquid, indicated with 22 is discharged through the discharge duct 23. The
5 distributing device 9 and the corresponding scraper 20 move very slowly along the surface of the sieve wall 8 and so the sugar is for some time in rest on the wall 8, before being removed by the scraper 20. The inclination of the wall 8 is such that the sugar is just kept in rest. The material
10 of the scraper 20 however, has a lower coefficient of friction than the wall 8 and as soon as the sugar particles are lifted from the wall by the scraper 20, the friction is not sufficient anymore to keep the particles in rest against the influence of the centrifugal force. Then the particles
15 move in outward direction and are discharged near the upper edge of the scraper 20, said upper edge being at the same height as the discharge rim of the drum 2. The particles which leave the upper edge of the scraper have a very large tangential velocity. These particles are collected by the
20 hood like collecting wall 25 as will be described in the following.

The particles which are deflected by the walls 25 are collected on the vibrating conveyor which consists of a ring like trough extending around the centrifugal drum and
25 supported by inclined springs 28 and which is driven by a vibrating device. The sugar collected in the trough 27 is conveyed around the drum to a discharge opening 29 which adjoins a discharge pipe 30,

The hood like collecting wall 25 is arranged as near as
30 possible to the drum. The horizontal distance between the discharge rim of the drum at 24 and the portion of the collecting wall 25 lying on the same height is as small as possible. Moreover in a vertical section this portion of the collecting wall 25 makes an angle with the axis of the drum which differs
35 only very little from 90° . Owing to this measure the particles leaving the drum both seen in a horizontal as well in a vertical plane substantially tangentially contact the collecting wall 25. The effect of the collision of the particles is very small and the particles are gradually collected by the collec-

ting wall and retarded, Moreover the effects of collision between the particles are smaller when the collecting wall is as near to the discharge rim of the drum as possible.

In figure 2 schematically the discharge rim of the drum is indicated with 31. Further are shown a collecting wall 32 lying in the immediate vicinity of the drum and a collecting wall 3 lying on a larger distance of the drum. At 34 a particle leaves the discharge rim 31 along a tangent 35 to the drum. When a particle is reflected it has after reflection of the collecting wall 32 the direction 36. It is clear that a reflected particle which moves in the direction 36 has mainly the same direction of movement as a particle that is not yet reflected. The effect of the collision between these particles is not very important.

In the case of a collecting wall 33 the particles leaving the drum at 34 will move further in the direction 35 and contact the collecting wall 33 and then be reflected in the direction 37. It is clear that the particles which are not yet reflected move more transversally to each other or even in opposite direction. The risk of fracturing of the particles is increased, Figure 2 further shows what happens when a particle is not reflected but deflected by the wall,

A particle which leaves the drum at 38 and contacts the collecting wall 32 at 39, will be deflected and then get the direction of the vector 40. The velocity of the collision with the wall is indicated by the vector 41. The component 42 of the vector 41 which is directed perpendicular to the wall has a definite value and as a result of the collision the energy in the direction of the vector 42 gets lost. In the case of a collecting wall 33 the particle will contact the wall at 43 and has about the same velocity as in the preceding case and the velocity is indicated by the vector 44. The component directed perpendicularly to the wall is indicated with 45 and the component directed along the wall is indicated with 46. It is clear that the component 45 directed perpendicularly to the wall is greater than the corresponding vector 42 from the preceding case. So, here more energy is lost and so the risk of fracturing as a result of the collision is greater. According to the above it is clear that

the nearer the collecting wall is to the discharge rim of the drum, the smaller the effect of the collision between the particles and the smaller the effect of the collision against the wall is.

5 Figure 3 shows schematically from above and in a vertical section the velocity vectors. The rim of the drum is indicated with 47. A particle discharged from the drum leaves the drum in the direction of the vector 48 and contacts the collecting wall 25 at 49. If this particle is reflected, then
10 the velocity vector of the further moving particle is indicated with 50 and when the particle is deflected along the wall the path is indicated by the vector 51. In a vertical section the collecting wall is indicated with 25 and in a vertical section through the vector 48 the wall has the shape
15 25'. A particle which contacts the wall at 49' changes in direction and gets substantially the direction of the vector 52. The particles discharged from the drum are changing their direction by influence of the wall in two planes and as a result the particles will describe a screw like path along
20 the collecting wall and the velocity will decrease under influence of the friction till they leave the wall 25 in vertical direction and are collected on the conveyor 27.

 In the embodiment according to figure 4 the vibrating conveyor 27 is also used for supporting the wall 25. By means
25 of the elements 53 the wall 25 is attached to the trough 27. In figure 4 is also indicated that the vibrating conveyor 27 is driven by means of a crank mechanism 54 which is driven through a worm drive by an electric motor 56.

 In the embodiment shown in figure 6 the difference in
30 view of the embodiment according to figure 1 is that the wall 25 rotates in relation to the frame 1. The wall 25 for example can rotate at a velocity which is half the velocity of the drum 2. So, the relative velocity of the particles in relation to the collecting wall 25 is smaller and so the
35 effect of the collision becomes smaller and the risk of fracturing also becomes smaller.

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CLAIMS

1. Continuously working centrifuge for separating a mixture of solids and of a liquid, with a centrifugal drum, with supply means for the mixture to be separated and with discharge means for conveying the solids along the wall of the drum to a discharge rim of the drum, the solids also under influence of the centrifugal force passing the rim of the drum and leaving the drum, characterized in that at least around the discharge region of the drum a collecting wall for the solids is arranged, the portion of said collecting wall lying in the region of the plane through the discharge rim of the drum making in the points of intersection of the tangents to the discharge rim and the wall, a small angle with the relevant tangents.

2. Centrifuge according to claim 1, characterized in that the collecting wall in the region of the plane through the discharge rim of the drum is lying in the immediate vicinity of the discharge rim.

3. Centrifuge according to claim 2, characterized in that the collecting wall consists of a cylindrical wall lying

co-axially with the drum.

4. Centrifuge according to claim 1, characterized in that the portion of the collecting wall which is struck by the discharged solids is substantially perpendicular to the axis of the drum.

5. Centrifuge according to claim 4, characterized in that the discharge wall is in the shape of a surface of revolution, which in a ^{section} through the axis has a curved shape.

6. Centrifuge according to claim 5, characterized in that the outer edge portion of the curved surface of revolution forms a transitional portion to a wall lying co-axially with the drum.

7. Centrifuge according to claim 1, characterized in that the collecting wall is in the shape of a part of a conical surface.

8. Centrifuge according to one or more of the preceding claims, characterized in that the collecting wall is mounted by means of adjustable supports, such that the collecting wall can be adjusted in axial direction in relation to the centrifugal drum.

9. Centrifuge according to one or more of the preceding claims, characterized in that the collecting wall at its inner side is covered with a resilient layer.

10. Centrifuge according to one or more of the preceding claims characterized in that the collecting wall at its inner side is smooth or provided with a layer repelling incrustation.

11. Centrifuge according to one or more of the preceding claims characterized in that means are provided for heating the collecting wall.

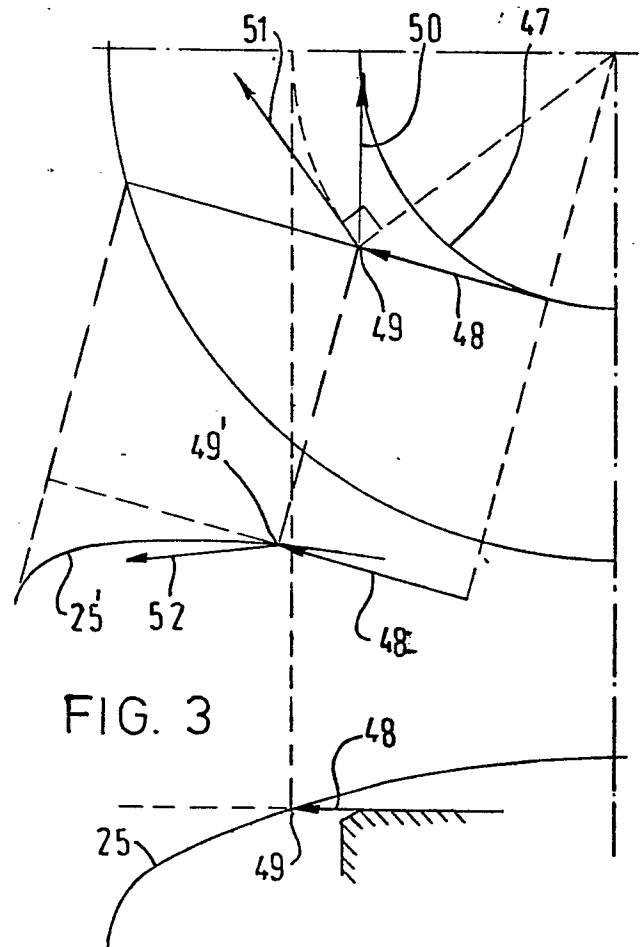
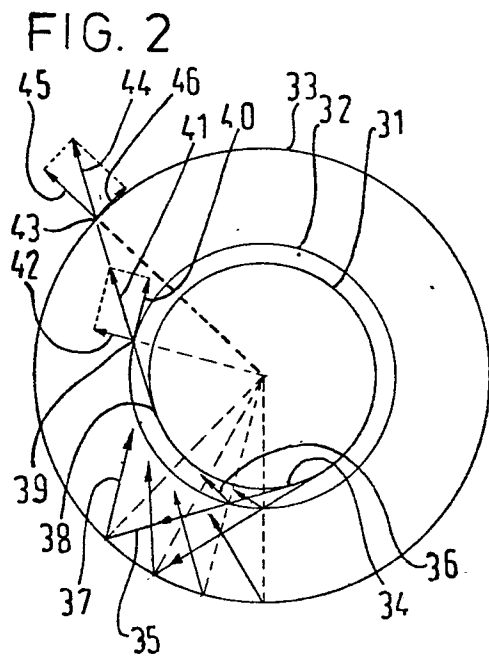
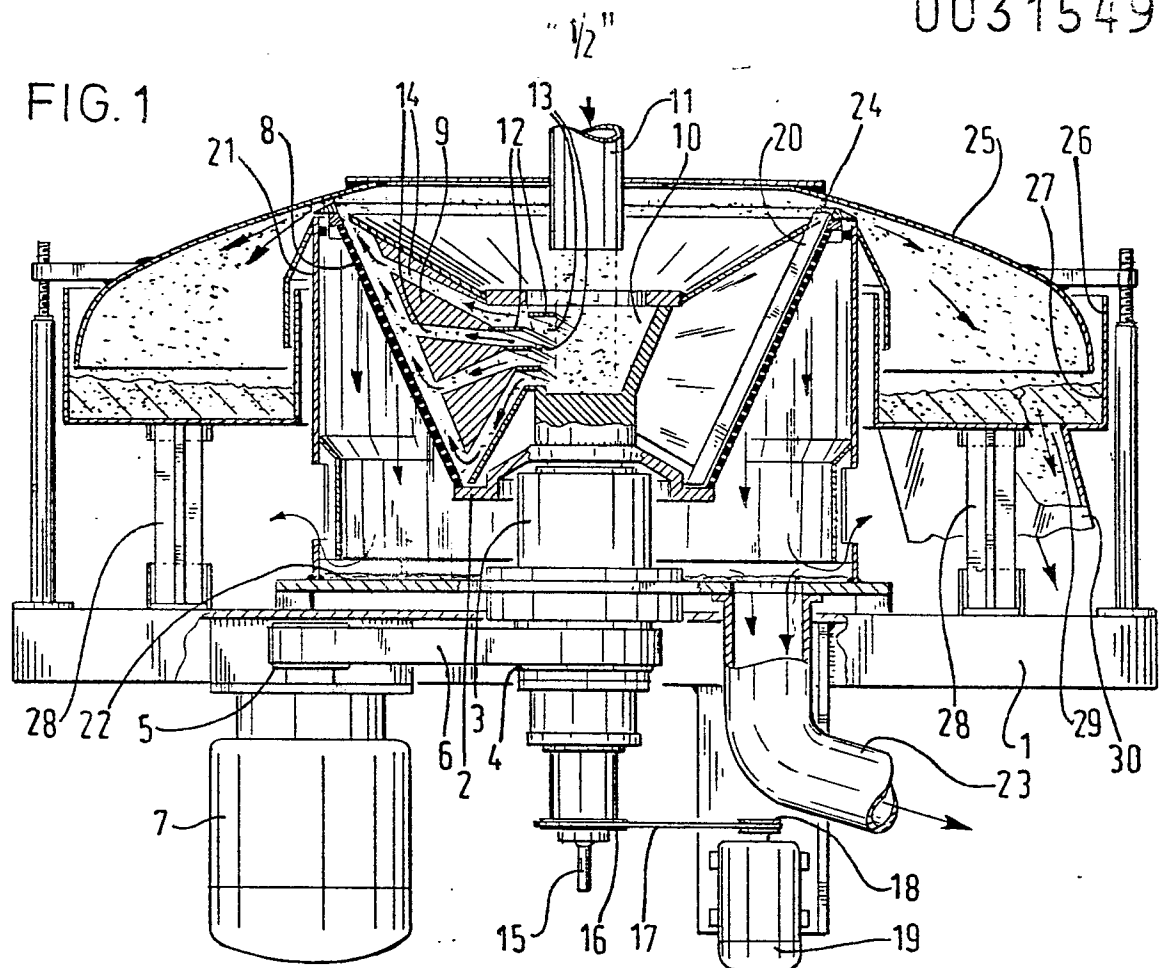
13. Centrifuge according to one or more of the preceding claims, characterized in that at the lower end of the collecting wall conveying means for conveying the collected solids is provided.

13. Centrifuge according to claim 11, characterized in that the conveying means consists of a vibrating conveyor extending around the centrifugal drum.

14. Centrifuge according to claim 12, characterized in that the collecting wall is supported by a frame which is connected

to the vibrating conveyor,

15. Centrifuge according to one or more of the preceding claims, characterized in that the collecting wall is fixed to a support, which is mounted co-axially with the axis of the drum and is mounted for rotation in the same direction as the centrifugal drum, however with a smaller velocity, such that the relative velocity of the solids in relation to the collecting wall is so small that the risk of fracture of the crystals is further diminished,



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FIG. 4

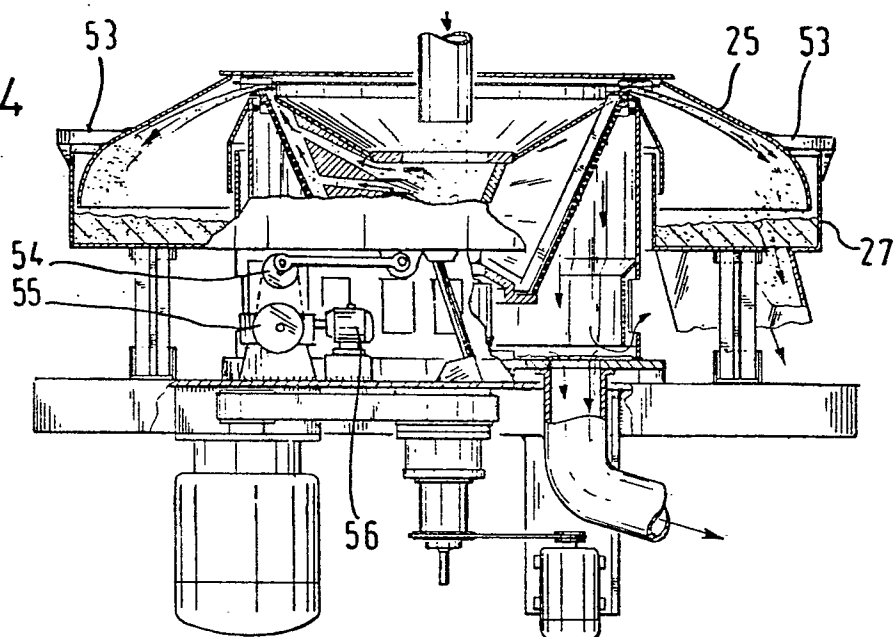
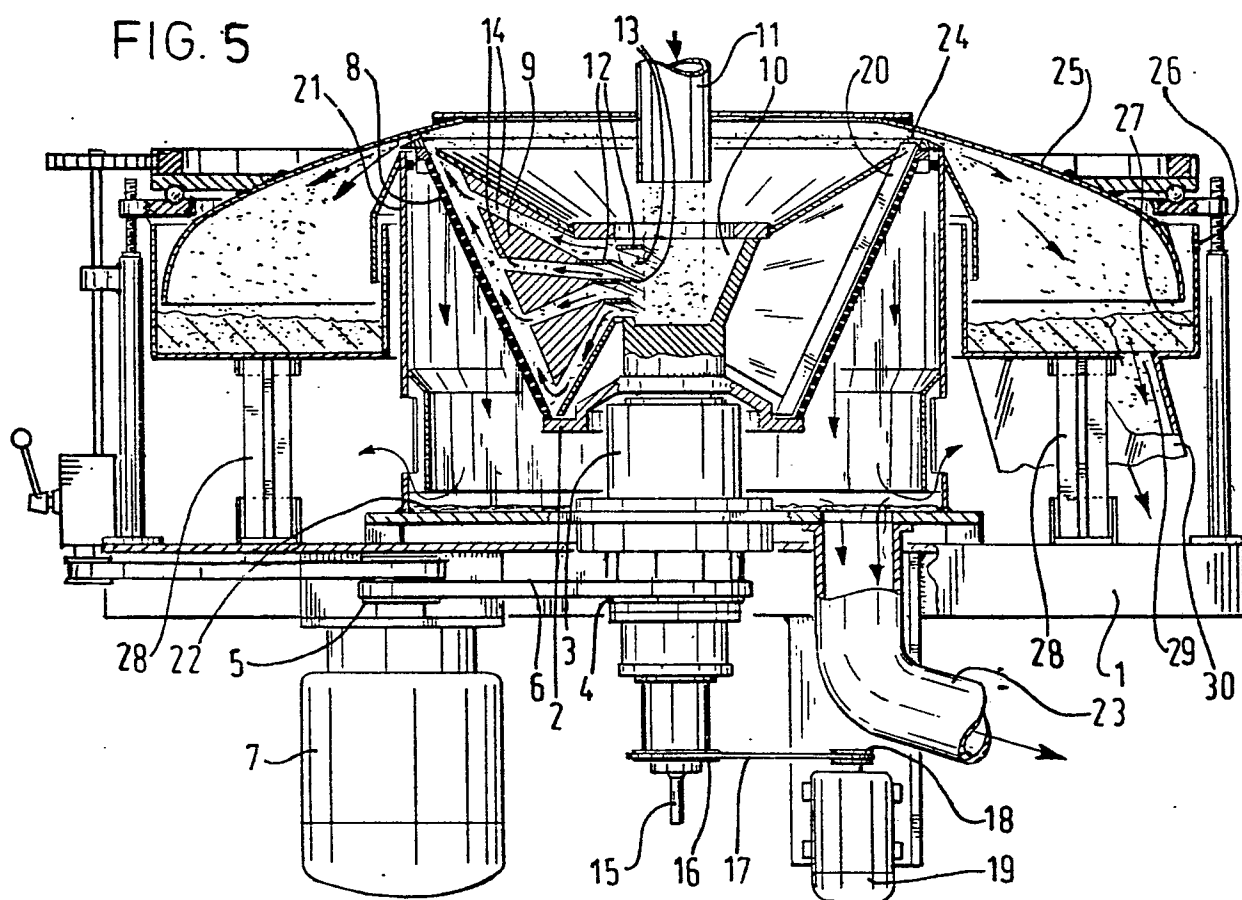


FIG. 5





DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	<u>GB - A - 1 490 323</u> (BRAUNSCHWEIGISCHE) * page 6, lines 32-84 * --	1	B 04 B 7/04 11/02
A	<u>FR - A - 2 187 422</u> (FIVES LILLE CAIL) * page 3, lines 18-40; page 4, lines 1-24; page 1, lines 16-26 * --	1	
A	<u>NL - A - 69 17 205</u> (BROADBENT) * page 9, claim 1 * & GB - A - 1 293 761 --	1	TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	<u>FR - A - 2 186 298</u> (FIVES LILLE CAIL) * page 3, lines 9-11; figure 1 * & GB - A - 1 416 093 --	1, 5, 6, 9	B 04 B
A	<u>DE - A - 1 757 854</u> (ESCHER WYSS) * page 10; claim 1 * --	10, 11	CATEGORY OF CITED DOCUMENTS
A	<u>GB - A - 1 247 279</u> (W.S.M.) * page 2, lines 105-129; page 3, lines 1-3 * -- ./	1, 10, 15	X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
☒ The present search report has been drawn up for all claims			&: member of the same patent family, corresponding document
Place of search The Hague		Date of completion of the search 23-03-1981	Examiner VERDONCK



DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	<u>DE - A - 2 803 160</u> (BRAUNSCHWEI- GISCHE) * page 9, lines 13-15 * & GB - A - 2 017 516 --	1, 12	
A	<u>US - A - 3 366 318</u> (STEIMEL) * column 4, lines 26-41; column 5, lines 1-12 * -----	1, 12, 13, 14	
			TECHNICAL FIELDS SEARCHED (Int. Cl.)