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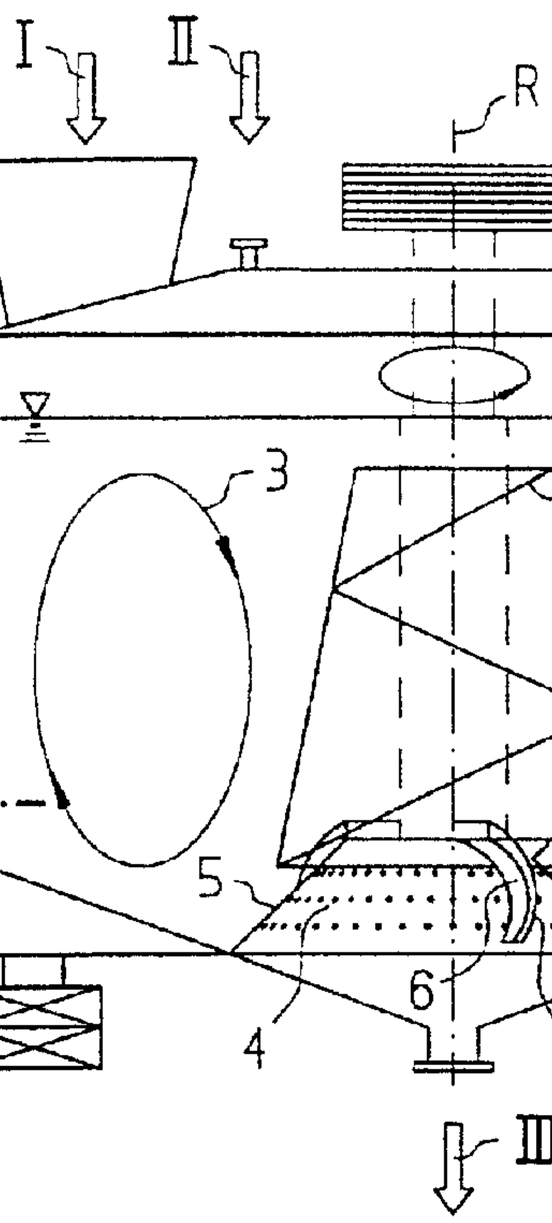

(57) Abrégé/Abstract:
The invention relates to a pulper device comprising a vessel (1) in which an annular flow can be generated. Said flow acts upon a liquid-solid mixture located inside said vessel (1) and effects a pulping of the same. Said device also comprises a screening device (4) for separating course materials from the suspension, whereby the screening device (4) has the shape of a truncated cone. Said truncated cone is provided with holes on the lateral surface thereof and can be mounted on the base of the vessel (1) in such a way that the truncated cone points upward with the small circular surface thereof, and the lateral surface lies in an approximately tangential manner to the toroidal flow. The screening device (4) is subdivided into different segments and these segments can be individually mounted from the external side of the vessel.

PCT

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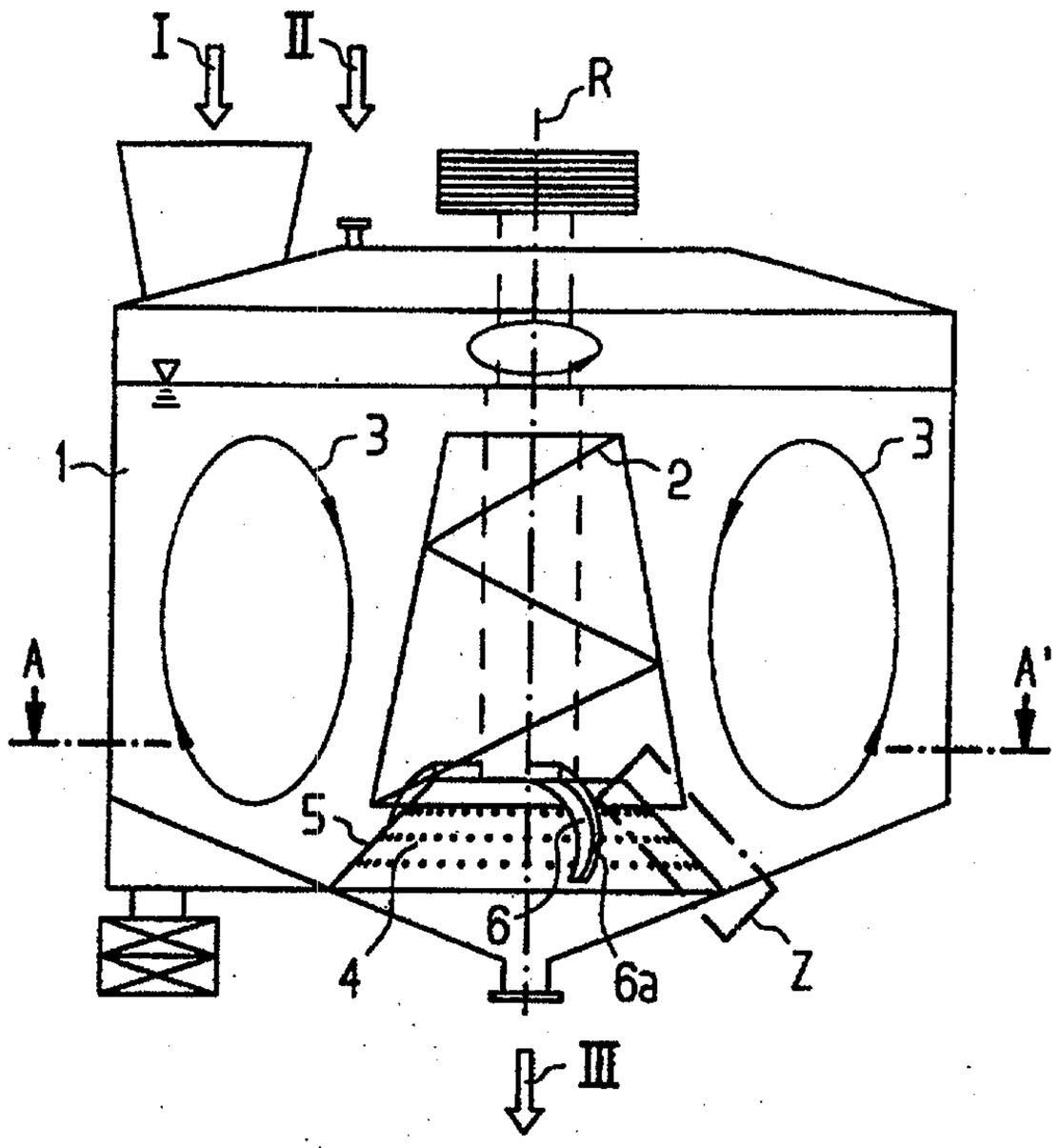
(54) **Title:** PULPER

(54) **Bezeichnung:** STOFFLÖSEVORRICHTUNG

(57) **Abstract**

The invention relates to a pulper device comprising a vessel (1) in which an annular flow can be generated. Said flow acts upon a liquid–solid mixture located inside said vessel (1) and effects a pulping of the same. Said device also comprises a screening device (4) for separating course materials from the suspension, whereby the screening device (4) has the shape of a truncated cone. Said truncated cone is provided with holes on the lateral surface thereof and can be mounted on the base of the vessel (1) in such a way that the truncated cone points upward with the small circular surface thereof, and the lateral surface lies in an approximately tangential manner to the toroidal flow. The screening device (4) is subdivided into different segments and these segments can be individually mounted from the external side of the vessel.



(57) **Zusammenfassung**

Stofflösevorrichtung mit einem Behälter (1), in dem eine ringförmige Strömung erzeugbar ist, die auf ein in dem Behälter (1) befindliches Flüssigkeits–Feststoff–Gemisch einwirkt und eine Zerfaserung desselben bewirkt, mit einer Siebvorrichtung (4) zum Trennen von Grobstoffen aus der Suspension, wobei die Siebvorrichtung (4) die Form eines Kegelstumpfes aufweist, der an seiner Mantelfläche mit Löchern versehen ist und derart am Boden des Behälters (1) einbaubar ist, daß der Kegelstumpf mit seiner kleineren Kreisfläche nach oben zeigt und die Mantelfläche in etwa tangential zur torodialen Strömung liegt; wobei die Siebvorrichtung (4) in verschiedene Segmente unterteilt ist und diese einzeln von der Behälteraußenseite her anbringbar sind.

Pulper

Description

The present invention relates to a pulper comprising a vessel, a means for pulping and generating an annular flow of a liquid-solid mixture located in said vessel and a screening device for separating coarse materials from the suspension, as is known from DE 964 286 C.

Such pulper devices are disclosed in DE-AS 23 48 540 and in DE-AS 26 58 845 as well as in DE 20 61 519 C2 and in US-A-2,661,666. Another pulper device is disclosed in FR-A-1 374 767.

Screening devices are used in most various industrial branches for the most different cases of application. Screening devices are widely used in processing technologies for sorting free-flowing substances, which contain solid materials of different sizes. An important case of application relates to the so-called pulper, which is used for processing material mixtures containing easy to pulp components. Important cases of application relate to the processing of wastes and waste-like materials as well as to paper industry for the processing of waste paper.

Such a pulper comprises a vessel provided with a rotor. During operation of the material mixture to be processed is charged into the vessel, and a liquid, in general water, is moreover filled into the vessel. The rotor is rotated thereby generating strong flow forces. Seen in an axial section through the pulper, said flow has a toroidal form, whereby two main flow components overlap each other, namely a radial and a concentric flow direction. In the region of the rotor said flow at first flows outwardly against the wall of the vessel

in a radial manner and then rises upwardly, so as to flow again radially towards the inside in the region of the surface of the liquid, whereupon it is conducted to the center of the rotor. Said flow can be supported by mounting additional guiding plates. At the same time, the liquid is subjected to a motional impulse in the rotational direction of the rotor. Said toroidal flow causes the solid matter contained in the liquid to repeatedly reach the region of the rotor, where it is processed.

Due to the strong flow the easily pulpable solid materials contained in the pulper are pulped. Apart from the pulping, partly also a shortening of fibers takes place or, respectively, part of the pulpable materials is dissolved. As the main emphasis of the process, however, lies in the pulping, merely the "pulping" will be discussed in this respect, while the disintegration and the dissolution taking place parallel to it will not be dealt with separately.

The pulped components of the charged material mixture form a suspension together with the liquid, which can be drawn off from the pulper by means of a punched screen. The non-pulped components remaining in the pulper (hereinafter also called "coarse materials") can be removed from the pulper in a different manner, e.g. by means of a coarse dirt collector projecting into the pulper.

A preferred case of application, for instance, relates to the processing of waste paper or the processing of wastes for a biological utilization of individual components. During the processing of wastes the components, which under a biological aspect are favorable for utilization, are separated from those components, which cannot biologically be utilized, as the biologically utilizable components can be pulped easily

whereas it is difficult or impossible to pulp the other components.

The formed suspension separated by the punched screen, in which the biologically utilizable components are concentrated, can then be subjected to the biological processing, whereas the biologically non-utilizable components, i.e. the coarse materials remaining in the pulper after the suspension has been drawn off, are separated and can be supplied to another appropriate form of utilization, or they may be removed.

Other screening devices so far used in connection with pulpers for separating coarse materials from the suspension are either formed as flat screens (such as in EP 0 520 172 B1 or DE 195 06 084 A1) or as cylindrical screens (such as in EP 0 598 187 B1).

The use of a flat screen results in that the toroidal flow is diverted on the screen entailing the disadvantage that the solid materials in the pulper, which cannot or only with difficulties be pulped, such as pebbles, broken glass or the like, thereby cause a high wear of the screen. Moreover, there is the risk that the screen holes are clogged. Heavy components in the material mixture tend to sink onto the screen, where they remain unless they are pulped, so that they cannot pass the screen together with the suspension. A common method for keeping the screen free from such coarse materials and for guaranteeing the passage of the suspension is to repeatedly clean the surface of the screen by means of clearance rails. Said clearance rails, however, are also subject to a high wear.

The use of a cylindrical vertical screen entails other disadvantages. The suspension is here drawn off through the vertically situated screen elements. The non-pulped coarse

materials in this case tend to accumulate around the screen on the bottom of the pulper thereby clogging the passageway through the screen: The flow conditions in the pulper are not suited to effect a satisfactory progression of the coarse materials and thereby a cleaning of the surface of the screen, since the flow does not touch the vertical elements of the screen. Here, too, the screen can only be cleaned by additional methods, in general by using clearance rails. The coarse materials accumulating around the screen on the bottom of the pulper likewise contribute to a high wear. The use of clearance rails, moreover, results in another essential disadvantage, as the clearance rails strongly disintegrate the plastic components present in the waste. Said small plastic particles can thereby pass the punched screen together with the suspension. In this way they contaminate the suspension destined for a biological utilization, which also results in an undesired contamination level of the finished products, above all of the compost and the process water.

It is the object of the present invention to improve the above-defined pulper device for separating coarse materials from a suspension so as to reduce wear, to facilitate the cleaning and maintenance of the screen, to accelerate the passage of the suspension and to improve the product quality.

Accordingly, in one aspect of the present invention there is provided a pulper comprising: (a) a vessel; (b) a means for pulping and generating an annular flow of a liquid-solid mixture located in said vessel; and (c) a screening device for separating coarse materials from the suspension, wherein the screening device has the shape of a truncated cone being provided with holes on the lateral surface

thereof and being mounted on the base of the vessel, and the truncated cone pointing upwardly with the smaller circular surface thereof and the lateral surface lying in an approximately tangential manner to the toroidal flow, the screening device being sub-divided into different segments and that these segments are individually attached from the external side of the vessel and are individually detachable from the internal side of the vessel.

According to another aspect of the present invention there is provided a pulper comprising: (a) a vessel; (b) a means for pulping and generating an annular flow of a liquid-solid mixture located in said vessel; (c) a screening device for separating coarse materials from the suspension, wherein the screening device has the shape of a truncated cone being provided with holes on the lateral surface thereof and being mounted on the base of the vessel, and the truncated cone pointing upwardly with the smaller circular surface thereof and the lateral surface lying in an approximately tangential manner to the toroidal flow, the screening device being sub-divided into different segments and that these segments are individually attached from the external side of the vessel and are individually detachable from the internal side of the vessel; and (d) at least one scraper with at least one of an exchangeable wear shield and an adjustable wear shield on the front face thereof.

The gist underlying the present invention resides in that a screening device is used, which has the shape of a truncated cone. The truncated cone points upwardly with the smaller circular surface thereof. The holes of the screening device are provided on the inclined lateral surface of the truncated

cone. The inclination is configured such that it lies in an approximately tangential or, respectively, parallel manner to the toroidal flow. Moreover, the screening device is segmented and can be mounted externally.

The angle or inclination amounts to preferably 30°-50°, whereby said value can vary in response to the shape of the vessel. The inclined arrangement results in that the flow constantly causes the coarse materials sinking down in the pulper to be removed from the lateral surface of the screen, i.e. they are entrained by the flow. Said process is even supported by the use of scrapers, which are, however, subject to a smaller load in comparison to those according to the prior art, as the cleaning is not exclusively effected by clearance rails - in contrast to the described flat screens or cylindrical screens - but to a considerable extent by the flow.

As the coarse materials are constantly moved away from the screen with the flow so that, in contrast to the screening device used according to the prior art, they can accumulate on the screen or around the screen to a much smaller extent, also the abrasion caused by sand, pebbles, glass etc. is essentially reduced. Due to the better cleaning of the surface of the screen, moreover, the passage through the screen is rendered more favorable, whereby the draw-off time of the suspension is reduced.

The holes in the screen may be shaped differently, they may have, for instance, square, circular or oblong shapes. Their characteristic dimensions preferably are 6-30 mm. The screen is preferably sub-divided into segments so as to facilitate the disassembly thereof.

The scrapers used for supporting the cleaning of the screen holes from coarse dirt are preferably mounted on the rotor or the shaft thereof and may likewise have different shapes. They may, for example, be straight or inclined. The scrapers are preferably continuously or discontinuously curved opposite to the flow, and are provided with a wear shield. The wear shield can preferably be exchanged and/or adjusted.

For drawing off the suspension from the pulper through the screen a pump is preferably applied, the drive of which can be controlled. However, also an unobstructed discharge into a lower-lying storing vessel is possible.

The invention is especially suited for the use in processing and separating waste mixtures with a high organic portion, e.g. of communal biological wastes. Apart from biogenous organic components, which are suited for a biological treatment and subsequent recycling into the natural circulation, said wastes are characterized by a relevant portion of non-biogenous organic interference materials, such as plastics, pebbles, glass and metals.

The present invention will hereinafter be explained in more detail by means of a preferred embodiment with reference to the accompanying drawing.

Figures 1a to 1c show a schematic illustration of an embodiment of the screening device according to the invention, wherein fig. 1a shows a cross-section, fig. 1b shows a section along line A-A' of fig. 1a and fig. 1c shows an enlarged section of the area designated by Z.
The waste mixture is fed to the cylindrical pulper vessel 1 with the addition of water. I designates the waste supply and II the water supply.

By rotations of the rotor 2 about the axis R of the vessel the waste-water mixture is started to move. A strong toroidal flow 3 is generated resulting in the pulping of the biogenous organic non-lignified components of the waste. Said fibers form a suspension together with the liquid present in the pulper, which is drawn off through the truncated punched screen 4 located in the lower part of the pulper and flows out through the outflow III, to which a pump (not shown) may be connected, if required. The non-biogenous organic and the lignified components of the waste remain in the pulper vessel 1, which remain largely undestroyed by the flow forces, i.e. the coarse materials.

The formed suspension separated by the punched screen, in which the biologically utilizable components are concentrated, can then be subjected to the biological processing, while the biologically non-utilizable components, i.e. the coarse materials remaining in the pulper after the suspension has been drawn off, can be subjected to another appropriate form of processing or another form of removal.

The herein described embodiment of the inventive screening device 4 has the shape of a truncated cone. The holes of the screen are provided on the lateral surface 5 of the truncated cone, they are round and have a diameter of typically 10 mm. The angle of the external surface of the screen is about 30° to 50° relative to the rotational axis R.

As can particularly be seen in fig. 1b, scrapers 6 are fastened to the rotor 2 or the rotor shaft, respectively, which are curved in an arc-shaped manner opposite to the flow. The front face of the scrapers 6 is protected by an exchangeable and adjustable wear shield 6a. A collecting

container (not shown) is provided underneath outflow III, in which the discharged suspension is collected.

As can be seen in fig. 1c, the screen segments of screen 4 are attached from the external side of the vessel with screws 8 to webs 9 such that they can be detached from the internal side of the vessel when the screws 8 are removed.

Although the present invention was described above on the basis of a preferred embodiment, it is not restricted thereto, but may be modified in various ways and manners.

What is claimed is:

1. Pulper comprising: (a) a vessel; (b) a means for pulping and generating an annular flow of a liquid-solid mixture located in said vessel; and (c) a screening device for separating coarse materials from the suspension, wherein the screening device has the shape of a truncated cone being provided with holes on the lateral surface thereof and being mounted on the base of the vessel, and the truncated cone pointing upwardly with the smaller circular surface thereof and the lateral surface lying in an approximately tangential manner to the toroidal flow, the screening device being sub-divided into different segments and that these segments are individually attached from the external side of the vessel and are individually detachable from the internal side of the vessel.

2. Pulper according to claim 1, wherein the angle of the lateral surface is between 30° and 50°.

3. Pulper according to claim 1 or 2, wherein the screen holes have a square shape.

4. Pulper according to claim 1 or 2, wherein the screen holes have a circular shape.

5. Pulper according to claim 1 or 2, wherein the screen holes have an oblong shape.

6. Pulper according to any one of claims 1 to 5, wherein the characteristics dimensions of the screen holes are 6 - 30 mm.

7. Pulper according to any one of claims 1, 2 or 4, wherein the screen holes are circular and have a diameter of 8 - 12 mm.

8. Pulper according to any one of claims 1 to 7, wherein a rotor device is further provided in the vessel and that the truncated cone is mounted essentially parallel to the rotor axis.

9. Pulper according to any one of claims 1 to 8, wherein a scraping device is further provided, which is rotatably connected to the rotor device, and that the screen surface provided with holes is cleaned by the scraping device.

10. Pulper according to claim 9, wherein the scraping device comprises at least one scraper having a curvature opposite to the flow.

11. Pulper according to claim 10, at least one scraper is provided with at least one of an exchangeable wear shield and an adjustable wear shield on the front face thereof.

12. Pulper according to any one of claims 1 to 11, wherein the suspension is drawn off through the screening device by means of a pump provided with a controllable drive.

13. Pulper comprising: (a) a vessel; (b) a means for pulping and generating an annular flow of a liquid-solid mixture located in said vessel; (c) a screening device for separating coarse materials from the suspension, wherein the screening device has the shape of a truncated cone being provided with holes on the lateral surface thereof and being mounted on the base of the vessel, and the

truncated cone pointing upwardly with the smaller circular surface thereof and the lateral surface lying in an approximately tangential manner to the toroidal flow, the screening device being sub-divided into different segments and that these segments are individually attached from the external side of the vessel and are individually detachable from the internal side of the vessel; and (d) at least one scraper with at least one of an exchangeable wear shield and an adjustable wear shield on the front face thereof.

14. Pulper according to any one of claims 1 to 13 wherein the screening device is oriented such that a smaller end of the screening device is positioned above a larger end of the screening device.

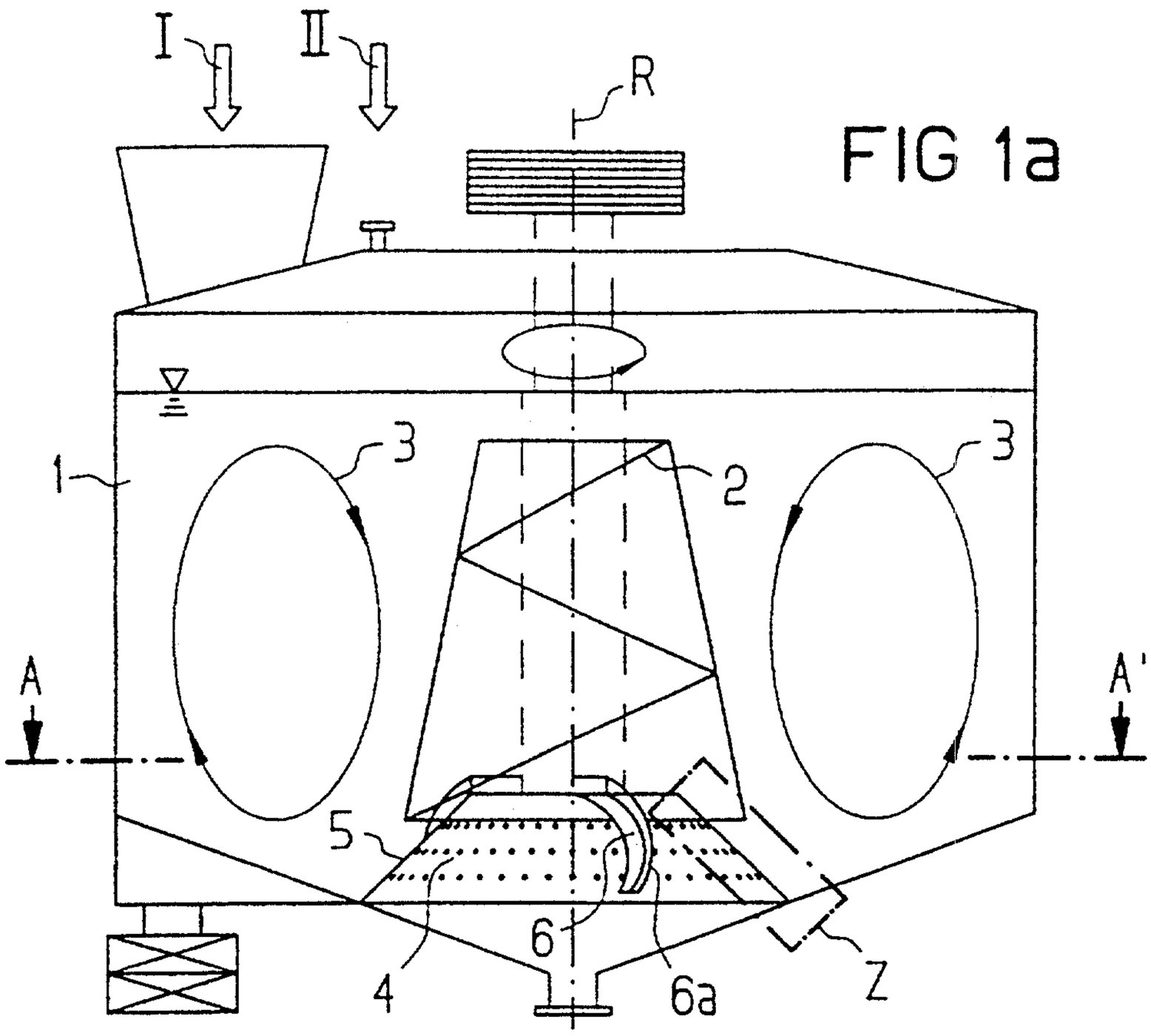


FIG 1a

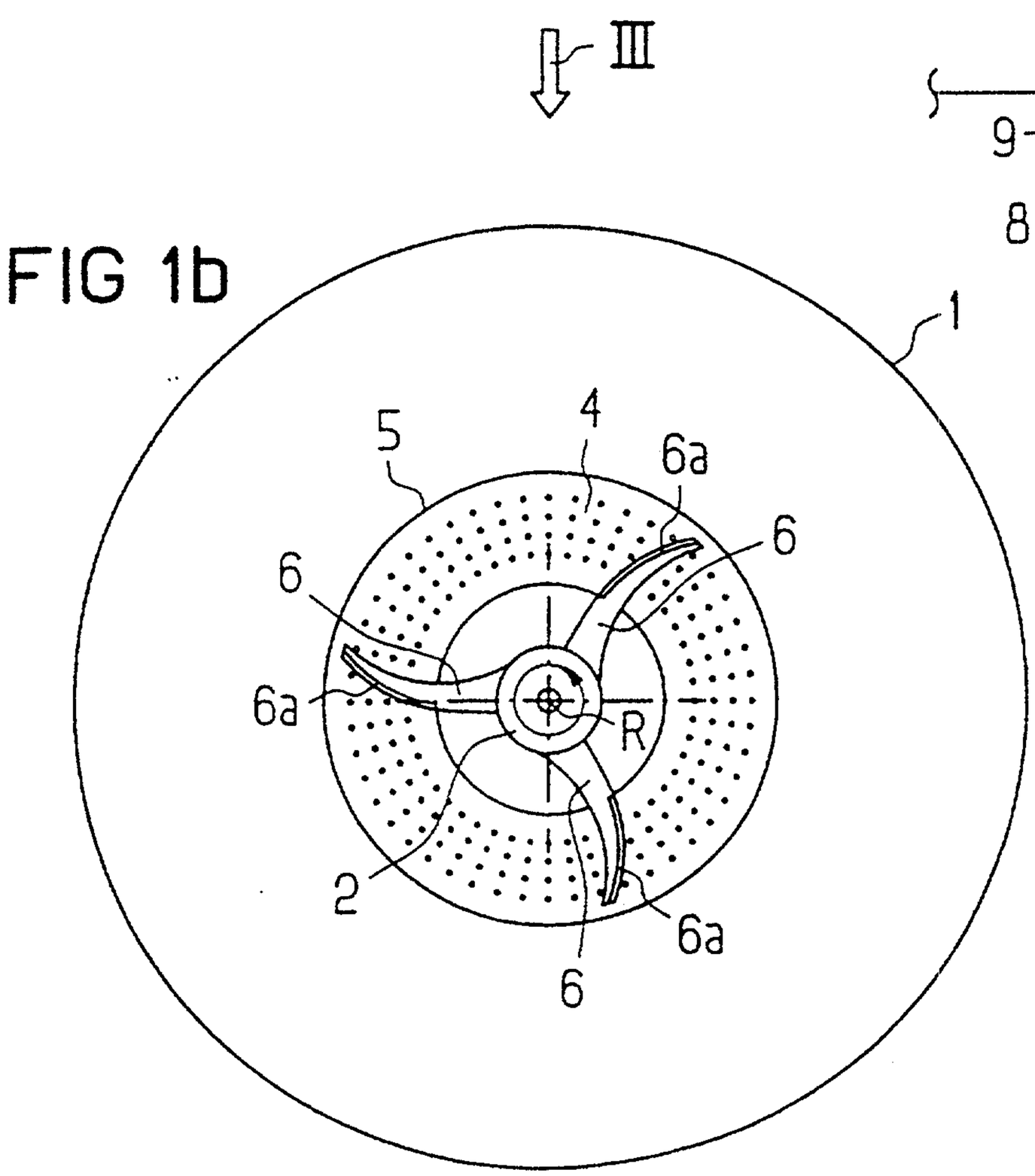


FIG 1b

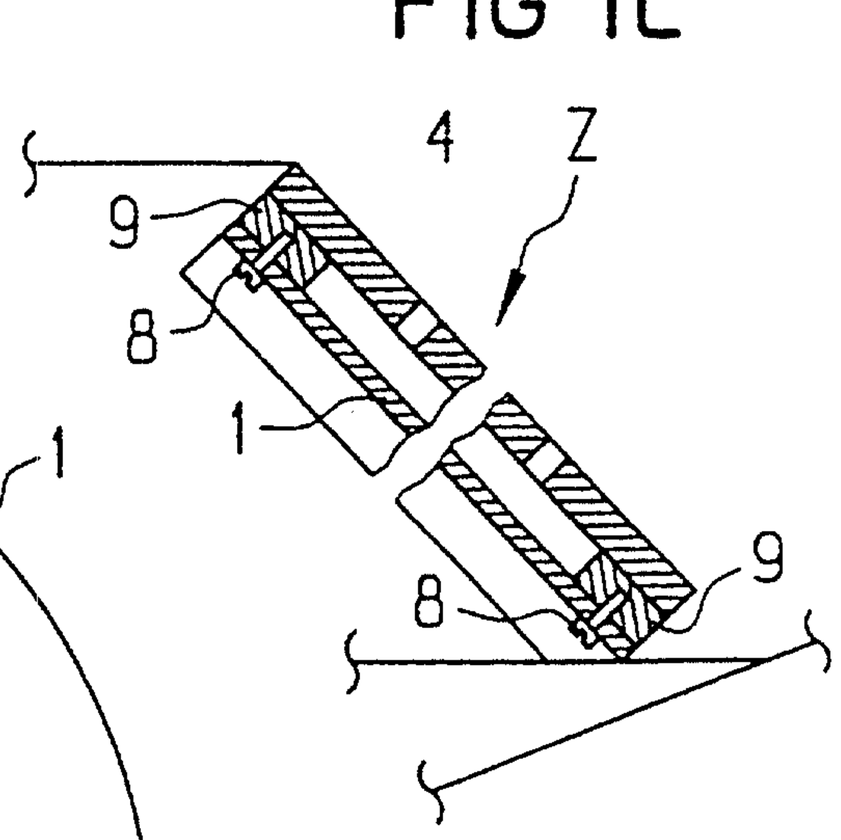
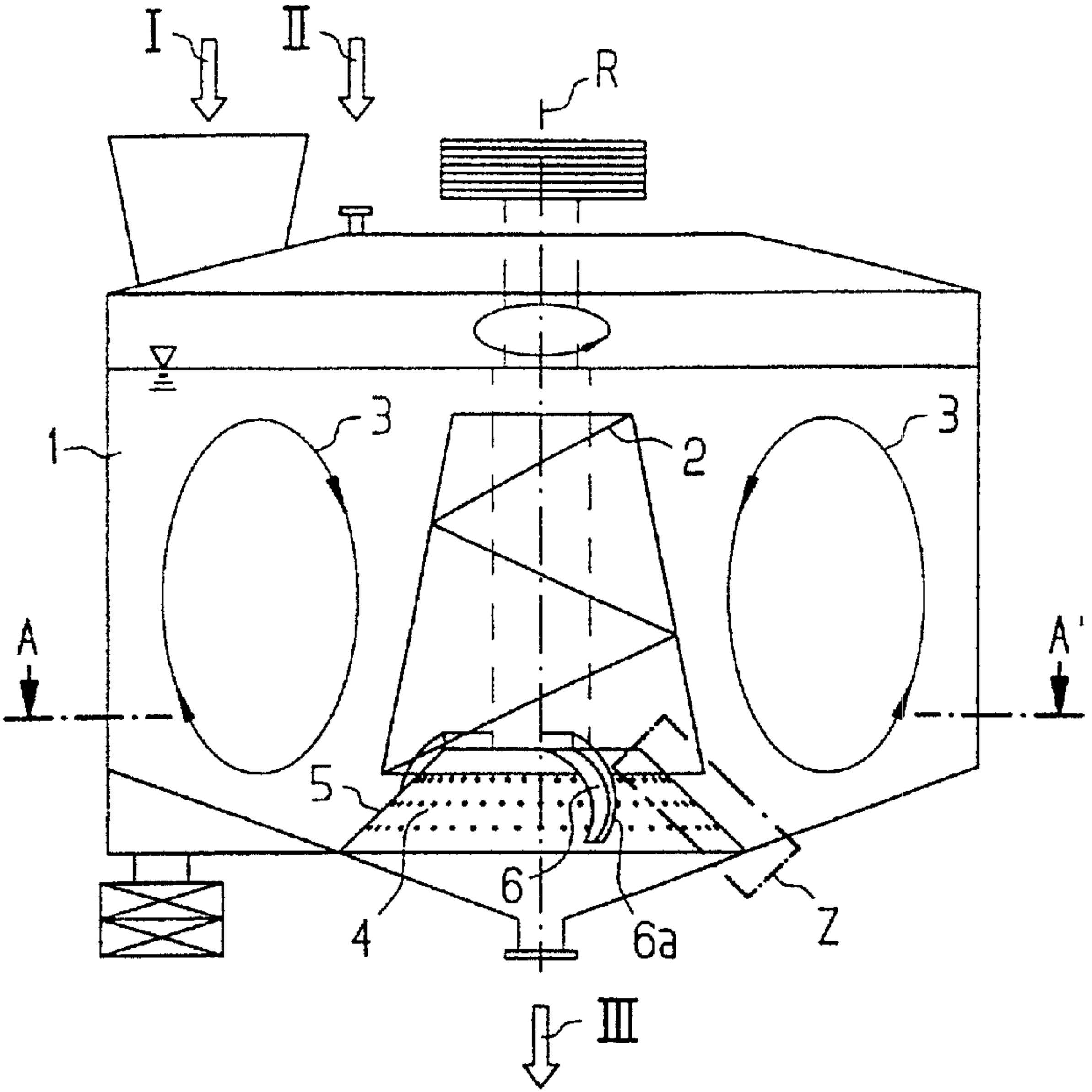


FIG 1c


I
II
R
1
3
2
3
A
A'
5
6
4
6a
Z
III