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(54) **Particle classifier**

(57) A particle classifier comprising a casing (12) with a vertical axis, having a top part (1) and a bottom part (10) coaxial to each other, said top part housing two or more separating chamber (2) evenly spaced around

said vertical axis. Each chamber (2) has its axis parallel to that of the classifier, i.e. vertical, and houses a separating assembly including a separating wheel (3) mounted for rotation about a shaft (4).

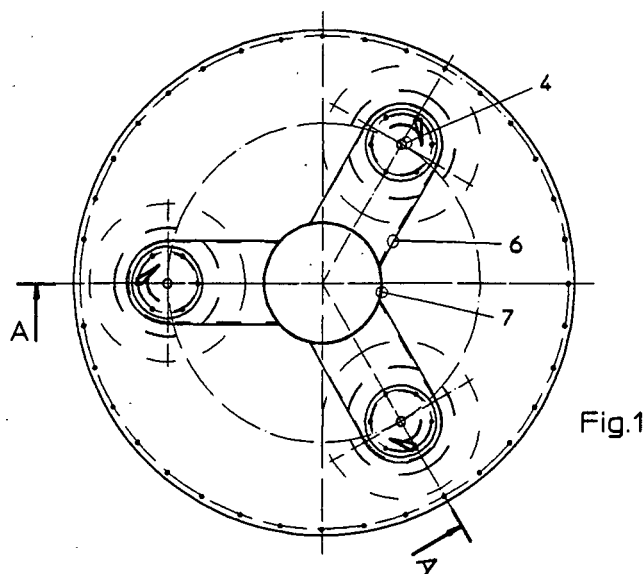


Fig.1

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Description

[0001] The present invention relates to a particle classifier for separating fine material solids from coarser particles, both being dispersed in an air flow.

[0002] In an apparatus of this type the material to be separated is dispersed in an air flow admitted into a separation chamber where - under the action of a rotor (separating wheel) - the coarse material is rejected by the centrifugal action of the wheel and drops by gravity to the bottom of the separation chamber, whereas the finer particles pass through the separating wheel and are ejected from the top section of the classifier.

[0003] In the known apparatuses the separating wheel is housed within a separation chamber and comprises a wheel formed with a plurality of evenly-spaced blades, arranged in the form of a blade ring with the blades extending parallel to the axis of rotation of the wheel or along a generatrix of a cone the axis of which coincides with the axis of rotation of the separating wheel.

[0004] The bottom of the separation chamber is connected to an outlet funnel for collecting and discharging the coarse particles falling downwards, while the top of the separation chamber is connected to a discharge pipe line through which the fine particles are sucked by a fan and sent to a device for separating the fine particles from the air current.

[0005] In the known apparatuses the capability of separating very fine particle resides in the centrifugal force applied by the wheel to the flow of material to be separated, and is therefore directly dependent upon the peripheral speed of the wheel and inversely dependent upon the wheel diameter.

[0006] In order to separate very fine particles, with all the airflowing conditions being equal, one can increase the wheel peripheral speed with the associated drawback of an unavoidable increase of both the material wear and the power consumption, and moreover with the limit set forth by the wheel mechanical resistance at high speed.

[0007] It is generally chosen to use two or more classifiers having wheels of a smaller diameter which implies the drawback of a smaller flow of the processed material.

[0008] EP-A-0 115 057 discloses a particle classifier comprising a single classification chamber with a vertical axis, having a top part and a bottom part coaxial to each other, said top part housing a number of separating wheels mounted for rotation about axes lying in a plane at right angle to the axis of said classification chamber.

[0009] This construction has the drawback of generating interferences and turbulences in the flows created by the wheels, which substantially increase the power consumption and impair the effectiveness of particles classification. Indeed it happened that, with an equal selection value, this solutions requires higher speed compared to the speed required by smaller classifiers, with

consequent increase of erosion of rotor parts in contact with the material, and of mechanical stress, and a very high power consumption, which cannot be admitted in low commercial value products.

[0010] The object of the present invention is to overcome the drawbacks of the prior art devices, by providing a particle classifier adapted to separate very fine particles in large flow of the material, with a smooth operation, a low erosion value and a low power consumption.

[0011] The invention accomplishes the above objects through a particle classifier as claimed in claim 1. Further advantageous features are recited in the dependent claims.

[0012] If we use separate chambers for each rotor, funnel-shaped or cylindrical with vertical axis, the classifying process happens independently in each chamber, thus allowing, compared to the absence of chambers, a reduction of erosion of those rotor parts in contact with the material, and a remarkable energy saving. Moreover, the invention allows compared to the use of different small dimensioned classifiers - an increase of production capacity, even though we keep the option of producing even different selection values, one for each chamber.

[0013] The invention will now be disclosed with reference to a preferred but not limiting embodiment thereof, illustrated in the attached drawings in which:

Fig. 1 is a schematic plan view of a separator according to the invention equipped with three separating wheels; and

Fig. 2 is a schematic cross section view along line A-A of Fig. 1.

[0014] Throughout all the Figures the same references are used to indicate equal or corresponding parts.

[0015] With reference to Figures 1 and 2, the separator according to the invention comprises a chamber 12 formed as a casing with a funnel-shaped top part 1 reducing the overall dimension of the apparatus and a cylindrical bottom part 10, both parts having the same vertical axis. The funnel-shaped top part 1 contains three evenly spaced funnel-shaped independent separation chambers 2 disposed around such axis. Each chamber 2 has its axis parallel to that of the classifier, i.e. vertical, and houses a separating assembly including a separating wheel 3 mounted for rotation about a shaft 4 in support members or bearings 5 located outside the classification chamber, with all said axes being parallel to the axis of said classification chamber.

[0016] Each of the separating wheels 3 comprises a plurality of blades located along the generatrix of a cone the axis of which coincides with the axis of rotation of the wheel, said blades being evenly spaced to one another and radially or obliquely oriented.

[0017] The top part of each separation chamber 2 is connected, preferably but not necessarily, to a central outlet discharge 7 through ducts 6, while the bottom part

is in communication with a single feeding duct 9, preferably through three ducts 8 - each for each chamber - merging into the feeding duct 9.

[0018] The ducts 8 - when provided for - are substantially located in the cylindrically-shaped bottom part 10 of the casing 12 and an outlet funnel 11 is connected to the lower end of the cylindrical part and partially surrounds the duct 9 feeding the airflow with the dispersed particulate material.

[0019] The operation of the classifier according to the invention is the following.

[0020] A flow of air in which is dispersed the material to be separated (that is a mixture of particles having different sizes) is fed from the bottom upwards through the feeding duct 9 and divided into three flows having substantially the same flowrate that are conveyed through the ducts 8 into the separation chambers 2 where the flows are subjected to the separating action of the wheels 3.

[0021] In the separation chambers 2 there are carried out autonomous processes for separating the finer particles from the coarser ones whereby the coarse particles are rejected from each wheels in a substantially independent manner thanks to the disposition of their axes, and gravity discharged through the cylindrical bottom part 10 into the outlet funnel 11. On the other hand the finer particles passing through the wheels 3 together with the dispersing air are sucked by means of a single fan not illustrated in the drawings, and sent to a further air-dust separating device of known type.

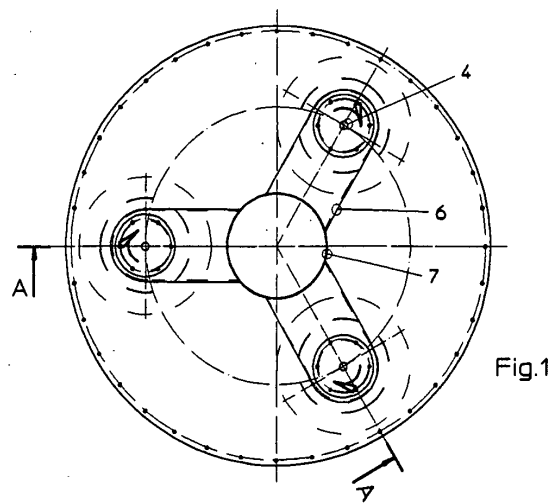
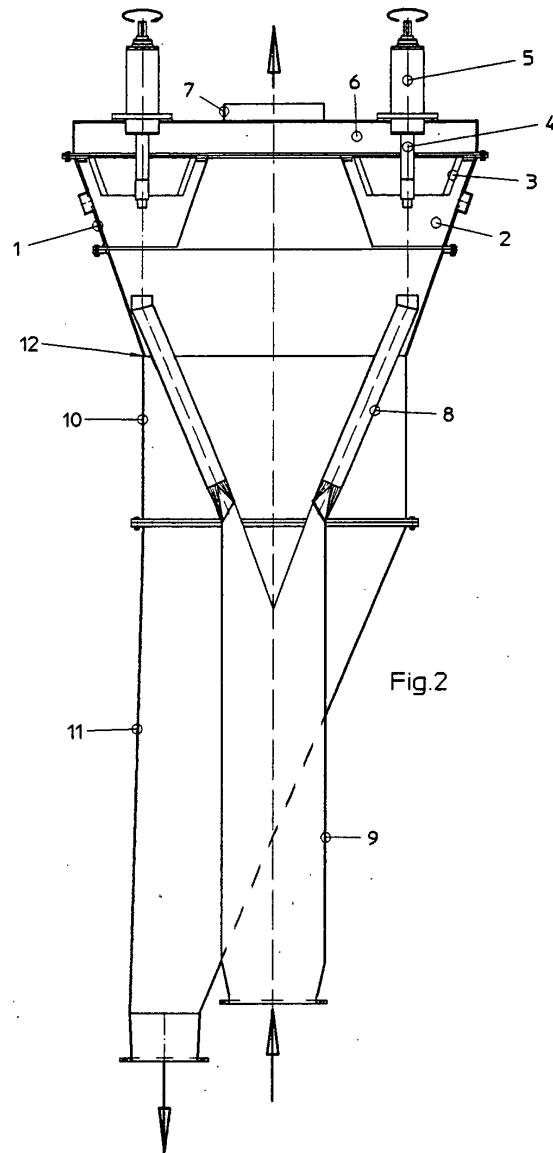
[0022] In accordance with a preferred embodiment of the invention, each separating assembly is actuated independently from the other, for example with each wheel 2 being driven by a separate motor so that each assembly can be operated independently from the other. This working modality is useful, for example, to check possible unbalances in the rotors, as well as the proper mechanical operation of each separating assembly. Moreover by using motors that are separately operable, and in case at different speeds, it is possible to obtain different types of separation of the fine particles for each separation chamber.

[0023] The invention allows for the separation of fine particles through an apparatus having reduced overall size and a performance similar or higher to the performance that can be obtained by using small particle classifiers, but with the advantage of conveying the airflows containing the finer particles into a single outlet discharge duct, provided with a single suction system, and of collecting the coarser particles from a single outlet funnel.

[0024] Although the present invention has been illustrated with reference to preferred embodiments, it is generally subjected to other applications and modifications which fall within the scope of the invention, as it will be evident to the skilled of the art.

Claims

1. A particle classifier comprising a casing (12) with a vertical axis, having a top part (1) and a bottom part (10) coaxial to each other, said top part housing a number of separating wheels (3) evenly spaced around said vertical axis for separating the finer particles in a mixture of particles dispersed in an airflow directed to said separating wheels (3), and a central outlet discharge duct (7) for collecting said fine particles, **characterised in that** said wheels (3) are housed within as many independent separation chambers (2).
2. A particle classifier as claimed in claim 1, **characterised in that** the axes of said separating wheels (3) are parallel to the vertical axis of the machine.
3. A particle classifier as claimed in claim 1, **characterised in that** said top part (1) housing the separating wheels (3) is funnel-shaped and **in that** each of said separating wheels (3) is contained in a funnel-shaped separation chamber (2).
4. A particle classifier as claimed in claim 1, **characterised in that** said top part (1) housing the separating wheels (3) is cylindrical and **in that** each of said separating wheels (3) is contained in a cylindrical separation chamber (2).
5. A particle classifier as claimed in claim 1, **characterised in that** said wheels (3) are mounted for rotation about shafts (4) in support members or bearings (5) located outside said separation chambers (2).
6. A particle classifier as claimed in any of the preceding claims, **characterised in that** said airflow in which a mixture of particles is dispersed is fed through a single feeding duct (9) in communication with the bottom part of said casing (12).
7. A particle classifier as claimed in claim 6, **characterised in that** said feeding duct (9) communicates with said separation chamber (2) through separate ducts (8) merging into said feeding duct (9).
8. A particle classifier as claimed in any of the preceding claims, **characterised in that** each of said wheels (3) is driven independently from the other.





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EUROPEAN SEARCH REPORT

Application Number
EP 02 02 0347

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		6 February 2003	Laval, J
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 02 02 0347

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