(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 369 594 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **89310305.1**

(51) Int. Cl.[5]: **B07B 7/083**

(22) Date of filing: **09.10.89**

(30) Priority: **14.11.88 GB 8826540**

(43) Date of publication of application:
23.05.90 Bulletin 90/21

(84) Designated Contracting States:
DE ES FR GB IT

(71) Applicant: **F.L. Smidth & Co. A/S**
77 Vigerslev Alle
DK-2500 Valby Copenhagen(DK)

(72) Inventor: **Rohde, Gorm Erik**
77 Vigerslev Alle
DK-2500 Valby Copenhagen(DK)

(74) Representative: **Brunner, Michael John et al**
GILL JENNINGS & EVERY 53-64 Chancery Lane
London WC2A 1HN(GB)

(54) Separator for sorting particulate material.

(57) A separator for sorting particulate material suspended in a conveying gas into a fine fraction and a coarse fraction, has a rotor (1) with vanes (2) rotatable about a generally upright axis and a drive shaft (3) which is tubular, and has an outside diameter which is at least substantially the same size as that of the outlet opening (6) of the separator. The shaft (3) is rotatably mounted at its uppermost end on top of the separator housing per se. A separator housing (4) encases the rotor and has an inlet duct (5) for the supply of unsorted material to the rotor and a central outlet opening (6) at the top of the separator housing connected with an outlet duct (7) for discharge of the separated fine fraction.

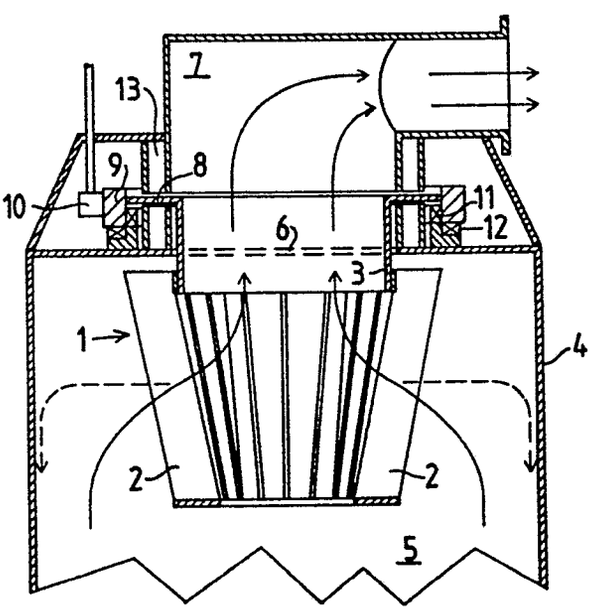

Fig.1

EP 0 369 594 A1

SEPARATOR FOR SORTING PARTICULATE MATERIAL

The invention relates to a separator for sorting particulate material, suspended in a conveying gas, into a fine fraction and a coarse fraction, the separator comprising a rotor with vanes rotatable about a substantially vertical axis and having a drive shaft rotatably mounted at the top of the separator, a separator housing encasing the rotor and having an inlet duct for the supply of unsorted material to the outer side of the rotor and a central outlet opening at the top of the separator housing connected with an outlet duct for discharge of the separated fine fraction.

In a separator of this kind the material/gas suspension is conveyed past the rotating vanes, where the coarse fraction is flung outwards towards the wall of the housing by the centrifugual force. Since the gas stream velocity at this wall is insufficient to entrain the coarser particles, the latter will fall down along the wall to the bottom of the separator, whilst the finer fraction of the material remains entrained in the gas stream and is conveyed past the rotor vanes and out through the outlet duct of the separator for subsequent separation from the gas stream, e.g. by a precipitator arrangement.

A separator of the above kind is often incorporated at the top of a vertical roller mill. Such an application is known, for example, from US-A-4235385.

As disclosed in the above patent specification, the rotor shaft is rotatably mounted at the top of the outlet duct, and the distance between the point where the rotor shaft is suspended and the rotor proper is comparatively large. This results in extreme sensitivity of the rotor arrangement to vibrations occurring in the separator in use, especially if the separator is incorporated at the top of a vertical roller mill, which, in itself, often generates vibrations during the material grinding.

In the mill, known from the above patent specification, the rotor is provided with a solid drive shaft, but in mills where it is advantageous to supply the material to be ground centrally to the grinding compartment under the separator, the rotor may be equipped with a hollow or tubular drive shaft so that the material is supplied through the hollow shaft. However, the shaft diameter is much smaller than the outlet opening of the separator and the shaft will still be suspended at the top of the outlet duct as shown in above example.

An object of the present invention is to reduce the incidence of the aforementioned adverse vibrations in the rotor arrangement of a separator of the kind described, and, according to the invention, this is achieved by means of a tubular rotor drive shaft having an outside diameter which is at least substantially the same size as that of the outlet opening of the separator, the shaft being rotatably mounted at its uppermost end on top of the separator housing per se.

Because the drive shaft, and hence the rotor, is mounted at the top of the separator housing proper and not on top of the outlet duct, a significant reduction in the length of the drive shaft is attained as compared with that of the known separators, thus eliminating or, at least, significantly reducing the incidence of the aforementioned adverse vibrations.

The tubular drive shaft may advantageously, at its uppermost end, be provided with a driving means, for instance a ring gear, to rotate the shaft and thus the rotor.

If the diameter of the drive shaft is substantially the same as that of the outlet opening of the separator housing, it may be extended upwards within the lower part of the outlet duct, and may have, at its uppermost end, a substantially horizontal flange which passes through the wall of the outlet duct and through a sealing air chamber encasing this wall, and the driving means may then be fitted on the flange around the sealing air chamber.

If the drive shaft diameter is larger than that of the outlet opening, the drive shaft may extend up through the top of the separator housing around the outlet duct and through a sealing air chamber located on top of the separator housing.

Two examples of a separator constructed in accordance with the invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is an axial sectional view through a separator with a first of rotor drive shaft design; and,

Figure 2 is a similar view of a separator with an alternative drive shaft design.

The separators shown each have a rotor 1 with vanes 2 rotatable about a vertical axis driven by a motor (not shown) via a drive shaft 3. The rotor is encased in a cylindrical housing 4, the lower part of which also constitutes an inlet duct 5 for supplying unsorted material, suspended in a conveying gas, to the rotor 1. At the top of the housing 4 is an outlet duct 7 for carrying away a fine fraction of the material separated in the rotor.

The separator operates in the following known way. The material to be sorted in the separator is supplied, suspended in conveying gas, upwards within the lower part 5 of the housing 4, from where the suspension flows into the rotor 1, passing, as

indicated by full-line arrows, through the vane set 2 of the rotor. The material is sorted into a coarse fraction which, as indicated by dotted arrows, is flung outwards, by the centrifugal forces provided by the rotor 1, towards the housing 4 and falls down along the wall of the latter, and a fine fraction which passes through the outlet opening 6, to be discharged from the separator throught the outlet duct 7.

Figure 1 illustrates a separator having the drive shaft 3 provided with a flange 8, on which a gear ring 9 is mounted which can be driven via a drive 10 by a motor (not shown).

The drive shaft arrangement is shown suspended and mounted on radial and axial bearings 11 and 12, supported at the top of the separator housing.

The flange 8 passes a sealing air chamber 13 in order to prevent outflow of material from the outlet duct to the environment in the event of overpressure in the separator.

The separator illustrated in Figure 2 is different from that presented in Figure 1 in that the drive shaft diameter exceeds that of the outlet opening 6. Therefore, in this example the cylindrical part of the drive shaft passes through the top of the separator housing 4 and through a sealing air chamber 14 on the top of the housing 4.

In both examples the relative shortness and greater effective diameter of the drive shaft, in comparison with conventional designs, serves to reduce vibration of the rotating vanes.

Claims

1. A separator for sorting particulate material suspended in a conveying gas into a fine fraction and a coarse fraction, the separator comprising a rotor (1) with vanes (2) rotatable about a generally upright axis and having a drive shaft (3) rotatably mounted at the top of the separator; a separator housing (4) encasing the rotor and having an inlet duct (5) for the supply of unsorted material to the rotor and a central outlet opening (6) at the top of the separator housing connected with an outlet duct (7) for discharge of the separated fine fraction, characterised in that
the rotor drive shaft (3) is tubular, and has an outside diameter which is at least substantially the same size as that of the outlet opening (6) of the separator, and in that the shaft (3) is rotatably mounted at its uppermost end on top of the separator housing per se.

2. A separator according to claim 1, characterised in that the tubular drive shaft (3) is provided, at its uppermost end, with a driving means (9) for rotating the shaft.

3. A separator according to claim 2, characterised in that the drive shaft (3) extends upwards within the lower part of the outlet duct (7) and has, at its uppermost end, a substantially horizontal flange (8) which passes through the wall of the outlet duct (7) and through a sealing air chamber (13) surrounding the wall, and in that the driving means (9) is fitted on the flange (8) around the sealing air chamber (13).

4. A separator according to claim 2, characterised in that the drive shaft (3) extends through the top of the separator housing (4) around the outlet duct (7) and through a sealing air chamber (14) located on top of the separator housing.

5. A separator according to any of claims 2 to 4, characterised in that the driving means is a ring gear (9).

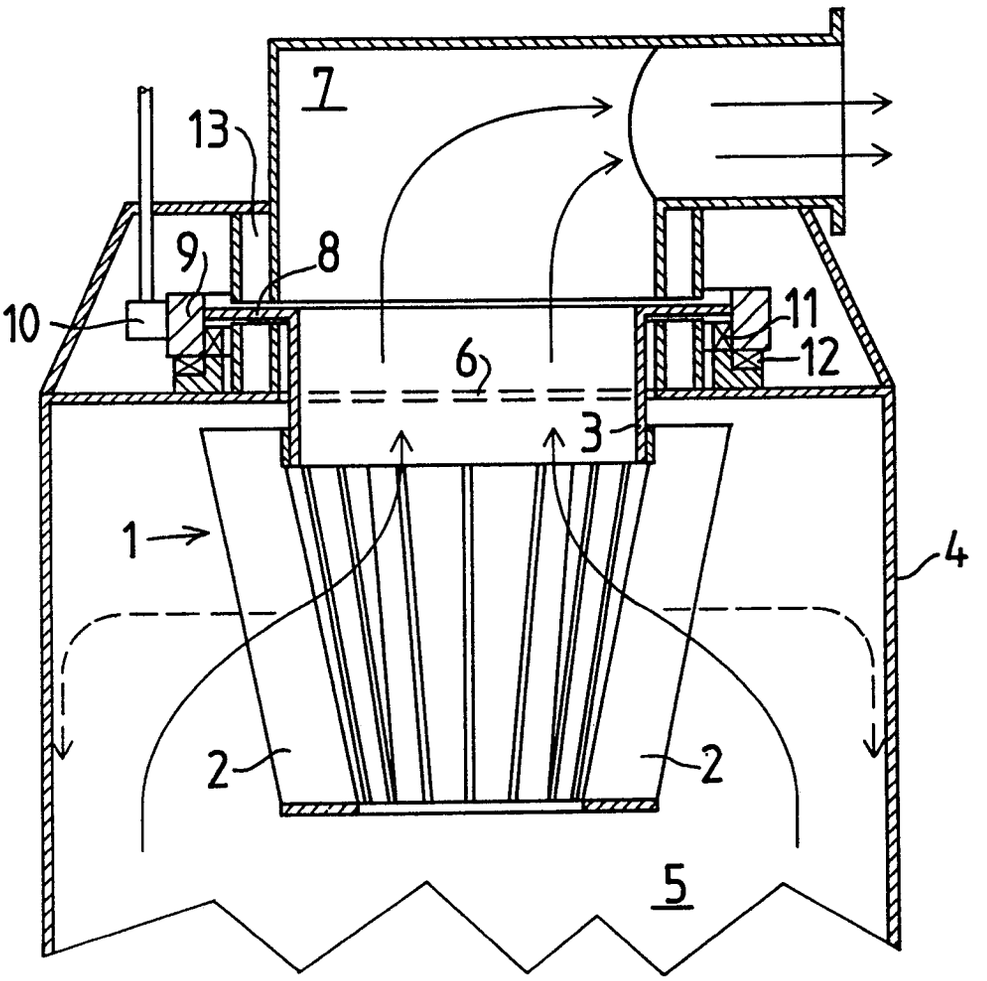

Fig.1

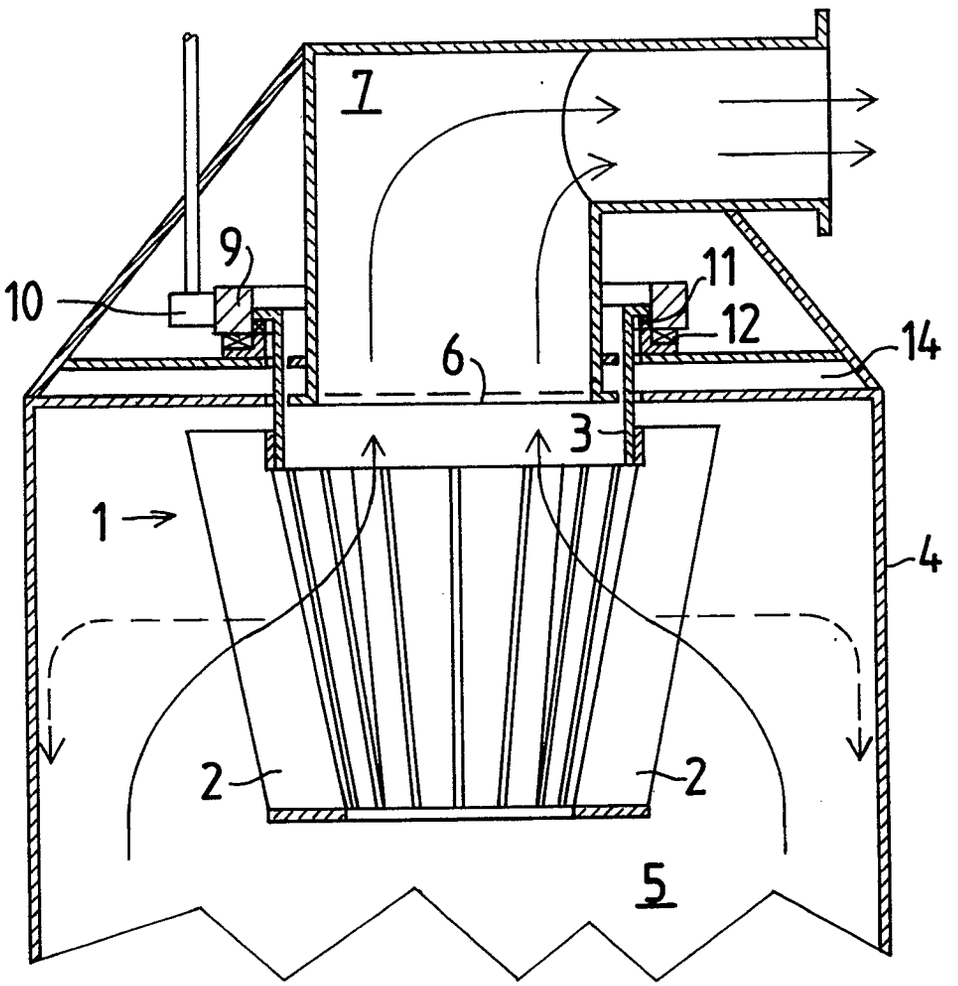

Fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 31 0305

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-E- 27 742 (LAPPLE) * Column 3, line 41 - column 4, line 60; column 5, lines 27-32; column 5, line 46 - column 6, line 5; column 6, line 74 - column 7, line 46; figures *	1,2,5	B 07 B 7/083
A	---	3,4	
A	EP-A-0 204 412 (F.L. SMIDTH & CO. A/S) * Abstract; page 1, lines 19-25; page 3, line 36 - page 4, line 12; figure *	1,2	
D,A	---		
	US-A-4 235 385 (BRUNDIEK) * Column 2, lines 39-47; column 3, lines 16-22; figures 1,1a *	1,2	
A	---		
	DE-A-3 712 909 (INSTITUT CHIMII TVERDOGO TELA I PERERABOTKI MINERAL'NOGO SYR'JA SIBIRSKOGO OTDELENIJA AKADEMII NAUK SSSR) * Column 4, lines 16-39; column 4, line 58 - column 5, line 11; figures *	1,2,4	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
B 07 B B 02 C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	08-02-1990	VAN DER ZEE W.T.

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

EPO FORM 1503 03.82 (P0401)