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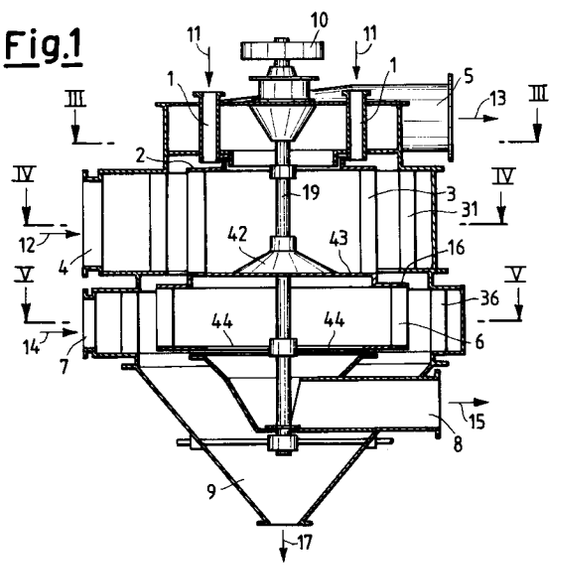
(54) Dynamic separator for pulverulent materials, in particular cement, and a plant incorporating it.

(57) The invention provides a dynamic separator for pulverulent materials, particularly cement, of the type incorporating rotary drums (3,6) traversed by an air stream acting as the separating medium, characterised by comprising a pair of rotary drums (3,6) arranged separately in series one above the other, each of said drums being traversed by an air stream fed independently into the separator and towards each drum through a spiral duct (4,7) with its inlet and outlet tangential, so that each air stream in passing through each drum causes the formation of two separate particle size fractions, namely a fine fraction which leaves from said tangential ducts and a coarse fraction which descends into the separator, the separator hence producing a total of three particle size fractions.

Fig.1



EP 0 519 535 A1

For the industrial separation of pulverulent products, particularly cement, machines have for some time known consisting of a selector in the form of a drum rotating about a vertical axis and comprising a plurality of selector blades mounted on its perimeter. The material to be separated is fed and distributed over the selector so that it falls peripherally to the lateral surface of the drum, through which separation air passes transversely.

The final product (in particular cement) is entrained by the air passing through the drum and is recovered in a cyclone or filter. The fineness of the final product depends on various parameters. The greater the flow rate and hence velocity of the air passing through the drum selector, the coarser the entrained particles, leading to a reduction in product fineness.

In addition, for equal traversing air velocities an increase in the peripheral speed of the selector drum leads to rejection of the coarser particles and a resultant finer product.

Likewise, for equal peripheral drum speeds, an increase in the number of selector blades mounted on the drum periphery again leads to rejection of the coarser particles and a resultant finer product.

These machines are distinguished by high precision cut-off, so that the product has a narrower particle size distribution than that obtained by separators of older design.

A problem generally arises when the grinding plant with which the separator is used, mainly of roller pulverizer type, itself tends to produce a material to be separated which is low in very fine matter and hence having a narrower particle size distribution.

The resultant product is then unpopular with the user because it suffers from problems of excessively fast setting and poor workability.

A method of overcoming this problem could be to lower the cut-off point of the separator, hence losing precisely the advantage of these machines, or to improve the efficiency of the entire grinding plant to which they are connected.

A further method could be to produce two types of cement of different fineness in two parallel plants and then mix them in suitable proportions to vary the final particle size distribution. It is however expensive in terms of plant cost to provide a system for dividing the material feed along two parallel lines, and in addition involves problems of spatially accommodating the two lines, and difficulties in incorporating them into existing plants.

The object of the present invention is to effectively solve the problem of the product particle size distribution curve and hence the problem of product quality, without renouncing the high efficiency of known separators of rotary drum selector type.

This object is attained according to the present invention by a dynamic separator of rotary drum type for pulverulent materials, particularly cement, characterised by comprising a pair of rotary drums arranged separately in series one above the other, each of said drums being traversed by its own air stream, which is fed independently into the separator and towards each drum through a spiral duct with its inlet and outlet possibly tangential, so that each air stream in passing through each drum causes the formation of two separate particle size fractions, namely a fine fraction which leaves from said tangential ducts and a coarse fraction which descends into the separator, hence producing a total of three particle size fractions.

The characteristics and advantages of the present invention will be more apparent from the description of some embodiments thereof given hereinafter with reference to the figures of the accompanying drawings.

These embodiments are merely illustrative of the invention, and are not limitative thereof.

Figure 1 is a schematic elevational view of a separator according to the invention.

Figure 2 is a view analogous to the preceding, showing a modified embodiment of a separator according to the invention.

Figures 3, 4 and 5 are sections respectively on the lines III-III, IV-IV and V-V of Figures 1 and 2.

Figure 6 is a schematic illustration of a grinding plant incorporating the separator shown in Figure 1.

Figure 7 shows a possible embodiment of a plant incorporating the separator of the invention shown in Figure 2.

With reference to Figure 1, a separator comprises a substantially cylindrical body traversed along its vertical axis by a shaft 19 with a variable speed drive 10. The shaft 19 supports and drives a pair of separate rotary drums 3 and 6 rigid therewith, these being arranged in series one above the other within the separator.

These drums carry perimetrally a plurality of selector blades arranged radially or inclined, their purpose being to separate the material fed into the separator above the upper drum 3 via vertical feed tubes 1, to fall peripherally to the lateral surface of the drum in the region of the blades. External to each of the two drums and facing them there are provided an upper stator 31 and a lower stator 36, these also being provided with a plurality of blades, their primary purpose being to generate a tangential component in the separation air stream.

A first separation air stream of flow rate P_1 is fed into the top of the separator via a tangential inlet duct 4, which in the illustrated embodiment is of volute or spiral form.

A first fraction 13 of dust-laden air leaves from a duct 5 in the region above the drum 3.

The lower drum 6 is separated and sealed from

the upper drum 3 by the conical plate 42, the base 43 and the rim 16.

A second separation air stream 14 (of flow rate P_2) is fed into the lower region of the separator through a relative tangential inlet duct 7 which also extends in volute form, to leave from an outlet duct 8 as the second fraction 15 of dust-laden air.

At its bottom the separator is provided with a discharge hopper 9 for the coarser rejected material 17, which leaves via the bottom of the separator from the region external to the second drum. This latter is supported by the shaft 19, via radial arms 44.

The principle of operation of the separator shown in Figure 1 is essentially as follows: the material to be separated 11 is fed to the separator via the feed tubes 1 and is distributed by the top 2 of the rotary drum 3.

The separation 12 air is fed into the tangential inlet duct 4 and passes through the material 11 distributed by the rotary drum 3 to emerge as dust-laden air 13 from the outlet duct 5. The material suspended in the air 13 represents the first finished product, selected by the drum 3 driven at variable speed by the shaft 19. From the region external to the drum 3 the coarser material 17 falls onto the rim 16 and then in front of the second drum separator 6, which can differ from the first in its diameter and the height and number of its selector blades, according to the desired fineness of the product, which is traversed by the separation air 14 fed into the tangential inlet duct 7, to leave as dust-laden air 15 through the outlet duct 8.

The material suspended in this air represents the second final product, its fineness differing from that of the first final product because of the different dimensions of the second drum 6 and the different flow rate of the separation air 14.

The rejected coarse material 17 is evacuated from the underlying discharge hopper 9 to be recycled to the mill for further grinding.

Figure 2 shows a separator operating essentially according to the same principle but with the facility for varying the rotational speed of the lower drum 6 separately from that of the upper drum 3 by a suitable variable speed drive 18 which acts on a second shaft 19'.

Figure 6 shows a possible configuration of a grinding plant using the separator shown in Figure 1. In Figure 6, the material 26 to be separated is conveyed by an elevator 27 from a mill 25 to the separator 28.

The air 29 from the dust-collection stage of the mill 25 is used as the separation air for the upper stage, together if necessary with environmental air 30.

The air 13 leaving the upper stage is fed to a filter 32 and discharged via a stack 33, the first product 34 being collected in the bottom of the filter.

The separation air 35 of the lower stage leaves the separator as dust-laden air 15, which is subjected to dust removal in a cyclone 37 and recycled to the separator by a fan 38.

The second product 38 is discharged from the cyclone 37. The fineness of the two products 34 and 38 can be adjusted by varying the rotational speed of the drums by means of the drive 10 and the flow rate of the separation air streams 29, 30 and 35 by means of the flow regulators 39 and 40 respectively.

The separated coarse material 17 is returned to the mill for further grinding.

The two products obtained can be used separately or combined to form a product of wider particle size distribution.

A further embodiment of a plant according to the invention is illustrated in Figure 7, in which the air 14 for the lower separation stage is all environmental air and the dust-laden air 15 leaving said stage is subjected to dust removal in a filter 41 and discharged through a stack 48.

The fineness of the two products 17 and 45 is adjusted by varying the speed of the selectors of the two stages by means of the respective variable speed drives 10 and 18, and varying the flow rate of the separation air for the two stages by means of the flow regulators 46 and 47 respectively.

Again in this case the two products 17 and 45 can be used separately as products of different fineness, or be combined to widen the particle size distribution curve of the resultant product.

The rejected coarse material 17 is returned to the mill for further grinding.

Claims

1. A dynamic separator for pulverulent materials, particularly cement, of the type incorporating rotary drums traversed by an air stream acting as the separating medium, characterised by comprising a pair of rotary drums arranged separately in series one above the other, each of said drums being traversed by an air stream fed independently into the separator and towards each drum through a spiral duct with its inlet and outlet possibly tangential, so that each air stream in passing through each drum causes the formation of two separate particle size fractions, namely a fine fraction which leaves from said tangential ducts and a coarse fraction which descends into the separator, hence producing a total of three particle size fractions.

2. A separator as claimed in claim 1, charac-

terised by comprising a single shaft for rotating the drums.

3. A separator as claimed in claim 1, characterised by comprising two independent shafts, each separately driving each of said drums at its own rotational speed.

4. A separator as claimed in claim 1, characterised in that each of said separation air streams encounters a circular stator facing said tangential inlet duct and arranged external to each drum, so that said stator intercepts and conveys said air stream before it strikes said drum.

5. A separator as claimed in claim 1, characterised in that said two drums differ from each other in their dimensions or geometrical configuration, for example in their height or diameter.

6. A separator as claimed in claim 1, characterised in that said drums are provided with a plurality of selector blades fixed peripherally in a radial or inclined direction.

7. A separator as claimed in claim 6, characterised in that said drums differ from each other in the number of said selector blades.

8. A separator as claimed in claim 1, characterised in that each of said separation air streams can have a different flow rate.

9. A plant comprising the separator claimed in claim 1, characterised in that each of the two fine particle size cuts leaving said separator from said tangential ducts is fed to a corresponding dust removal stage.

10. A plant as claimed in claim 9, characterised in that the dust-laden air treated in said dust removal stage is recycled to the separator.

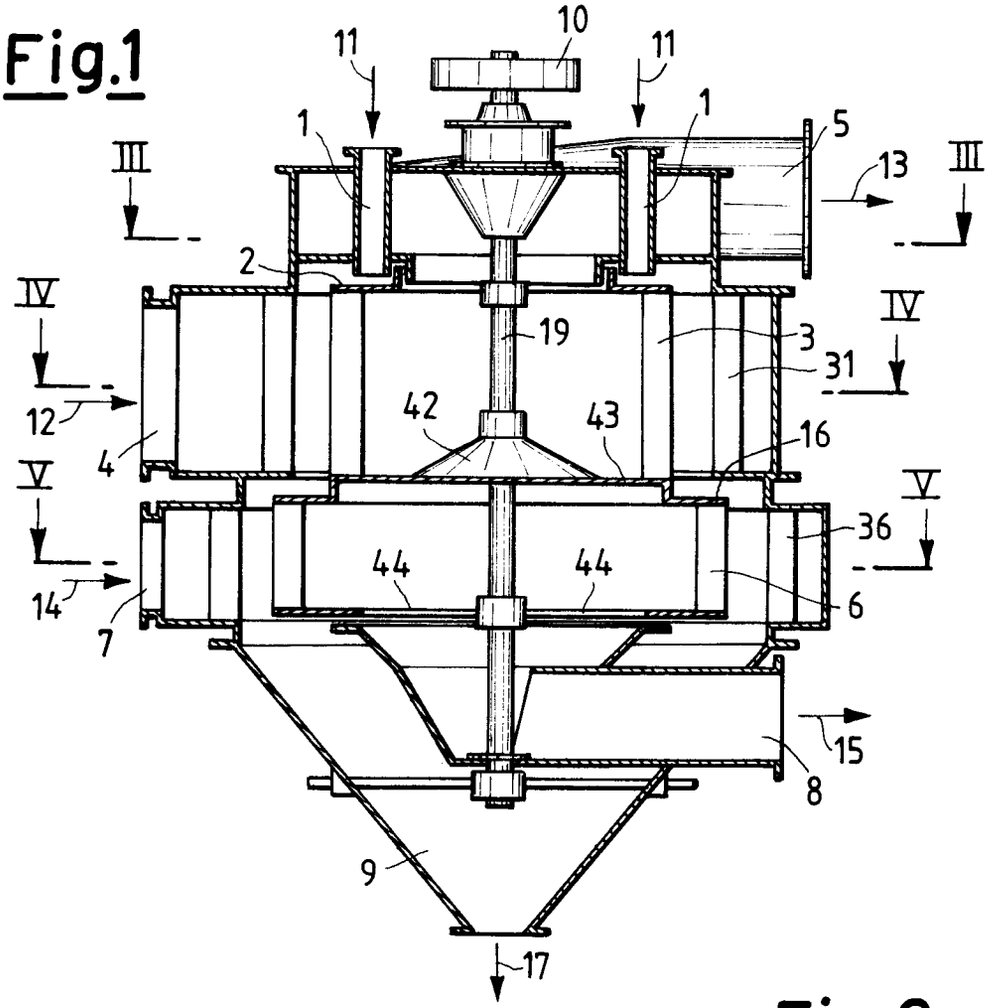
11. A plant as claimed in claim 9, characterised by comprising a mill for grinding into said pulverulent material, which is separated from an air stream, said stream being fed to the first drum of said separator as separation air, possibly mixed with environmental air.

12. A plant as claimed in claim 9, characterised in that the coarsest fraction produced in said separator is returned to said grinding stage.

13. A plant as claimed in claim 9, characterised in that environmental air, air originating from the mill or handling systems dust collection plant, or air recycled from the dust removal units can be used as separation air for each stage.

14. A plant as claimed in claim 9, characterised in that the products obtained from each of the two separation stages can be used separately or combined to form a single product of predetermined separation air stream.

Fig.1


10
11
11
1
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13
III
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2
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IV
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17

Fig.3

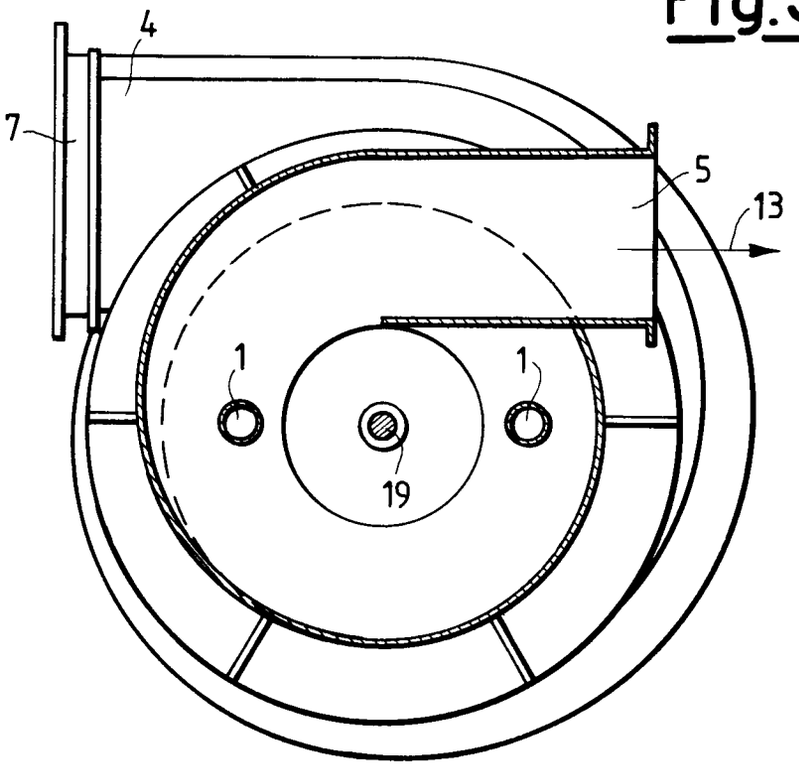

4
7
5
13
1
1
19

Fig.2

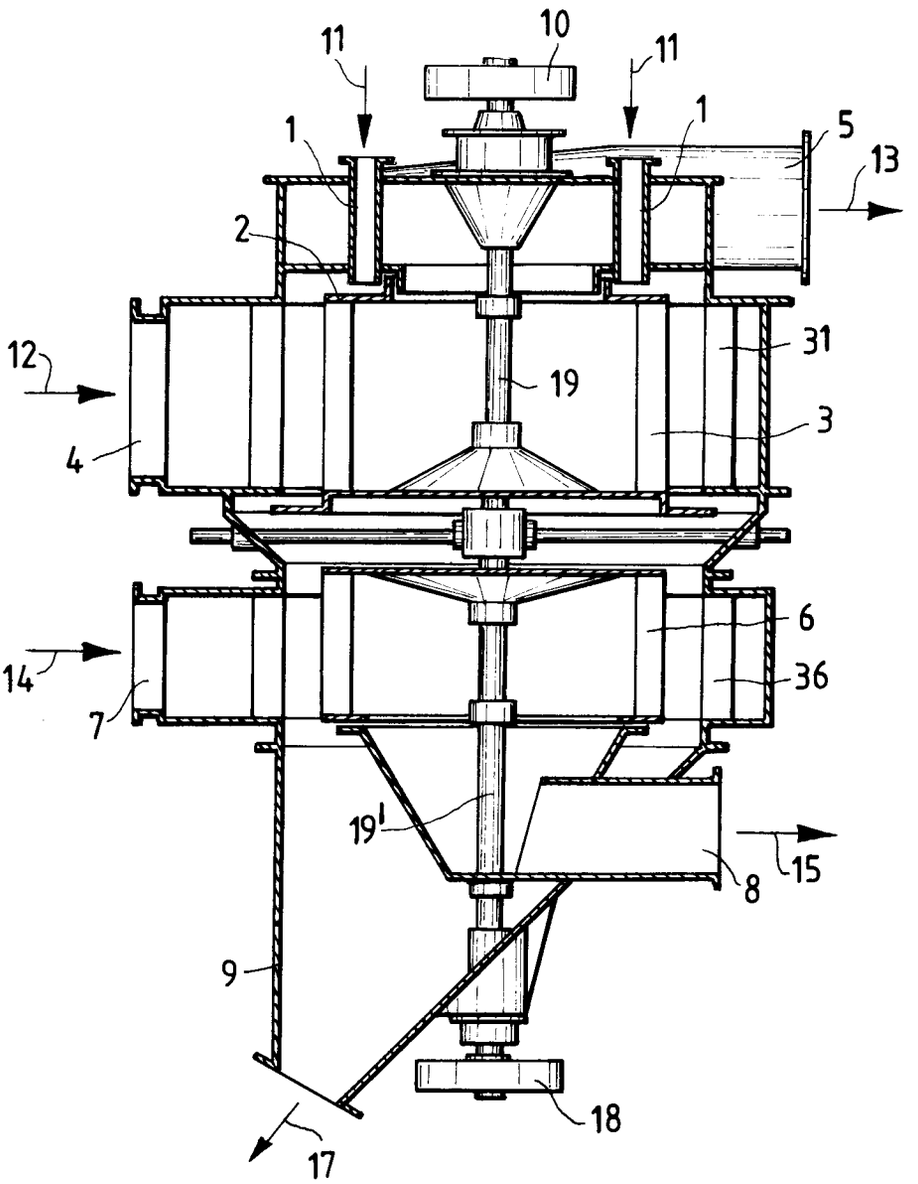


Fig.4

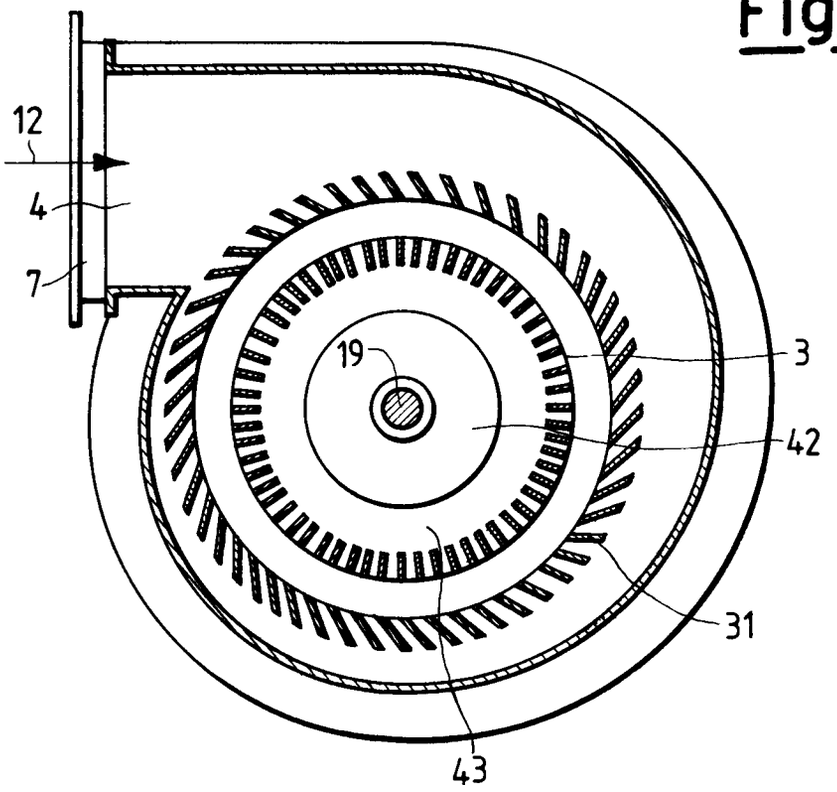
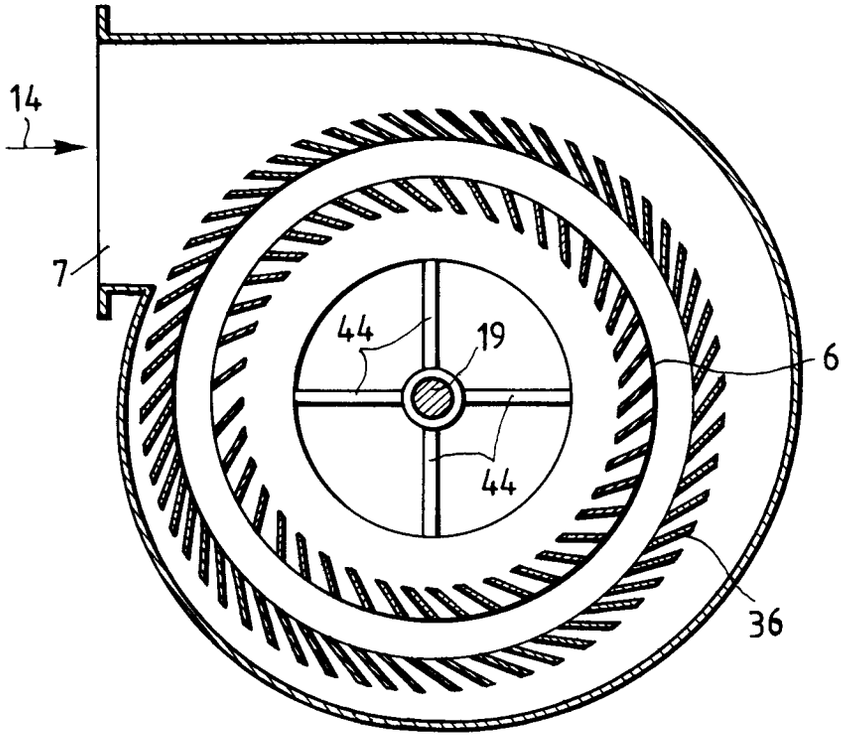


Fig.5



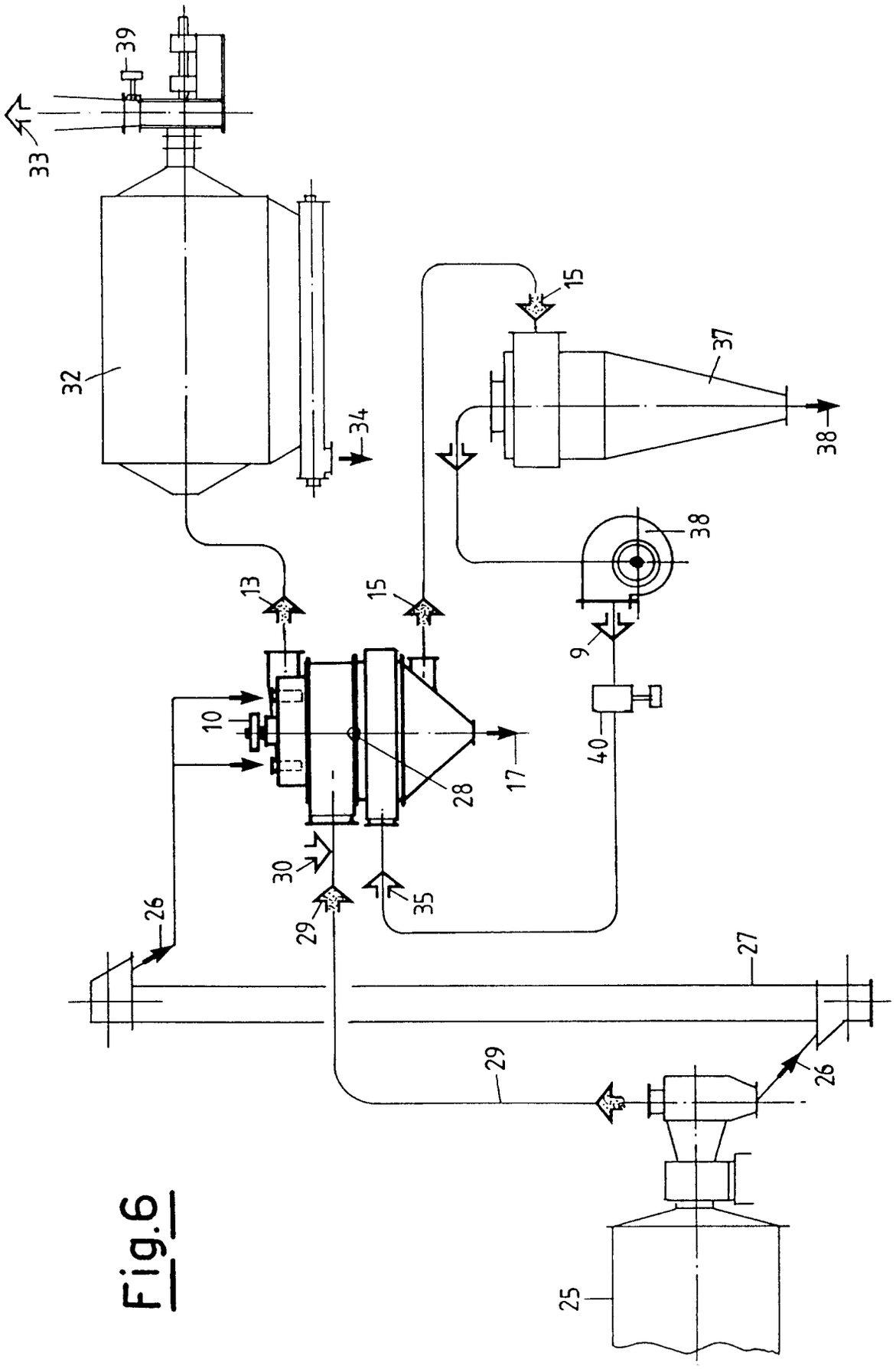


Fig.6

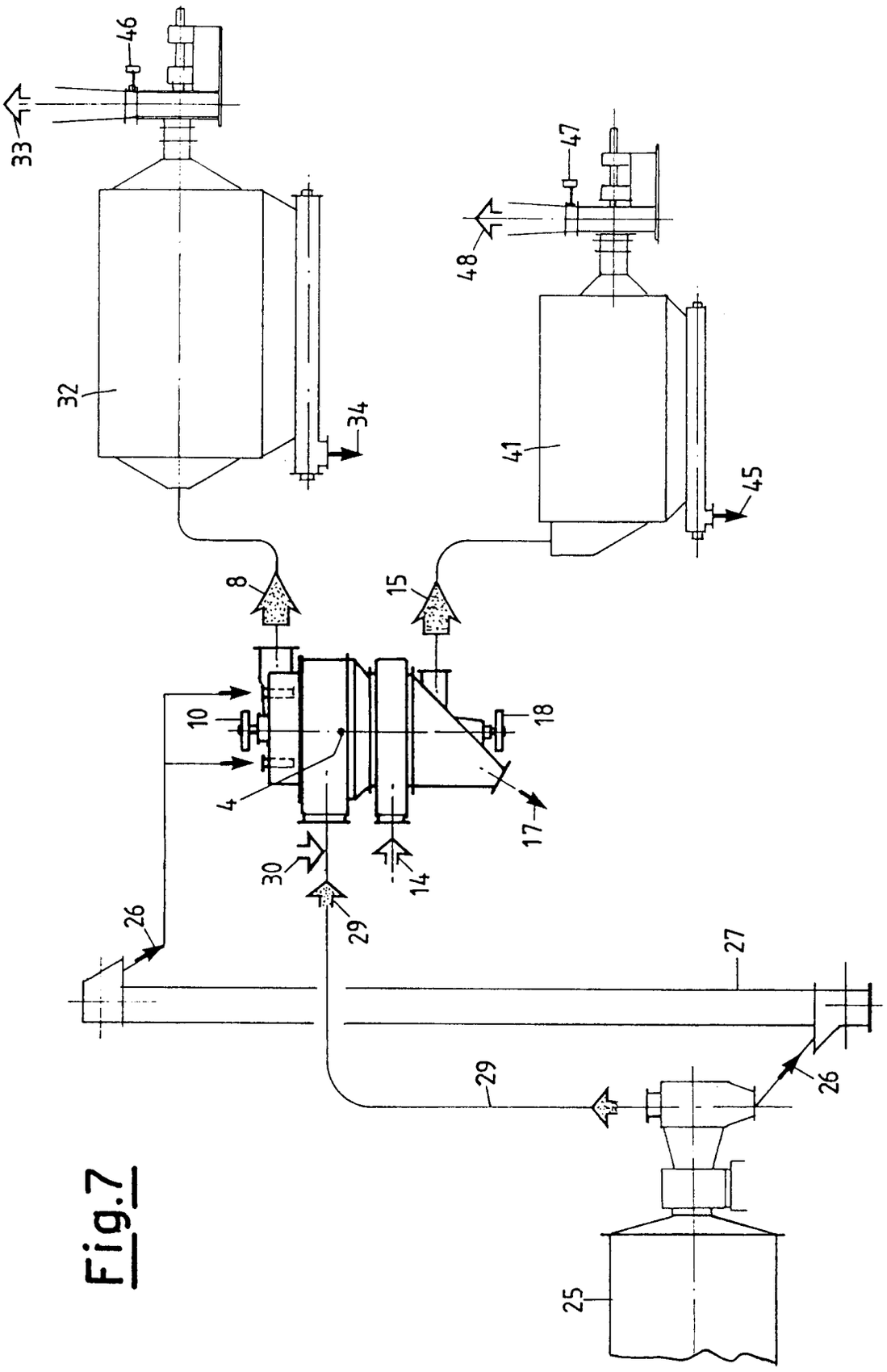


Fig.7

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EUROPEAN SEARCH REPORT

Application Number

EP 92 20 1462

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	EP-A-0 250 747 (PFEIFFER)	1-6,8,9, 11,13,14	B07B7/083 B02C21/00
Y	* column 3, line 41 - column 9, line 12 * * figure *	10,12	
Y	EP-A-0 374 491 (KRUPP POLYSIUS AG) * column 3, line 29 - line 47 * * figures 1,4 *	10	
Y	EP-A-0 209 663 (KRUPP POLYSIUS AG)	12	
A	* column 2, line 40 - column 3, line 10 * * figure 1 *	9,11	
X	OE-A-3 924 826 (KLÖCKNER-HUMBOLOT-DEUTZ) * column 1, line 1 - column 4, line 19 * * figures *	1-6,8	
A	IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS. vol. IA-22, no. 2, 1986, NEW YORK US pages 330 - 337; C. HERRMANN: 'Increased cement grinding efficiency by using high-efficiency separators' * page 334; figure 7 *	9-13	
A	EP-A-0 226 987 (ORENSTEIN & KOPPEL)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B07B
B02C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 AUGUST 1992	LAVAL J.C.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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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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