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(54) Roller mill.

(57) Raw coal (1) is caused to fall through a coal feed pipe (2) on a table (3) and pulverized by a roll, fine coal particles (5) and coarse coal particles (6) resulting from pulverization are moved upward between an auxiliary classifier cone (7) and a mill casing (19) by means of hot air (4) supplied from below the mill casing (19), the hot air (upward stream) carrying fine coal particles (5) and coarse coal particles (6) moves across a space of triangular cross section formed between the inverted conical body of the auxiliary classifier cone (7) and the mill casing (19) and flows through blowoff openings (8) defined between deflector plates (9) so that it is changed to a lateral rotative stream toward a rotary classifier (11), upon impinging on downward-inclined rotating vanes (10) of the rotary classifier (11), coarse coal particles (6) are sprung back toward a lower portion of the auxiliary classifier cone (7) and separated from fine coal particles (5), and fine coal particles (5) separated from coarse coal particles (6) are ejected together with the upward stream through a pulverized-coal eject pipe (12) out of the roller mill. Coarse coal particles (6) sprung back toward the lower portion of the auxiliary classifier cone (7) move along the inner surface of the auxiliary classifier cone (7) and fall on the table (3) so that they are re-pulverized by the roll.

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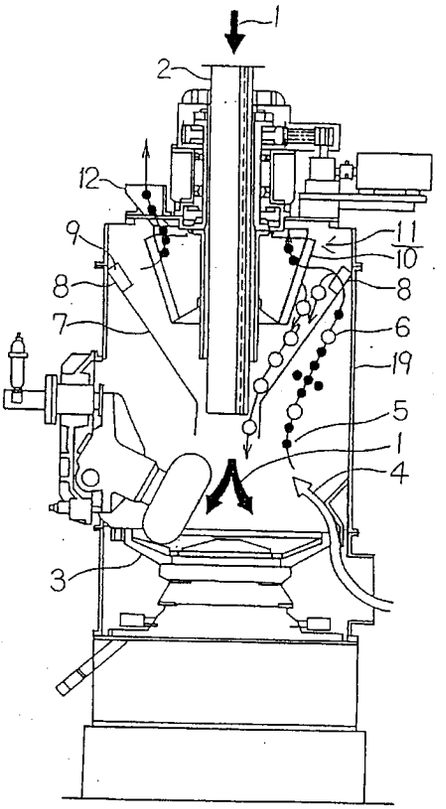
Fig. 1



BACKGROUND OF THE INVENTION:

Field of the Invention:

This invention relates to a roller mill for pulverizing, for example, coal to feed pulverized coal to a boiler.

Description of the Prior Art:

A conventional roller mill will be described with reference to Figs. 7 through 11. In Fig. 7, 13 designates an auxiliary classifier cone whose upper portion is made in a cylindrical shape and whose lower portion is made in an inverted truncated conical shape. In Figs. 7 through 11, 14 designates rotating vanes of a rotary classifier disposed inside the auxiliary classifier cone 13, which are rotatably supported by a coal feed pipe 20. 15 designates a plurality of deflector plates, 16 a pulverized-coal eject section, and 18 a mill casing. An upper portion and an lower portion of each rotating vane 14 are identical in phase with respect to the direction of rotation, and the deflector plates 15 are attached to a cylindrical upper portion of the auxiliary classifier cone 13 so that individual openings 17 are formed between them. 21 designates a table disposed directly under the coal feed pipe 20, and 22 a roll.

In this roller mill, raw coal is caused to fall through the coal feed pipe 20 on the table 21 and pulverized by the roll 22, and fine coal particles and coarse coal particles resulting from pulverization are moved upward between the auxiliary classifier cone 13 and the mill casing 18 by means of hot air supplied from below the mill casing 18.

The hot air (upward stream) carrying fine coal particles and coarse coal particles moves across an annular passage formed between an upper portion of the mill casing 18 and the cylindrical upper portion of the auxiliary classifier cone 13, and flows through the openings 17 defined between the deflector plates 15 so that it is changed to a lateral rotative stream toward the rotary classifier. Upon impinging on the rotating vanes 14 of the rotary classifier (see Fig. 11 wherein 5 designates fine coal particles and 6 designates coarse coal particles), coarse coal particles 6 are sprung back in the directions of the deflector plates 15 (see Figs. 9 and 10) and separated from fine coal particles; on the other hand, fine coal particles 5 separated from coarse coal particles 6 are ejected together with the upward stream through the pulverized-coal eject section 16 out of the roller mill. Coarse coal particles 6 sprung back in the directions of the deflector plates 15 move along the inner surface of the auxiliary classifier cone 13 and fall on the table 21 so that they are re-pulverized by the roll 22.

The conventional roller mill as shown in Figs. 7 through 11 has the following drawbacks:

(a) Since coarse coal particles 6 impinging on the rotating vanes 4 are sprung back in the directions of the deflector plates 15 as shown in Figs. 9 and 10, they are forced back by the air stream flowing through the openings 17 defined between the deflector plates 15 toward the rotary classifier, so that coarse coal particles 6 are mixed with the air stream carrying fine coal particles 5, resulting in a low efficiency of classification.

(b) Since the deflector plates 15 are attached to the cylindrical upper portion of the auxiliary classifier cone so that the openings 17 are formed between them, the annular passage must be provided around the circular array of openings 17, this demanding size enlargement of the upper portion of the auxiliary classifier cone 13 correspondingly to the cylindrical upper portion, resulting in an increase in cost. Contrarily, if the mill casing 18 were made in a straight shape, the auxiliary classifier cone 13 and the rotary classifier 11 will become small in diameter, this increasing the velocity of air flowing through them, resulting in a degradation in classification performance and an increase in pressure loss.

SUMMARY OF THE INVENTION:

It is an object of the present invention to provide a roller mill which is improved in classification efficiency and reduced in manufacturing cost and pressure loss.

To accomplish the foregoing object, the present invention provides a roller mill comprising a rotary classifier with a plurality of rotating vanes, and an auxiliary classifier cone surrounding the rotary classifier, wherein each rotating vane of the rotary classifier being designed such that its lower portion is trailing with respect to its upper portion in the direction of rotation so as to define a downward-inclined rotating vane, the auxiliary classifier cone being made in an inverted conical shape from its lower edge to its upper edge, the upper edge of the auxiliary classifier cone being attached directly to a mill casing, and a plurality of deflector plates being disposed in mutually spaced relation around an upper portion of the inverted conical body of the auxiliary classifier cone so that an upward stream moving upward on the outside of the auxiliary

classifier cone being changed to a lateral rotative stream toward the rotary classifier in the vicinity of the upper portion of the auxiliary classifier cone.

In the roller mill of the present invention, therefore, raw coal is caused to fall through a coal feed pipe on a table and pulverized by a roll, fine coal particles and coarse coal particles resulting from pulverization are moved upward between the auxiliary classifier cone and the mill casing by means of hot air supplied from below the mill casing, the hot air (upward stream) carrying fine coal particles and coarse coal particles moves across a space of triangular cross section formed between the inverted conical body of the auxiliary classifier cone and the mill casing and flows through blowoff openings defined between the deflector plates so that it is changed to a lateral rotative stream toward the rotary classifier, upon impinging on the downward-inclined rotating vanes of the rotary classifier, coarse coal particles are sprung back toward a lower portion of the auxiliary classifier cone and separated from fine coal particles, and fine coal particles separated from coarse coal particles are ejected together with the upward stream through a pulverized-coal eject pipe out of the roller mill. Coarse coal particles sprung back toward the lower portion of the auxiliary classifier cone move along the inner surface of the auxiliary classifier cone and fall on the table so that they are re-pulverized by the roll.

BRIEF DESCRIPTION OF THE DRAWINGS:

Fig. 1 is a schematic sectional view showing a roller mill according to the present invention;
Fig. 2 is a perspective view showing an auxiliary classifier cone of the present roller mill;
Fig. 3 is a perspective view showing deflector plates provided in an upper portion of the present auxiliary classifier cone;
Fig. 4 is a perspective view showing a rotary classifier of the present roller mill;
Figs. 5 and 6 are diagrams showing the function of a downward-inclined rotating vane of the present rotary classifier;
Fig. 7 is a schematic sectional view showing a conventional roller mill;
Fig. 8 is a perspective view showing a rotary classifier of the conventional roller mill; and
Figs. 9, 10 and 11 are diagrams showing the function of a rotating vane of the conventional rotary classifier.

DESCRIPTION OF THE PREFERRED EMBODIMENT:

A roller mill according to the present invention will now be described with reference to Figs. 1 through 6. In these drawings, 1 designates raw coal, 2 a coal feed pipe vertically disposed, 11 a rotary classifier, and 10 rotating vanes of the rotary classifier, which are rotatable about the coal feed pipe 2 clockwise as viewed from above as illustrated by the arrow in Fig. 5. As shown in Fig. 5, each rotating vane 10 is designed such that its lower portion is trailing with respect to its upper portion in the direction of rotation, defining a downward-inclined rotating vane.

3 designates a table, 4 hot air, 5 fine coal particles, 6 coarse coal particles, 7 an auxiliary classifier cone of inverted conical shape in general view which is disposed above the table 3, and 19 a mill casing. The upper edge of the inverted conical body of the auxiliary classifier cone 7 is attached to the mill casing 19 so that a space of triangular cross section is formed between the auxiliary classifier cone 7 and the mill casing 19.

In Figs. 1 and 3 through 6, 8 designates a plurality of blowoff openings formed in an upper peripheral portion of the auxiliary classifier cone 7 as to open obliquely downward into the space of triangular cross section. 9 designates a plurality of deflector plates attached to the inner surface of the upper peripheral portion of the auxiliary classifier cone 7 in mutually spaced relation, defining the blowoff openings 8. The combination of blowoff openings 8 and deflector plates 9 acts to change an upward stream moving upward on the outside of the auxiliary classifier cone 7 to a lateral rotative stream toward the rotary classifier 11 in the vicinity of the upper edge of the auxiliary classifier cone 7. 12 designates a pulverized-coal eject pipe provided at the top of the mill casing 19 in confronting relation to the upper end of the rotary classifier 11.

The operation of the roller mill shown in Figs. 1 through 6 will be described. The raw coal 1 is caused to fall through the coal feed pipe 2 on the table 3 so that it is pulverized by a roll, and fine coal particles 5 and coarse coal particles 6 resulting from pulverization are moved upward between the auxiliary classifier cone 7 and the mill casing 19 by means of the hot air supplied from below the mill casing 19.

The hot air (upward stream) carrying fine coal particles 5 and coarse coal particles 6 moves across the space of triangular cross section formed between the auxiliary classifier cone 7 and the mill casing 19 and flows through the blowoff openings 8 defined between the deflector plates 9, so that the hot air upward

stream is changed to the lateral rotative stream toward the rotary classifier 11. Upon impinging on the downward-inclined rotating vanes 10 of the rotary classifier 11 (see Figs. 5 and 6), coarse coal particles 6 are sprung back toward a lower portion of the auxiliary classifier cone 7 and separated from fine coal particles 5; on the other hand, fine coal particles 5 separated from coarse coal particles 6 are ejected together with the upward stream through the pulverized-coal eject pipe 12 out of the roller mill.

Coarse coal particles 6 sprung back toward the lower portion of the auxiliary classifier cone 7 as above move along the inner surface of the auxiliary classifier cone 7 and fall on the table 3 so that they are re-pulverized by the roll.

Table 1 lists the results of tests performed on a roller mill including the rotary classifier of the present invention and a similar one including the conventional classifier. As will be appreciated, for substantially the same pass amount relating to 200 mesh, the present invention provides only a very small residual amount relating to 100 mesh (corresponding to coarse coal particles) and needs only as slow a speed as about 40 rpm for rotation of the classifier. And, the mill pressure loss is as lower as 20 to 50 mmH_2O. That is, the listed results of tests will prove that the rotary classifier of the present invention has a high degree of classification performance.

Table 1

	roll mill with present classifier			roll mill with conventional classifier		
test run	1-1	1-2	1-3	2-1	2-2	2-3
classifier speed (rpm)	75	100	125	110	140	170
200-mesh pass amount (%)	76	88	99	75	87	99
100-mesh residual amount (%)	2.1	0.1	0.0	3.9	1.2	0.2
mill pressure loss (mmH_2O)	310	328	356	332	367	405

As described above, in the roller mill of the present invention, raw coal is caused to fall through the coal feed pipe on the table and pulverized by the roll, fine coal particles and coarse coal particles resulting from pulverization are moved upward between the auxiliary classifier cone and the mill casing by means of hot air supplied from below the mill casing, the hot air (upward stream) carrying fine coal particles and coarse coal particles moves across the space of triangular cross section formed between the inverted conical body of the auxiliary classifier cone and the mill casing and flows through the blowoff openings defined between the deflector plates so that it is changed to a lateral rotative stream toward the rotary classifier, and upon impinging on the downward-inclined rotating vanes of the rotary classifier, coarse coal particles are sprung back toward a lower portion of the auxiliary classifier cone so that they are separated from fine coal particles; therefore, coarse coal particles are prevented from mixing with fine coal particles, the air stream with fine coal particles carried thereon (which is ejected through the pulverized-coal eject pipe) carries substantially no coarse coal particles, and thus, the efficiency of classification can be enhanced.

Since coarse coal particles are sprung back toward the lower portion of the auxiliary classifier cone, the air stream flowing through the openings defined between the deflector plates toward the rotary classifier is not disturbed; thus, the pressure loss can be decreased.

Further, the auxiliary classifier cone is made in an inverted conical shape from its lower edge to its upper edge, the upper edge of the cone is attached directly to the mill casing, and the deflector plates are arranged in mutually spaced relation around the upper portion of the inverted conical body of the auxiliary classifier cone so that the upward stream moving upward on the outside of the auxiliary classifier cone is changed to a lateral rotative stream toward the rotary classifier in the vicinity of the upper end of the auxiliary classifier; therefore, it is not necessary to make an upper portion of the auxiliary classifier cone in a cylindrical shape as in the prior art, this allowing miniaturization of the auxiliary classifier cone and reduction of the manufacturing cost.

Claims

1. A roller mill characterized in comprising a rotary classifier (11) with a plurality of rotating vanes (10), and an auxiliary classifier cone (7) surrounding the rotary classifier, wherein each rotating vane (10) of said rotary classifier being designed such that its lower portion is trailing with respect to its upper portion in the direction of rotation so as to define a downward-inclined rotating vane, said auxiliary

classifier cone (7) being made in an inverted conical shape from its lower edge to its upper edge, the upper edge of said auxiliary classifier cone being attached directly to a mill casing (19), and a plurality of deflector plates (9) being disposed in mutually spaced relation around an upper portion of the inverted conical body of the auxiliary classifier cone (7) so that an upper stream moving upward on the outside of the auxiliary classifier cone being changed to a lateral rotative stream toward the rotary classifier in the vicinity of the upper portion of the auxiliary classifier cone.

2. A roller mill according to claim 1, wherein the rotating vanes (10) of the rotary classifier (11) are rotatable about a coal feed pipes (2) vertically disposed.

3. A roller mill according to claim 1 or 2, wherein a pulverized-coal eject pipe (12) is provided at the top of the mill casing (19) in confronting relation to the upper end of the rotary classifier (11).

Fig. 1

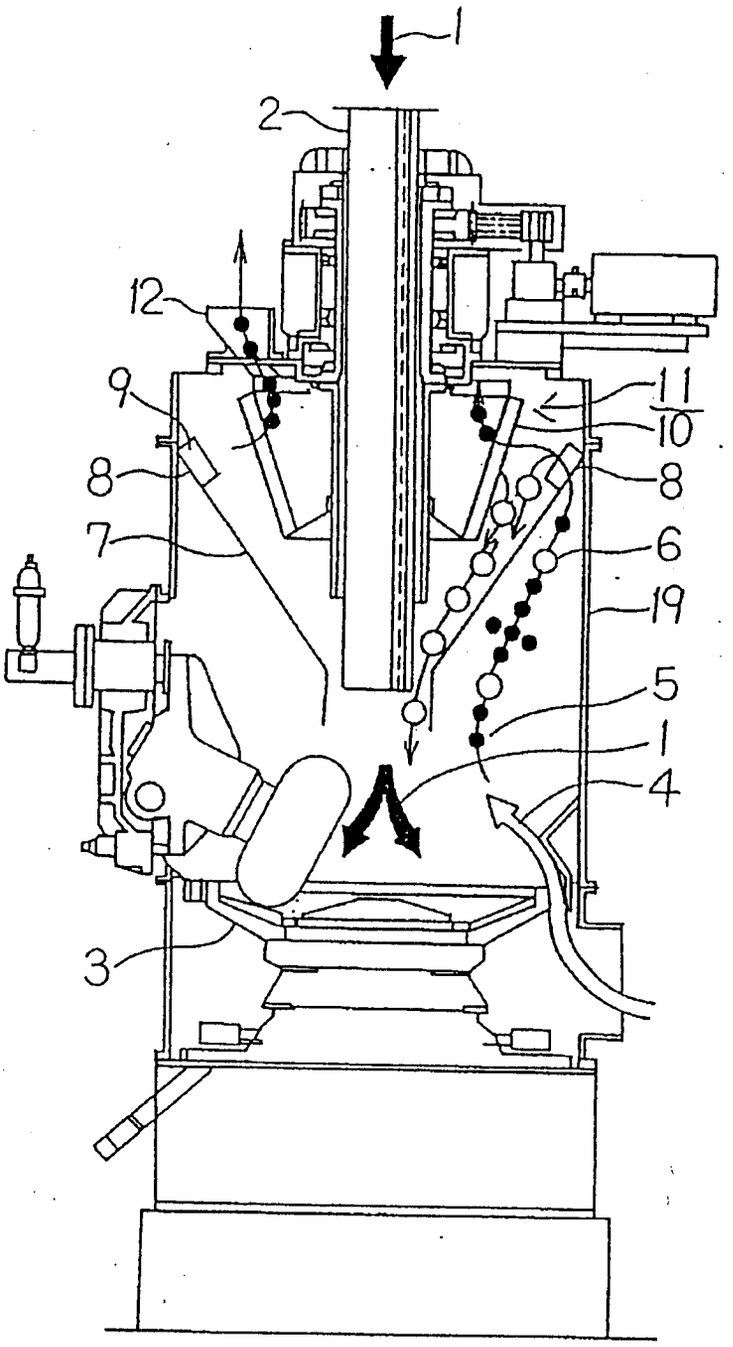


Fig. 2

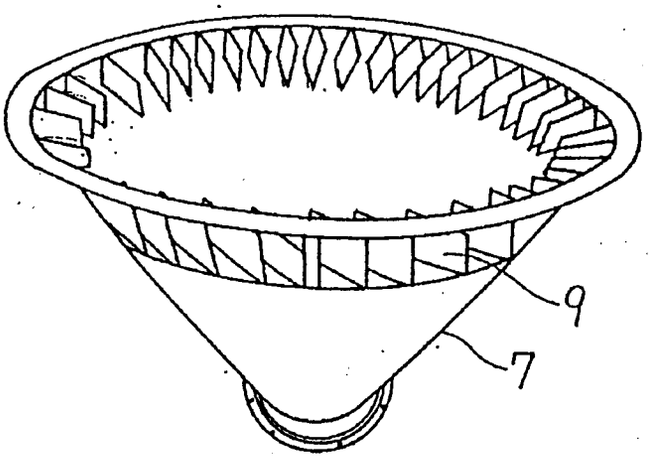


Fig. 3

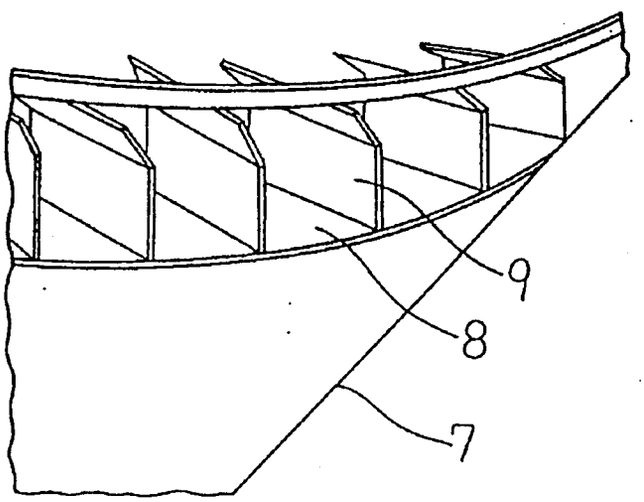


Fig. 4

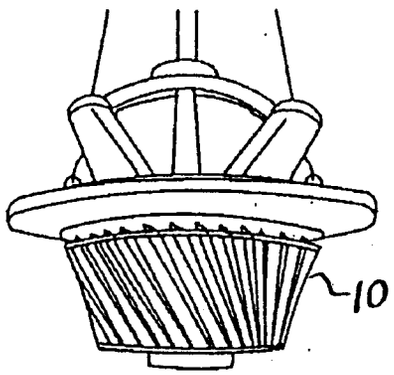


Fig. 5

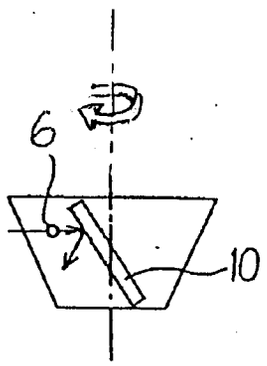


Fig. 6

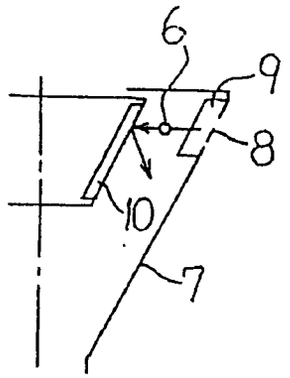


Fig. 7 (Prior Art)

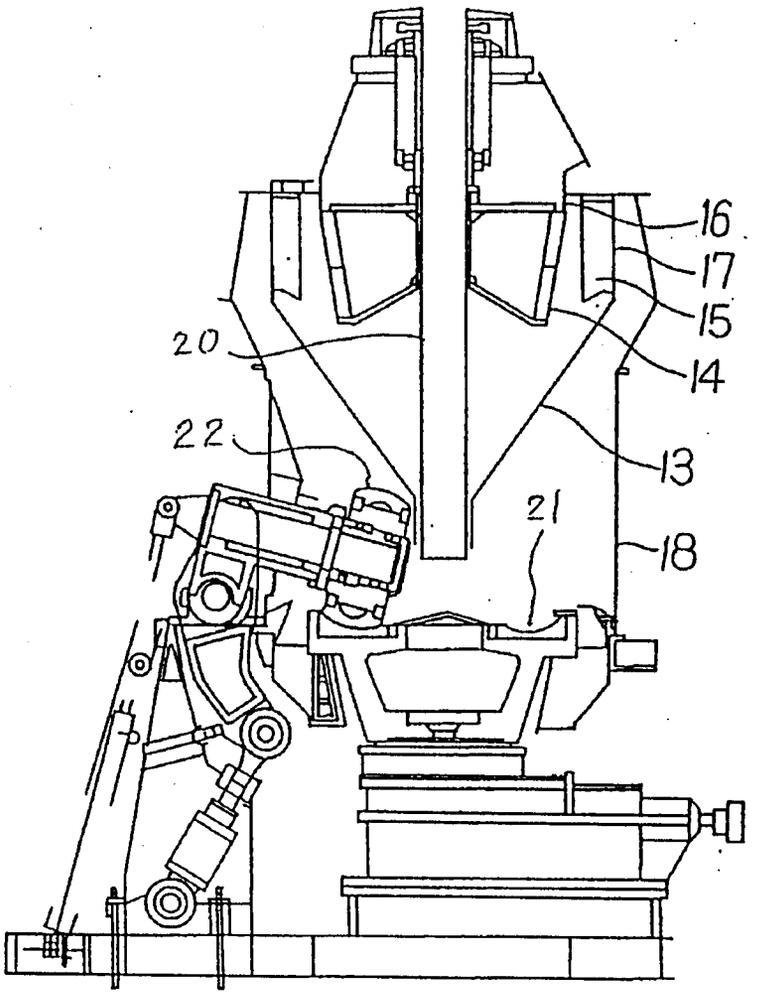


Fig. 8 (Prior Art)

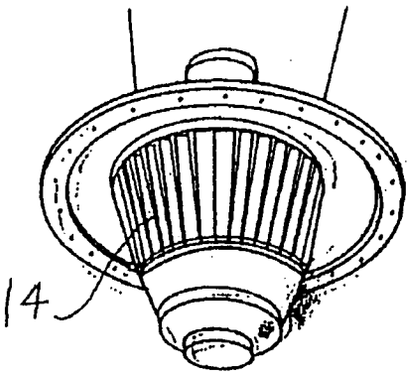


Fig. 9 (Prior Art)

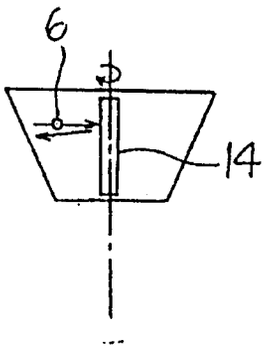


Fig. 10 (Prior Art)

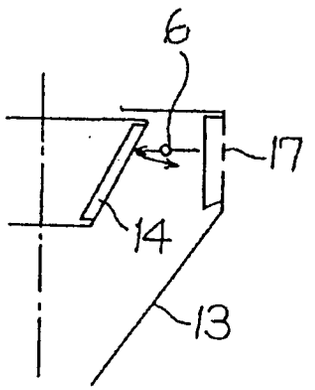
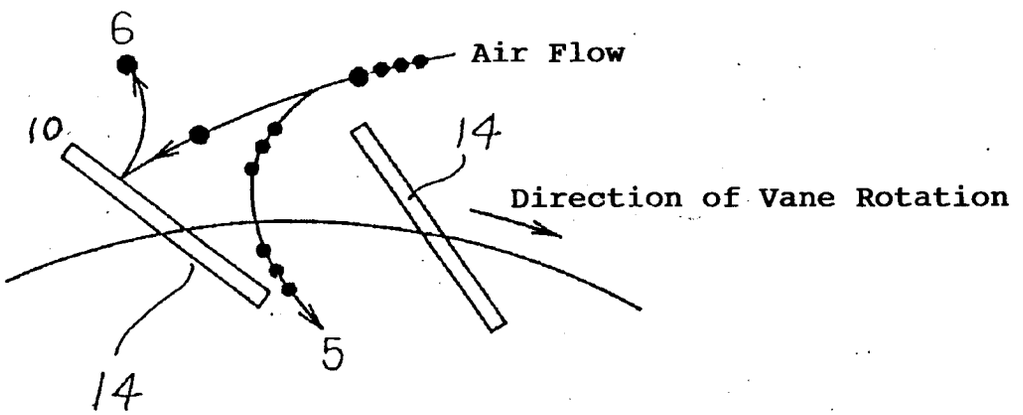


Fig. 11 (Prior Art)



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EUROPEAN SEARCH REPORT

Application Number

EP 91 12 2397

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)
A	DE-A-3 125 850 (VEB SCHWERM. KOMB. "ERNST THÄLMANN") * the whole document *	1	B02C15/00 B02C23/32 B07B7/083
A	FR-A-1 448 417 (RHEINISCHE KALKSTEINWERKE G.M.B.H.) * figure 1 *	1	
A	DE-A-1 938 772 (POLYSIUS AG.) * figure 1 *	1,3	
A	EP-A-0 325 770 (KRUPP POLYSIUS AG.) * the whole document *	1	
A	US-A-4 981 269 (T. KOGA , T. ISHIWAKA , K. MIYAZAKI) * figure 6 *	1,2	
A,P	DE-C-4 002 867 (EVT ENERGIE- UND VERFAHRENSTECHNIK) * figure 1 *	1,2	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B02C
B07B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 APRIL 1992	VERDONCK J.C.M.J.

CATEGORY OF CITED DOCUMENTS

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