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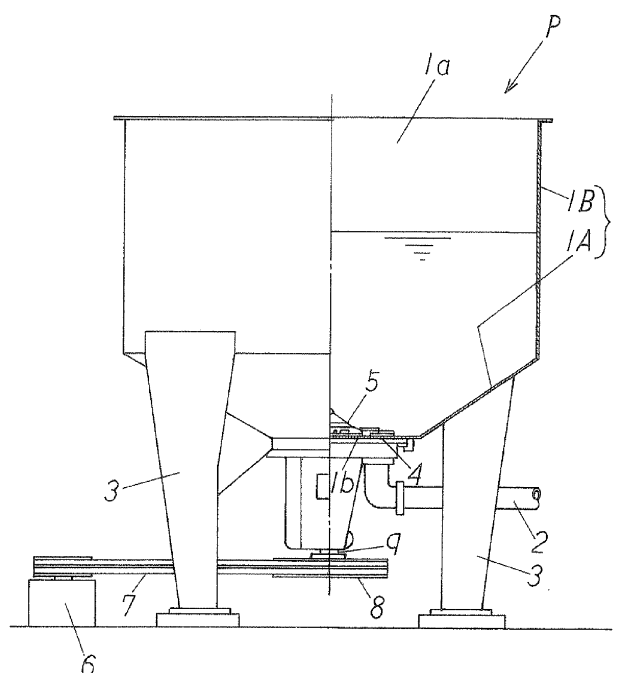
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(54) **Cutter blades for a pulper**

(57) A pulper (10) includes a tank (1) having a papermaking material insertion port (1a) and a discharge port (1b); a strainer (4) covering the discharge port (1b) of the tank (1); a rotor (5) provided above the strainer (4) for disintegrating the papermaking material and having a rotor vane with a front edge (AB) formed linearly in a plan view; a front cutter blade (10) attached to a back surface of the rotor (5), and extending long in a longitudinal

direction along the front edge (AB) of the rotary vane, the front cutter blade (10) being formed linearly in a plan view; and an inclined cutter blade (20) attached to the back surface of the rotor (5). The inclined cutter blade (20) extends long in the longitudinal direction and is inclined away from the front cutter blade (10) toward an outside. The inclined cutter blade (20) and the front cutter blade (10) are integrally formed via an inner portion (20A) of the inclined cutter blade (20).

FIG.1



## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to a pulper, and in particular, to a pulper including improved cutter blades.

### BACKGROUND ART

**[0002]** Conventionally, a pulper wherein a papermaking material such as pulp and waste paper is inserted into a tank and is disintegrated in water disintegrates the papermaking material while circulating the papermaking material in the tank by means of a rotor provided in the tank (refer to Patent Document 1).

In the pulper, a pair of first cutter blades, a second cutter blade, and a third cutter blade that are individually attached to the rotor cut the papermaking material.

### PRIOR ART DOCUMENTS

**[0003]** Patent Document 1: Japanese Unexamined Patent Publication No. 2008-291378

### SUMMARY OF THE INVENTION

#### PROBLEMS TO BE SOLVED BY THE INVENTION

**[0004]** However, when the cutter blades are damaged, all of the pair of first cutter blades, the second cutter blade, and the third cutter blade are often damaged and moreover, in a replacement operation, a line is stopped to remove the blades and therefore, only the cutter blade at a certain site is hardly replaced.

On the other hand, the first cutter blades, the second cutter blades, and the third cutter blades must be individually detached from and attached to the rotor, resulting in that it disadvantageously takes a long time to perform a construction operation.

**[0005]** The present invention has been made in consideration of the above-mentioned problem, and an object thereof is to provide a pulper including improved cutter blades.

#### SOLUTIONS TO THE PROBLEMS

**[0006]** A pulper in a first aspect comprises a tank including a papermaking material insertion port in an upper portion and a discharge port in a lower portion, the tank receiving the papermaking material and water; a strainer covering the discharge port of the tank; a rotor provided above the strainer in the tank, the rotor disintegrating the papermaking material; a front cutter blade attached to a back surface of the rotor, the front cutter blade extending long in a longitudinal direction along a front edge of a rotary vane of the rotor, the front edge being formed linearly in a plan view, the front cutter blade being formed linearly in a plan view; and an inclined cutter blade at-

tached to the back surface of the rotor, the inclined cutter blade extending long in the longitudinal direction so as to be inclined away from the front cutter blade toward the outside, and the inclined cutter blade and the front cutter blade are integrally formed via an inner portion of the inclined cutter blade.

**[0007]** A pulper in a second aspect comprises a tank including a papermaking material insertion port in an upper portion and a discharge port in a lower portion, the tank receiving the papermaking material and water; a strainer covering the discharge port of the tank; a rotor provided above the strainer in the tank, the rotor disintegrating the papermaking material; a front cutter blade attached to a back surface of the rotor, the front cutter blade extending long in a longitudinal direction along a front edge of a rotary vane of the rotor; and an inclined cutter blade attached to the back surface of the rotor, the inclined cutter blade extending long in the longitudinal direction so as to be inclined away from the front cutter blade toward the outside, the inclined cutter blade and the front cutter blade are bonded to each other via an inner portion of the inclined cutter blade, the inclined cutter blade and the front cutter blade are also connected to each other via a flat surface, and the flat surface contacts with the back surface of the rotor.

**[0008]** A pulper of a third aspect comprises a tank including a papermaking material insertion port in an upper portion and a discharge port in a lower portion, the tank receiving the papermaking material and water; a strainer covering the discharge port of the tank; a rotor provided above the strainer in the tank, the rotor disintegrating the papermaking material; a front cutter blade attached to a back surface of the rotor, the front cutter blade extending long in a longitudinal direction along a front edge of a rotary vane of the rotor; an inclined cutter blade attached to the back surface of the rotor, the inclined cutter blade extending long in the longitudinal direction so as to be inclined away from the front cutter blade toward the outside; and a flat surface connecting the inclined cutter blade to the front cutter blade, the flat surface is in contact with the back surface of the rotor.

#### EFFECTS OF THE INVENTION

**[0009]** According to the pulper of the first aspect, since the inclined cutter blade that is attached to the back surface of the rotor and extends long in the longitudinal direction so as to be inclined away from the front cutter blade toward the outside and the inclined cutter blade and the front cutter blade are integrally formed via the inner portion of the inclined cutter blade, the inclined cutter blade and the front cutter blade are provided adjacent to each other. As a result, when the inclined cutter blade is damaged, the front cutter blade is also damaged, so that attachment and detachment of the cutter blade can be performed in one replacement operation, improving the workability of replacement. Moreover, the front edge of the rotor described in the

conventional example is not formed linearly, and thus the cutter blades attached to the front edge of the rotor are the pair of first cutter blades. However, according to the pulper of the first aspect, since the front edge is formed linearly in a plan view, and the front cutter blade is also formed linearly in the plan view, both the front edge of the rotor and the front cutter blade can be easily worked.

**[0010]** According to the pulper of the second aspect, since the inclined cutter blade and the front cutter blade are connected to each other via the flat surface, coupling of the inclined cutter blade and the front cutter blade is enhanced. Moreover, since the flat surface contacts with the back surface of the rotor, that is, the back surface of the rotor is covered with the flat surface connecting the inclined cutter blade to the front cutter blade, the back surface of the rotor is prevented from being damaged by the papermaking material. Further, when the inclined cutter blade and the front cutter blade are damaged during use, the flat surface facing the papermaking material is also bored and damaged, attachment and detachment of the flat surface and the cutter blade can be performed in one replacement operation, improving the workability of replacement.

When the flat surface facing the papermaking material is bored and damaged, the papermaking material is accumulated in the damaged portion, and the accumulated papermaking material is not disintegrated, and suppresses movement of the papermaking material in the vicinity of the inclined cutter blade and the front cutter blade, decreasing the dissolving efficiency. Further, accumulation of the papermaking material increases only loads onto the rotor.

**[0011]** According to the pulper of the third aspect, since the inclined cutter blade and the front cutter blade are connected to each other via the flat surface, coupling of the inclined cutter blade and the front cutter blade is enhanced. Moreover, since the flat surface contacts with the back surface of the rotor, that is, the back surface of the rotor is covered with the flat surface connecting the inclined cutter blade to the front cutter blade, the back surface of the rotor is prevented from being damaged by the papermaking material. Further, when the inclined cutter blade and the front cutter blade are damaged during use, the flat surface facing the papermaking material is also bored and damaged, so that attachment and detachment of the flat surface and the cutter blade can be performed in one replacement operation, improving the workability of replacement.

## BRIEF DESCRIPTION OF THE DRAWINGS

### [0012]

Fig. 1 is a schematic sectional view of a pulper according to an embodiment of the present invention. Fig. 2 is a schematic exploded perspective view of a rotor and a strainer of the pulper in Fig. 1. Fig. 3 is a schematic plan view of the rotor in Fig. 2.

Fig. 4 is a schematic bottom view of the rotor in Fig. 2. Fig. 5 is a schematic perspective view of a part of Fig. 2 when viewed from diagonally below. Fig. 6 is a schematic exploded perspective view of a part of Fig. 5.

## EMBODIMENTS OF THE INVENTION

**[0013]** A pulper according to an embodiment of the present invention will be described with reference to the drawings.

In Fig. 1, P refers to a pulper wherein a papermaking material such as pulp and waste paper is inserted into a tank 1 to disintegrate the material in water, and the pulper P has a papermaking material insertion port 1a in an upper portion, a discharge port 1b in a lower portion, and the tank 1 for receiving the papermaking material and water.

The tank 1 has an inverted cone-like platform 1A located on a lower side and a cylindrical part 1B located on an upper side, and the cylindrical part 1B is connected to the inverted cone-like platform 1A.

The papermaking material (not shown) such as pulp and waste paper is continuously supplied into the tank 1 by a conveyor (not shown), water is supplied into the tank 1 by a first pipe (not shown), and the papermaking material disintegrated in the tank 1 is discharged to the outside of the tank 1 by a second pipe 2.

In Fig. 1, numeral 3 refers to legs for supporting the tank 1.

**[0014]** In Figs. 1 and 2, numeral 4 refers to a strainer provided to cover the discharge port 1b of the tank 1, and the strainer 4 is, for example, a disc having a large number of round holes. Here, numeral 5 refers to a rotor that is provided on the strainer 4, and disintegrates the papermaking material. The rotor 5 is rotated via a belt 7, a pulley 8, and a rotational shaft 9 by power transmitted from a motor 6.

**[0015]** In Figs. 2 and 3, each of numerals 5A, 5B is a protruding member that protrudes from a front edge AB of a vane of the rotor 5 (see Fig. 6), extends toward the strainer 4, and has a substantially polygonal cross section across the direction perpendicular to the protruding members 5A, 5B.

**[0016]** Numeral 10 in Fig. 4 to Fig. 6 refers to a front cutter blade, and the front cutter blade 10 is attached to a back surface of the rotor 5 (more specifically, a back surface of the rotary vane of the rotor 5), and extends along the front edge AB of the rotary vane of the rotor 5 (see Fig. 6) in the longitudinal direction. The front edge AB is formed linearly in a plan view, and the front cutter blade 10 is formed linearly in a plan view (see Figs. 3 to 6). In Figs. 4 to 6, numeral 20 refers to an inclined cutter blade, and the inclined cutter 20 is attached to the back surface of the rotor 5 (more specifically, is attached to the back surface of the rotary vane of the rotor 5), and extends long in the longitudinal direction so as to be inclined away from the front cutter blade 10 toward the outside as represented by an arrow X in Fig. 5.

The inclined cutter blade 20 and the front cutter blade 10 are integrally formed via an inner portion 20A of the inclined cutter blade 20.

**[0017]** Accordingly, in the above-mentioned pulper P, the papermaking material is circulated in the tank 1 by rotation of the rotor 5, and is cut by the front cutter blade 10 and the inclined cutter blade 20, which are provided on the back surface of the vane of the rotor 5. The papermaking material is also cut by edges of the corners of the protruding members 5A, 5B each having the polygonal cross section, which promotes disintegration of the papermaking material.

The inclined cutter blade 20 and the front cutter blade 10 are provided adjacent to each other and thus, when the inclined cutter blade 20 is damaged, the front cutter blade 10 is also damaged. For this reason, the attachment and detachment of the cutter blade can be achieved in one replacement operation, improving the workability of replacement.

Moreover, the front edge of the rotor described in the conventional example is not formed linearly and thus, the cutter blades attached to the front edge of the rotor are the pair of first cutter blades. However, in the pulper P in this embodiment, since the front edge AB is formed linearly in a plan view, and the front cutter blade 10 is also formed linearly in a plan view, both of the front edge AB of the vane of the rotor 5 and the front cutter blade 10 can be easily worked.

**[0018]** In Figs. 5 and 6, numeral 30 refers to a flat surface, and the inclined cutter blade 20 and the front cutter blade 10 are connected to each other via the flat surface 30. The flat surface 30 is higher than a lowermost surface of the inclined cutter blade 20 and a lowermost surface of the front cutter blade 10. The flat surface 30 contacts with the back surface of the rotor 5 (more specifically, the back surface of the rotary vane of the rotor 5).

The integrated inclined cutter blade 20 and front cutter blade 10 are attached by screwing bolts 40 into female screws 30a of the flat surface 30 through through holes 5a provided in the rotary vane of the rotor 5.

**[0019]** Accordingly, since a site (for example, Y in Fig. 5) of the back surface of the rotor 5 (more specifically, the back surface of the rotary vane of the rotor 5) is covered with the flat surface 30 connecting the inclined cutter blade 20 to the front cutter blade 10, the side Y (see Fig. 6) of the back surface of the rotor 5 is prevented from being damaged by the papermaking material. Moreover, when the inclined cutter blade 20 and the front cutter blade 10 are damaged during use, the flat surface 30 facing the papermaking material is also bored and damaged and therefore, attachment and detachment of the flat surface 30 and the cutter blades 10, 20 can be performed in one replacement operation, improving the workability of replacement.

When the flat surface 30 facing the papermaking material is bored and damaged, the papermaking material is accumulated in the damaged site, and the accumulated papermaking material is not disintegrated and suppresses

movements of the papermaking material in the vicinity of the inclined cutter blade 20 and the front cutter blade 10, decreasing the dissolving efficiency. Further, accumulation of the papermaking material increases only loads on the rotor 5.

**[0020]** In the above-mentioned embodiment, the inclined cutter blade 20 and the front cutter blade 10 are integrally formed via the inner portion 20A of the inclined cutter blade 20 (see Figs. 5 and 6), and the inclined cutter blade 20 and the front cutter blade 10 are connected to each other via the flat surface 30. However, the present invention is not limited to this, although not shown, the inner portion 20A of the inclined cutter blade 20 may be separated from the front cutter blade 10, and the inclined cutter blade 20 and the front cutter blade 10 may be integrally connected to each other via only the flat surface 30.

## Claims

### 1. A pulper comprising:

a tank for receiving the papermaking material and water, including a papermaking material insertion port in an upper portion and a discharge port in a lower portion;  
a strainer covering the discharge port of the tank;  
a rotor provided above the strainer of the tank, the rotor disintegrating the papermaking material and having a rotor vane with a front edge formed linearly in a plan view;  
a front cutter blade attached to a back surface of the rotor, the front cutter blade extending long in a longitudinal direction along the front edge of the rotary vane, the front cutter blade being formed linearly in a plan view; and  
an inclined cutter blade attached to the back surface of the rotor, the inclined cutter blade extending long in the longitudinal direction and being inclined away from the front cutter blade toward an outside,  
wherein the inclined cutter blade and the front cutter blade are integrally formed via an inner portion of the inclined cutter blade.

### 2. A pulper comprising:

a tank for receiving the papermaking material and water, including a papermaking material insertion port in an upper portion and a discharge port in a lower portion;  
a strainer covering the discharge port of the tank;  
a rotor provided above the strainer of the tank, the rotor disintegrating the papermaking material and having a rotor vane;  
a front cutter blade attached to a back surface of the rotor, the front cutter blade extending long

in a longitudinal direction along a front edge of the rotary vane; and  
an inclined cutter blade attached to the back surface of the rotor, the inclined cutter blade extending long in the longitudinal direction and being inclined away from the front cutter blade toward an outside,  
wherein the inclined cutter blade and the front cutter blade are integrally formed via an inner portion of the inclined cutter blade,  
the inclined cutter blade and the front cutter blade are also connected to each other via a flat surface, and  
the flat surface contacts with the back surface of the rotor.

3. A pulper comprising:

a tank for receiving the papermaking material and water, including a papermaking material insertion port in an upper portion and a discharge port in a lower portion;  
a strainer covering the discharge port of the tank;  
a rotor provided above the strainer in the tank, the rotor disintegrating the papermaking material and having a rotary vane;  
a front cutter blade attached to a back surface of the rotor, the front cutter blade extending long in a longitudinal direction along a front edge of the rotary vane;  
an inclined cutter blade attached to the back surface of the rotor, the inclined cutter blade extending long in the longitudinal direction and being inclined away from the front cutter blade toward an outside; and  
a flat surface connecting the inclined cutter blade to the front cutter blade, the flat surface contacting with the back surface of the rotor.

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FIG. 1

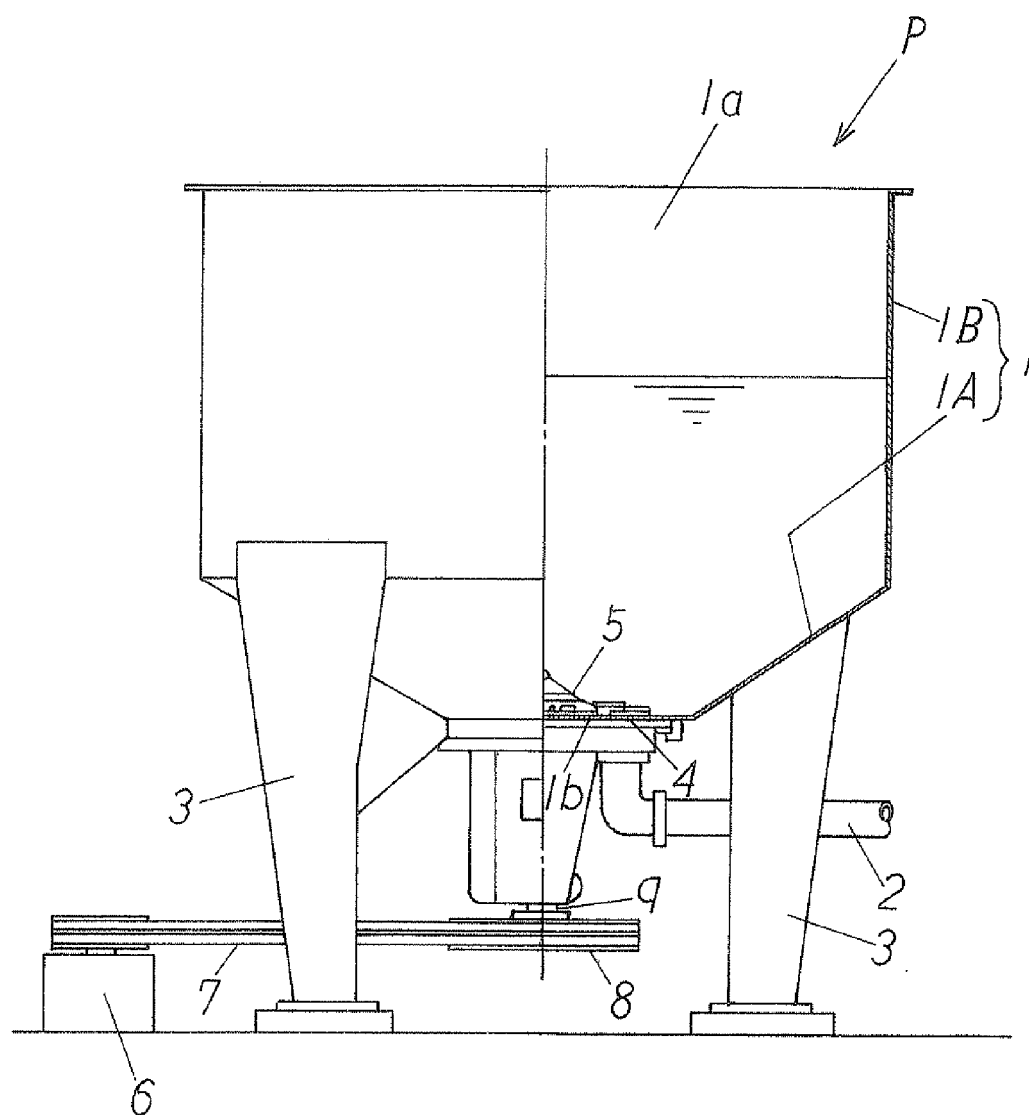


FIG.2

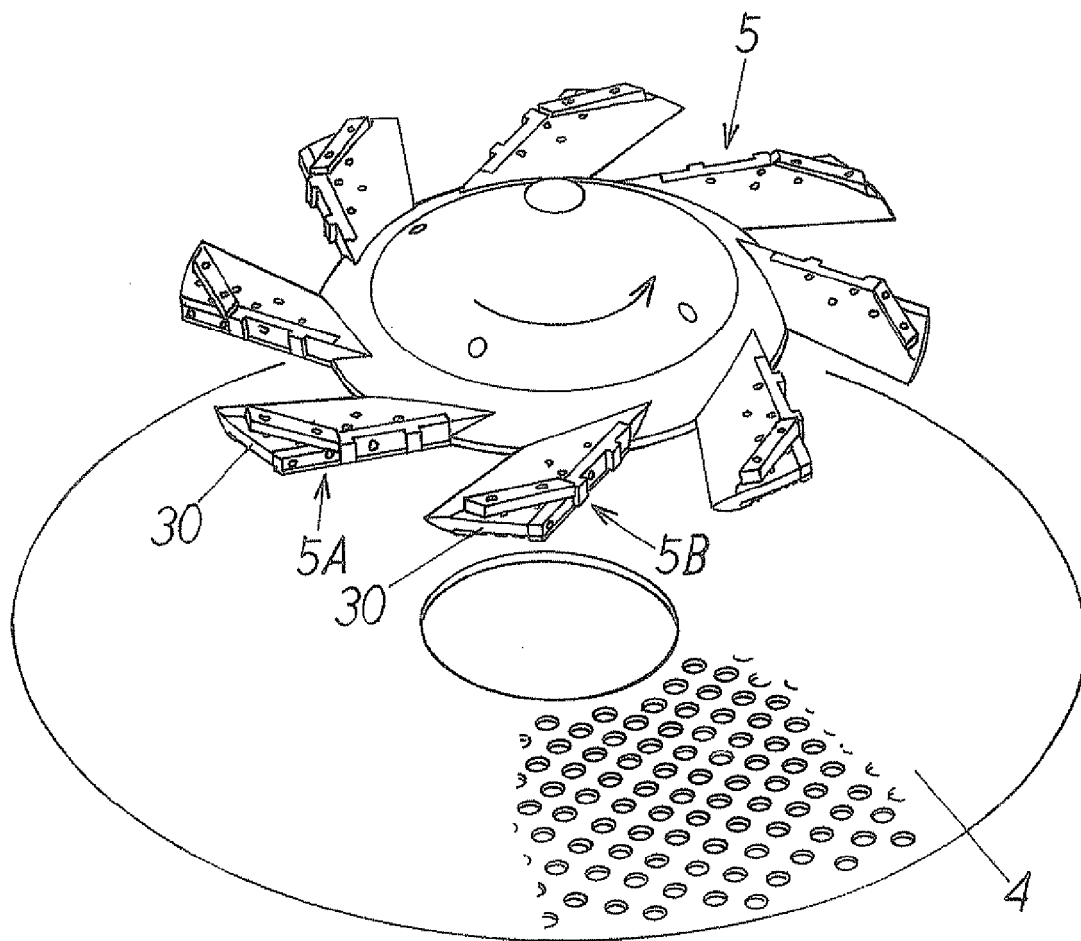


FIG. 3

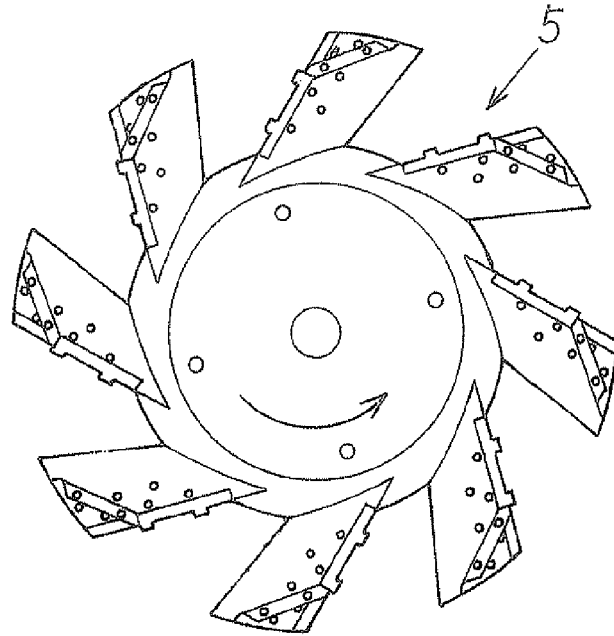


FIG. 4

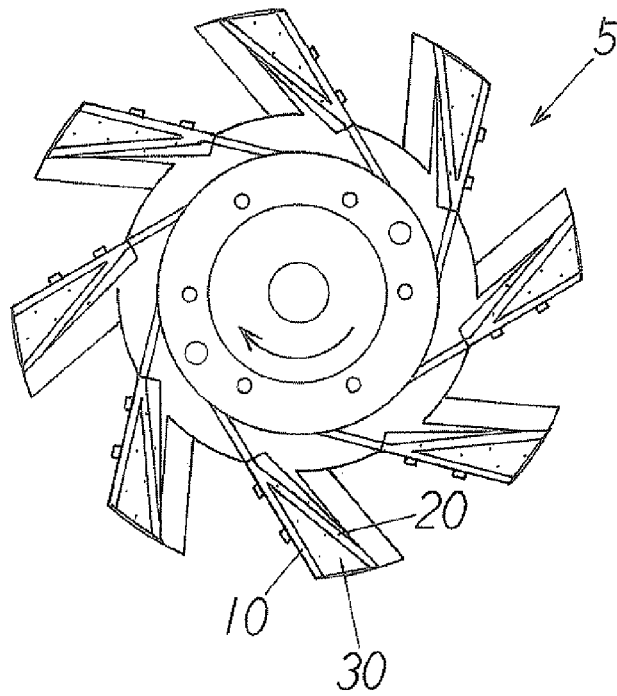




FIG. 5

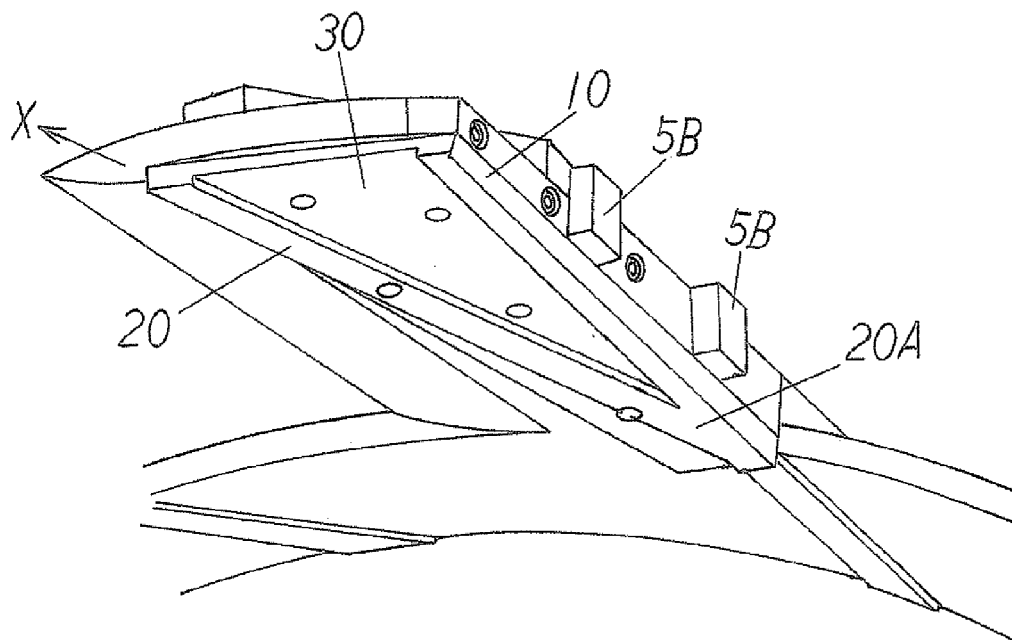
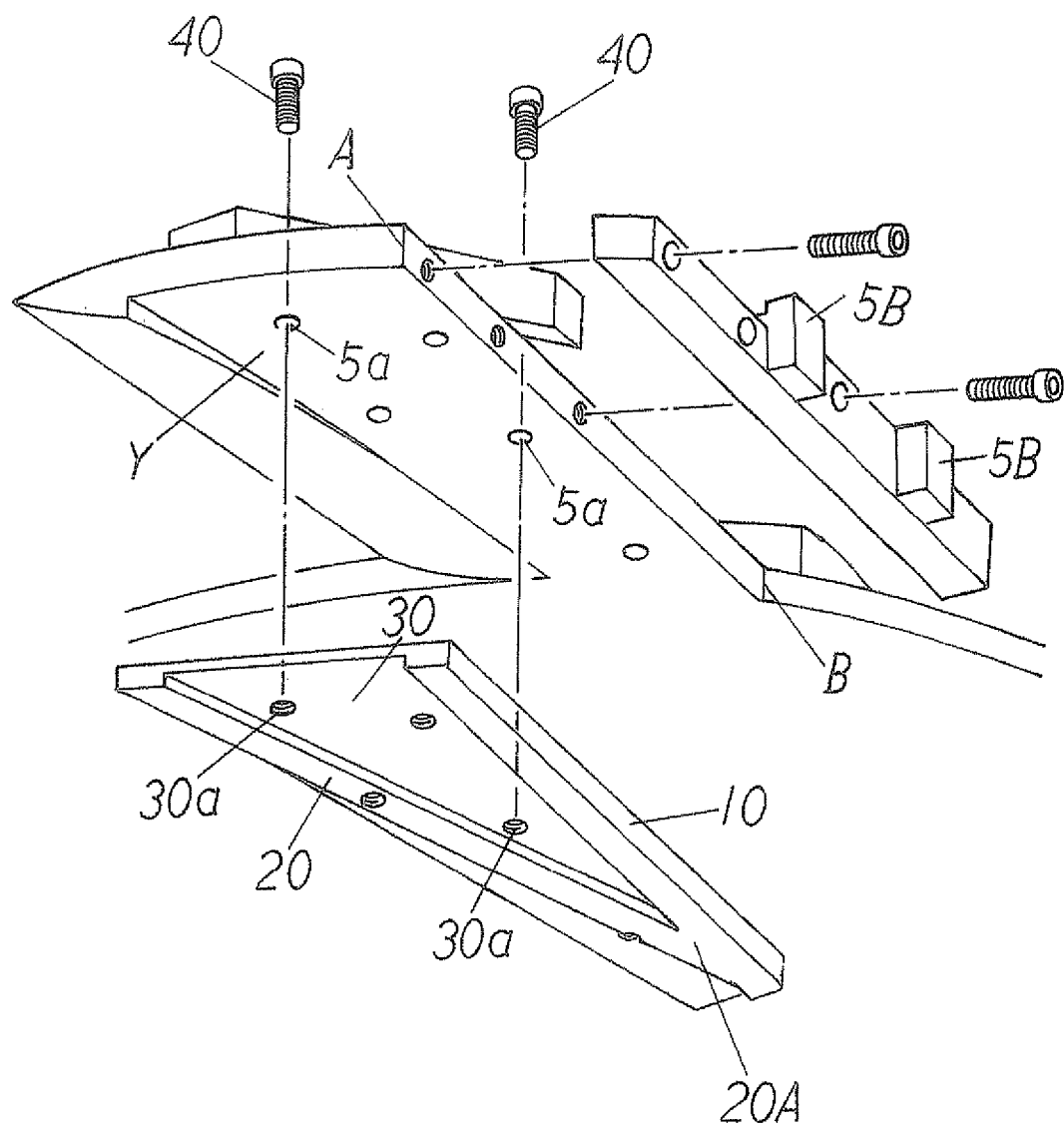


FIG. 6





## EUROPEAN SEARCH REPORT

Application Number  
EP 13 15 9643

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 20 2010 003358 U1 (VOITH PATENT GMBH [DE]) 1 July 2010 (2010-07-01)	3	INV. D21B1/34
A	* paragraph [0001] - paragraph [0005] * * paragraph [0026] - paragraph [0029]; figures 1, 2 * * paragraph [0043] - paragraph [0059]; figures 9, 11 *	1,2	
A,D	----- JP 2008 291378 A (VOITH PATENT GMBH) 4 December 2008 (2008-12-04) * paragraph [0031] - paragraph [0048]; figures 1, 5, 7 * -----	1-3	
			TECHNICAL FIELDS SEARCHED (IPC)
			D21B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 31 July 2013	Examiner Sabatucci, Arianna
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 15 9643

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31-07-2013

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**REFERENCES CITED IN THE DESCRIPTION**

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- JP 2008291378 A [0003]