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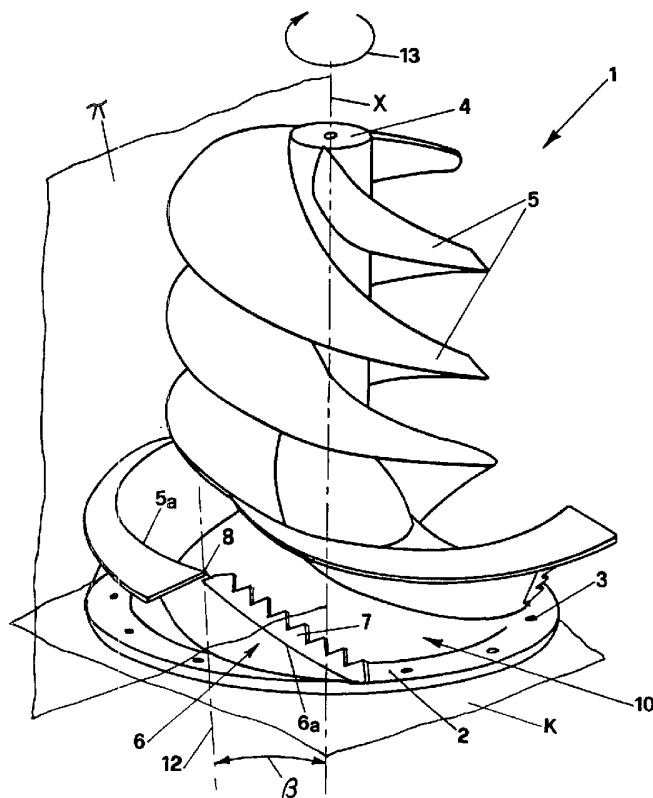
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(54) Title: IMPROVED IMPELLER FOR PAPER PULPS KNEADERS



(57) Abstract: An impeller (1; 20) for paper pulp kneaders is disclosed comprising an essentially plan bottom flange (2) connectable to driving means, a central shaft (4) which starts from the plane (K) defined by the bottom flange (2) in order to determine a longitudinal spin axis (X) of the impeller (1); one or more blades (5; 21) cross-wound around said central shaft (4). Each blade (5) has an ending section (6) connected to the bottom flange (2), where there is a toothing (7) on its peripheral edge (6a), which is delimited between: a first point (8) that corresponds to the intersection between the peripheral edge (5a) of the blade (5) and the peripheral edge (6a) of the ending section (6); a second point (9) that corresponds to the intersection between the peripheral edge (6a) of the ending section (6) and the bottom flange (2).



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- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*
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IMPROVED IMPELLER FOR PAPER PULPS KNEADERS

This invention is about an impeller for paper pulps kneaders.

As known, in the paper industry, devices named "kneaders" are used for the making of paper pulps, which basically consist of a container wherein an
5 impeller is placed that carries out the making of the pulp by chipping wastepaper into an aqueous bath.

The action carried out by the kneader allows separating the cellulose fibres and making homogenous the water suspension of the same fibres.

Another important function of the kneader is that of separating the ink which
10 soaks the cellulose fibres' paper so as to remake new paper free of ink contamination.

The impeller of the kneader has a frustum conical shape with the major base placed on the bottom of the tank and it is equipped with a number of blades cross-wound around a central vertical shaft which determines a longitudinal
15 spin axis.

During the rotation, the impeller acts essentially as a pump which conveys the paper pulp towards the bottom through the channels formed between the blades and then makes it ascend continuously from the bottom upward along the walls of the tank, thus carrying out the pulping action.

20 The separation of the pulp from the ink takes place because of the rubbing among the fibres.

The state of the art impellers are of the multi-start type, and they are usually equipped with three blades, like, for example, the state of the art kneader which is described in the patent EP 0 775 233 registered under the name of
25 the same applicant of this patent.

The kneader's impeller of the previously mentioned patent is exactly of the triple-start type, it has a frustum conical shape, and has a convergent taper towards the upper part of the tank which contains it.

It must also be noticed that in the ending section of the blades there is a
30 tothing having the function of promoting the tearing of the thicker parts of the mixture, such as cardboard for example, mostly in the pulping starting phase.

The inconvenience that the impeller described in the abovementioned patent has, consists in that the tothing placed on the edge of the ending section of the blades is turned upwards and therefore is not able to develop an optimal
35 tearing of the product to be treated.

As a matter of fact the paper mixture which slides along the channel formed by the blades and that therefore exits from the lower ending section of the impeller, is only minimally involved by the tearing action of the tothing, the latter being turned upward and lifted with respect to the bottom.

- 5 Another inconvenience consists in that the ending section of the blades which form the impeller, has a sharp verticality meaning that the angle formed by the tangent drawn to the outer wall with a vertical longitudinal spin axis of the impeller, has a small width.

This means that during the rotation, when the under treatment mixture reaches
10 the bottom, the mixture is not really forced to radially flow from the duct defined between the blades and then to ascend upwards along the tank's walls.

The present invention intends to remedy to said inconveniences.

More specifically, it is a first object of the invention that of making an impeller which has a greater tearing effect on the product to be treated compared to the
15 state of the art impellers.

It is another object of the invention that such tearing effect on the product would be carried out during the entire mixture treating phase.

It is a further object that the impeller of the invention would allow a greater radial flow of the mixture to be treated in proximity of the impeller's bottom in
20 order to improve the efficiency of the pulping treatment.

Said objects are accomplished by an impeller for paper pulps kneaders that in line with the main claim, it comprises:

- an essentially plan bottom flange connectable to driving means;
- a central shaft which starts from the plane defined by said bottom flange in
25 order to determine a longitudinal spin axis of said impeller;
- one or more blades cross-wound around said central shaft and is characterized in that each of said blades has an ending section, connected to said bottom flange, where there is a tothing on its peripheral edge, said tothing being delimited between the following:
30 - a first point that corresponds to the intersection between the peripheral edge of said blade and said peripheral edge of said ending section;
- a second point that corresponds to the intersection between said peripheral edge of said ending section and the bottom flange.

Advantageously the tothing, being placed slanted and at the end of each
35 blade, gets in contact with the entire mixture flow exiting from the channels

among the blades and is thus able to carry out, compared to the state of the art impellers, a greater pulping level of the under treatment product.

Yet advantageously, the presence of a directional member improves the radial flow of the product exiting from the impeller in proximity of the bottom and the axial flow during the subsequent ascent along the tank's walls.

Said objects and advantages will be better highlighted in an explanatory but not limiting way during the description of a preferred embodiment of the invention with reference to the annexed drawings, wherein:

- Figure 1 shows an isometric view of an embodiment of the impeller of the invention;
- Figure 2 shows an isometric view of an operative embodiment of the impeller of the invention.

The impeller of the invention is shown through an isometric view in figures 1 and 2, where is generally indicated with 1.

One can see that the impeller comprises an essentially plan bottom flange 2, connectable to driving means equipped with a central shaft 4 which starts from the plane K defined by the bottom flange 2 and where blades 5 are cross-wound around it.

The connection of the bottom flange 2 to the driving means takes place through screws which are coupled with through holes 3.

The central shaft 4 determines the longitudinal spin axis X of the impeller 1 which, in the case here described, has a frustum conical shape with the major base placed in the lower part and thus in proximity of the bottom of the container that holds it and that here is not shown.

Furthermore the impeller 1 is of the three-start type and thus is comprised of three blades.

More specifically the connection of the impeller 1 to the driving means, not shown, can also take place through different screw systems, in which case the bottom flange 2 will be free of holes 3.

The number of starts of the blades which make up the impeller can vary as a function of the different user's needs.

According to the invention each of said blades 5 has an ending section 6 connected to the bottom flange 2, where there is a toothing 7 on its peripheral edge 6a, which is delimited between the following:

- a first point 8 that corresponds to the intersection between the peripheral

edge 5a of the blade 5 and the peripheral edge 6a of the ending section 6 that as it is shown they have different inclinations among them;

- a second point 9 that corresponds to the intersection between the peripheral edge 6a of the ending section 6 and the bottom flange 2.

5 In such manner, the tothing 7 involves the ending section of each channel 10 defined between each pair of blades 5 and therefore goes to involve all the under treatment material every time it flows through the same channel 10 during the rotation of the impeller.

As a result, the tothing 7 being slanted with respect to the plane K of the
10 bottom flange 2, always involves the entire mixture's flow and hence not only in the initial phase of the treatment as it occurs for the state of the art impellers wherein the tothing is placed on the peripheral edge 5a of each blade 5 and is turned upwards.

Furthermore, it also must be noticed that the impeller comprises a directional
15 member 11 which radially protrudes from the impeller 1 and it is developed along the peripheral edge 5a of each blade 5 starting from the first point 8.

Preferably but not necessarily, the directional member 11 is developed for a stretch of the axial pitch of each matching blade 5 which, preferably but not necessarily, corresponds to one fourth of the same pitch.

20 The presence of the directional member 11 facilitates the radial outlet of the mixture from the channels between the blades and its subsequent ascent along the tank's walls. Thus the mixture is greatly involved by the pulping action induced by the rotation of the impeller.

In addition, the front corner 11a of said directional member 11 is radially
25 arranged parallel to said plane K and its extension passes through said longitudinal axis X.

In the impeller, as it is shown in figure 1, a plane π is defined which passes through the longitudinal axis X of the impeller 1 and through the first point 8 and that it determines a direction 12 on the outer surface 5b of each blade 5.

30 This direction, by intersecting the longitudinal axis X, forms a β angle which further improves the effect generated by the presence of the directional members 11.

In such manner, advantageously compared to the state of the art impellers, the ending section 6 of each blade 5 turns out to be more outward slanted and
35 thus it contributes, together with the pressure of the directional member 11, to

improve the mixture's radial flow exiting from the channels among the blades close to the bottom. As a result, the ascent of the mixture along the walls of the container which holds it, is also facilitated.

5 Considerable improvements are achieved when the β angle has a width greater than 30° .

The impeller of the invention shown in figure 1 rotates in the clockwise direction indicated by the arrow 13.

10 The same pulping action can be developed also by a further operative embodiment of the invented rotor, generally indicated with 20 and shown in figure 2, which has a right handed winding direction 21 of the blades and is put in rotation according to the counter-clockwise direction shown by the arrow 22. Based on what has been previously said, it is understood that the invented impeller achieves the preset objects in both illustrated and described embodiments.

15 During the executive phase of the invented impeller, some modifications suitable for improving its operation or for making its construction cheaper can be carried out.

20 Furthermore, as previously said, the impeller of the invention can be made by using any size, with any number of starts, and with blades having whatever inclination.

Further embodiments which were neither mentioned nor described, if falling within the scope of the following claims, they should be all considered protected by the present patent.

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CLAIMS

1) An impeller (1; 20) for paper pulps kneaders comprising:

- an essentially plan bottom flange (2) connectable to driving means;
- a central shaft (4) which starts from the plane (K) defined by said bottom flange (2) in order to determine a longitudinal spin axis (X) of said impeller (1);
- one or more blades (5; 21) cross-wound around said central shaft (4), **characterized in that** each of said blades (5) has an ending section (6), connected to said bottom flange (2), where there is a toothing (7) on its peripheral edge (6a), said toothing (7) being delimited between the following:
 - a first point (8) that corresponds to the intersection between the peripheral edge (5a) of said blade (5) and said peripheral edge (6a) of said ending section (6);
 - a second point (9) that corresponds to the intersection between said peripheral edge (6a) of said ending section (6) and the bottom flange (2).

2) The impeller (1; 20) according to claim 1), **characterized by** comprising a directional member (11) being part of each blade (5) and radially protruding from said impeller (1; 20).

3) The impeller (1; 20) according to claim 2), **characterized in that** said directional member (11) is developed along said peripheral edge (5a) of each corresponding blade (5) starting from said first point (8).

4) The impeller (1; 20) according to claim 3), **characterized in that** said directional member (11) is developed along the matching blade (5) for a stretch corresponding to a fraction of the pitch.

5) The impeller (1; 20) according to claim 4), **characterized in that** said stretch along which said directional member (11) is developed corresponds to one fourth of said pitch.

6) The impeller (1; 20) according to claim 1), **characterized in that** a direction (12) is determined on the outer surface of said ending section (6), which corresponds to the tangent drawn through said first point (8) and laying on the vertical plane (π) passing through said longitudinal axis (X).

7) The impeller (1; 20) according to claim 6), **characterized in that** said direction (12) forms a (β) angle greater than 30° with said longitudinal axis (X).

8) The impeller (1; 20) according to claim 2), **characterized in that** a front corner (11a) is defined in said directional member (11), which is placed parallel to said plane (K) determined by said bottom flange (2) and passing through said longitudinal axis (X).

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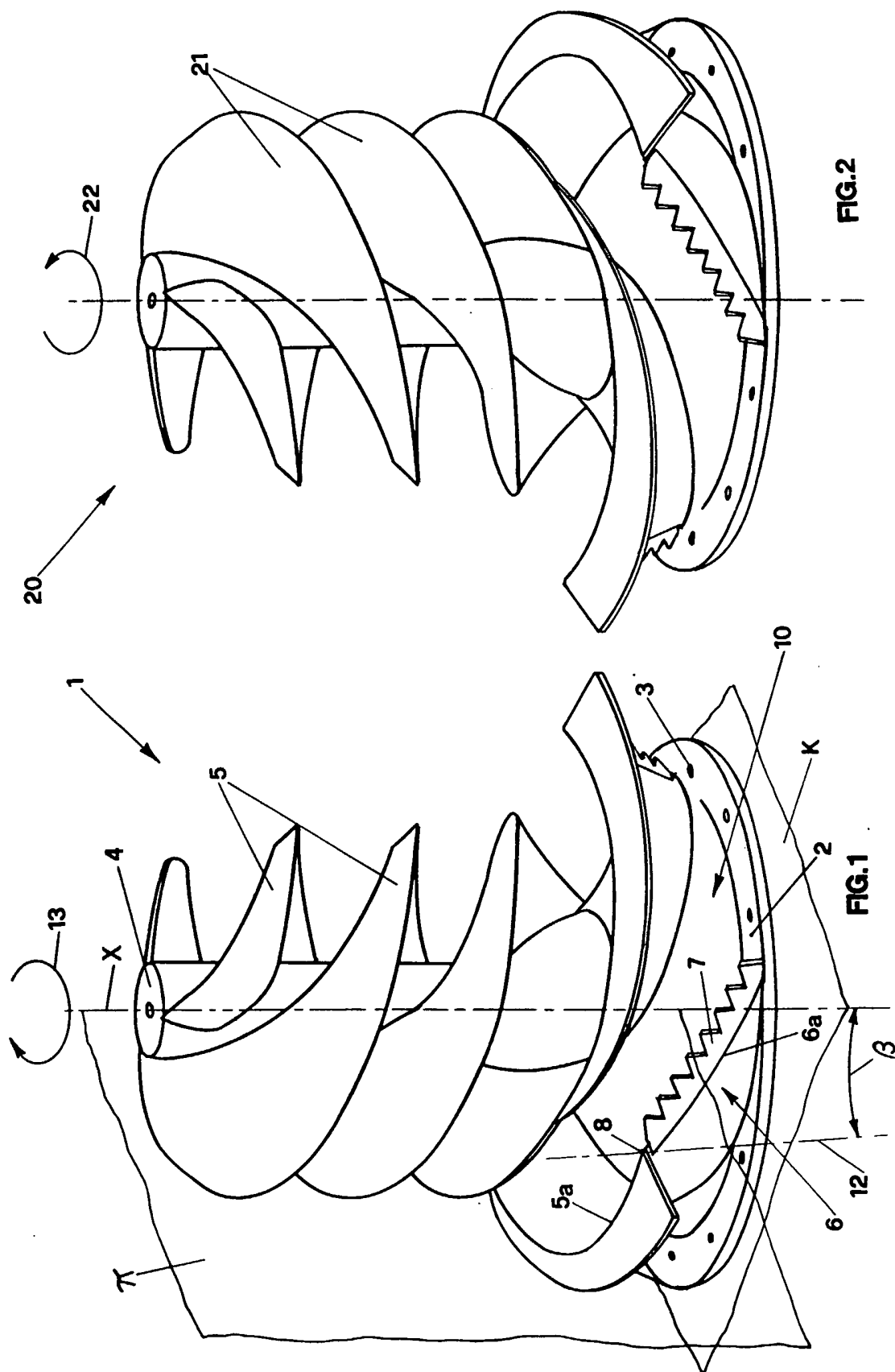
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INTERNATIONAL SEARCH REPORT

International Application No

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 D21B1/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 D21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96 39557 A (COMER SPA ;DAL MASO GIANCARLO (IT)) 12 December 1996 (1996-12-12) cited in the application page 3, line 34 -page 4, line 21 figure 1	1-4
A	US 4 413 789 A (RIENECKER REIMUND ET AL) 8 November 1983 (1983-11-08) column 2, line 16 -column 3, line 25 figure 2	1-4

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

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- *E* earlier document but published on or after the international filing date
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- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *G* document member of the same patent family

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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