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(54) **Method for controlling the refining characteristics of a refiner and a blade for the refiner.**

(57) The invention concerns a method for controlling the refining results imparted on stock in refiners used in the pulp and paper industry, said refiner performing refining between opposed refiner blades (1), of which at least one is rotary, and said blades having protruding blade edges (2, 3) on their surface. The method according to the invention is implemented by arranging the cutting length of the refiner blades (1) to be alterable by moving one or a multitude of the blade edges (3) with respect to the other blade edges (2).

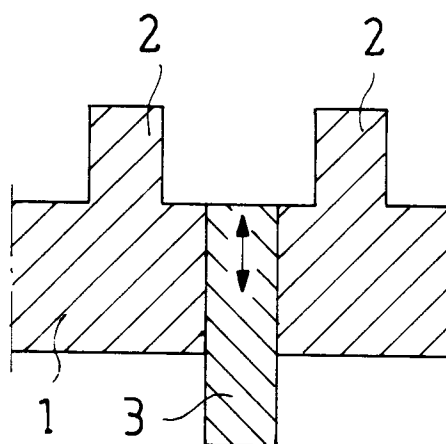


Fig.2

The present invention relates to a method for controlling the refining results imparted on stock in refiners used in the pulp and paper industry, said refiner performing refining between opposed blades, of which at least one is rotary, said blades having protruding blade edges on their surface. Furthermore, the invention concerns a refiner blade capable of implementing said method.

Today, the pulp and paper industry uses predominantly refiners with disk or conical blades for refining the stock. Irrespective of the type of refiner, dimensioning of the refining process is based on the requirements for altering the characteristics of fibers in the stock to be refined (according to the different types of wood and characteristics of their fibers, as well as the final products to be produced). The production throughput (ton/day) itself has an effects only on the size dimensioning of the refiner.

Refining parameters selected for each stock type are also dependent on the pulping method, which can involve mechanical softwood and hardwood pulps, chemical softwood and hardwood pulps, combinations thereof, as well as different kinds of recycled paper pulps. According to conventional techniques, the amount of refining applied to each different pulp fiber type (for the alteration of fiber characteristics) is achieved by transferring the energy released by the motor of the refiner along a rotating shaft to the rotor and stator blades within the refiner, and therefrom to the stock and individual fibers in it. The specific energy consumption (Kwh/ton) varies depending on the different stock grades.

Because the required energy is transferred to the pulp via the blades of the refiner, the characteristics of the blades (width of blade edges, width and depth of grooves, tip angles of blade edges, number of blade edges and their metallurgical characteristics) become extremely important.

Conventionally, specific edge loading (Ws/m) is defined as the variable which appropriately relates to the result of the refining process. The design value for specific edge loading (OSK) is chosen according to the energy input (P_e) to the refiner, the rotational speed (n) of the refiner and the cutting length (L_s) of refiner blades according to the following formula:

$OSK = P_e / (n * L_s)$, in which

$L_s = Z_r * Z_{st} * l$;

Z_r = number of edges in rotor blades

Z_{st} = number of edges in stator blades

l = cutting length of blade edges.

The value of OSK chosen depends on the length of fibers in the stock, thickness of fiber walls and the need for a desired change in the formation characteristics of fibers.

As soon as the values of the so-called fixed parameters (that is, the output power (kW) of the installed motor and its rotational speed (n)) are set, the only method not requiring stopping the refiner for altering

the refining result is limited to changing the effective input energy to the refining process. Changing the refiner input power level causes changes in both the specific energy consumption (change in loading) and the specific edge loading.

With an increase in the throughput of the plant, the loading of refiners can be elevated by maintaining the specific energy consumption constant, while simultaneously increasing the specific edge loading; this, however, causes an essential change in the fiber characteristics in the stock exiting the refiner. In this case, the specific edge loading can be maintained constant by altering the rotational speed of the motor and/or by changing the blades within the refiner and/or increasing the number of refiners. In other words, the only current method in conventional refiners and refining arrangements for maintaining a constant stock quality from refining with changes in throughput and/or fiber characteristics is the changing of refiner blades, which requires stopping the refiners and, in general, detachment of piping components.

It is an object of the present invention to achieve a method for improving the refining result imparted on stock in refiners used in the pulp and paper industry, said method being free from the above-described drawbacks, and further, said method being capable of maintaining a constant output stock quality from the refining process irrespective of changes in throughput and/or fiber characteristics.

The method is characterized in that the cutting length of the refiner blades is altered by moving one or more blade edges with respect to the others.

A preferred embodiment of the invention is characterized in that the cutting length of the refiner blades is altered by elevating or lowering one or more blade edges in the stator and/or rotor blades in a perpendicular direction to the blade's surface.

Another preferred embodiment of the invention is characterized in that the cutting length of the refiner blades is altered by moving one or more blade edges in the stator and/or rotor blades in a direction essentially orthogonal to the length of the other blade edges.

Yet another preferred embodiment of the invention is characterized in that, in order to adjust the refining result, the tip angle of one or more blade edges is altered in the stator and/or rotor blades.

A further another preferred embodiment of the invention is characterized in that the cutting length of the refiner blades is altered during the running of the refiner motor without causing an essential break in production.

Furthermore, a refiner blade for refiners used in the pulp and paper industry, capable of implementing the method according to the invention, said refiner blade having a multitude of protruding blade edges, is characterized in that at least one of the blade edges is arranged to be movable with respect to the other blade edges.

A preferred embodiment of the refiner blade according to the invention is characterized in that at least one blade edge is arranged to be elevatable and lowerable in a perpendicular direction to the blade's surface.

Another preferred embodiment of the refiner blade according to the invention is characterized in that at least one blade edge is arranged to be movable in an orthogonal direction with respect to the other blade edges.

A further another preferred embodiment of the invention is characterized in that every second blade edge is stationary, while every other adjacent blade edge is movable.

According to the invention, the specific energy consumption can be varied according to production requirements by maintaining the specific edge loading at a constant level. As indicated by the formula given above, with an increase in the effective input power to the refiner, also the specific edge loading grows, unless the rotational speed (n) and/or the cutting length of the blade edges (L_s) is not simultaneously increased correspondingly. In practice, altering the rotational speed (n) requires either a DC drive or a dedicated frequency converter, whereby problems arise from insufficient torque for refining and changes in the flow characteristics of the refiner caused by the changes in the rotational speed.

The method according to the invention makes it possible to alter the cutting length of the refiner blades without changing the blades within the refiner. In practice, changing the cutting length takes place by moving one or a multitude of blade edges in the rotor and/or stator blades, whereby the cutting length of the blades is altered.

The structure of refiner blade is next examined in greater detail with the help of exemplifying embodiments by making reference to attached drawings, in which

Figure 1 shows a part of the refiner blade in a top view.

Figure 2 shows a section of an embodiment along the line A-A shown in Fig. 1.

Figure 3 shows the same arrangement as Fig. 2, in this case for a different setting of the movable blade edge.

Figure 4 shows a section of another embodiment along the line A-A shown in Fig. 1.

Figure 5 shows the same arrangement as Fig. 4, in this case for a different setting of the movable blade edge.

Figure 6 shows a part of the refiner blade in a top view.

Figure 7 shows a section of drawing in Fig. 6 along the line B-B.

Figure 8 shows a section of further another embodiment along the line A-A shown in Fig. 1.

Fig. 1 illustrates a refiner blade 1, which is pro-

vided with parallel blade edges 2 protruding from the refiner blade surface. As mentioned earlier, disk or conical refiners are conventionally used for refining the stock. For the purpose of the present invention, this matter is irrelevant.

Fig. 2 illustrates a section of the drawing in Fig. 1 along the line A-A. As is evident from the drawing, an elevatable and lowerable blade edge 3 is arranged between the stationary blade edges 2. The movement of the blade edge can be arranged by means of, e.g., hydraulic cylinders (not shown in the diagrams). In the situation shown in Fig. 2, the movable blade edge is in its lower position, and correspondingly, in the situation shown in Fig. 3, in its upper position. Advantageously, the edges are arranged movable in groups so that, e.g., every other edge is stationary, while every other adjacent edge is movable.

Figs. 3 and 4 illustrate an embodiment in which the movable blade edge 3 in its upper position essentially fills the gap between the stationary blade edges. The basic construction of blade movement can in this embodiment be identical to that described above.

Furthermore, it is possible to arrange the blade edges to be movable in an orthogonal direction to the length of the stationary blade edges as shown by arrows in Figs. 6 and 7. In principle, such a construction is also feasible in which the same blade edge is movable both vertically and sideways. Moreover, it is possible to adjust the result of the refining process in the fashion shown in Fig. 8 by altering the tip angle of the blade edges, whereby the total cutting area between blade edges of the rotor and stator blades is varied.

For those versed in the art it is evident that the invention is not limited by the exemplifying embodiments described above, but instead, it can be varied within the claims of the invention.

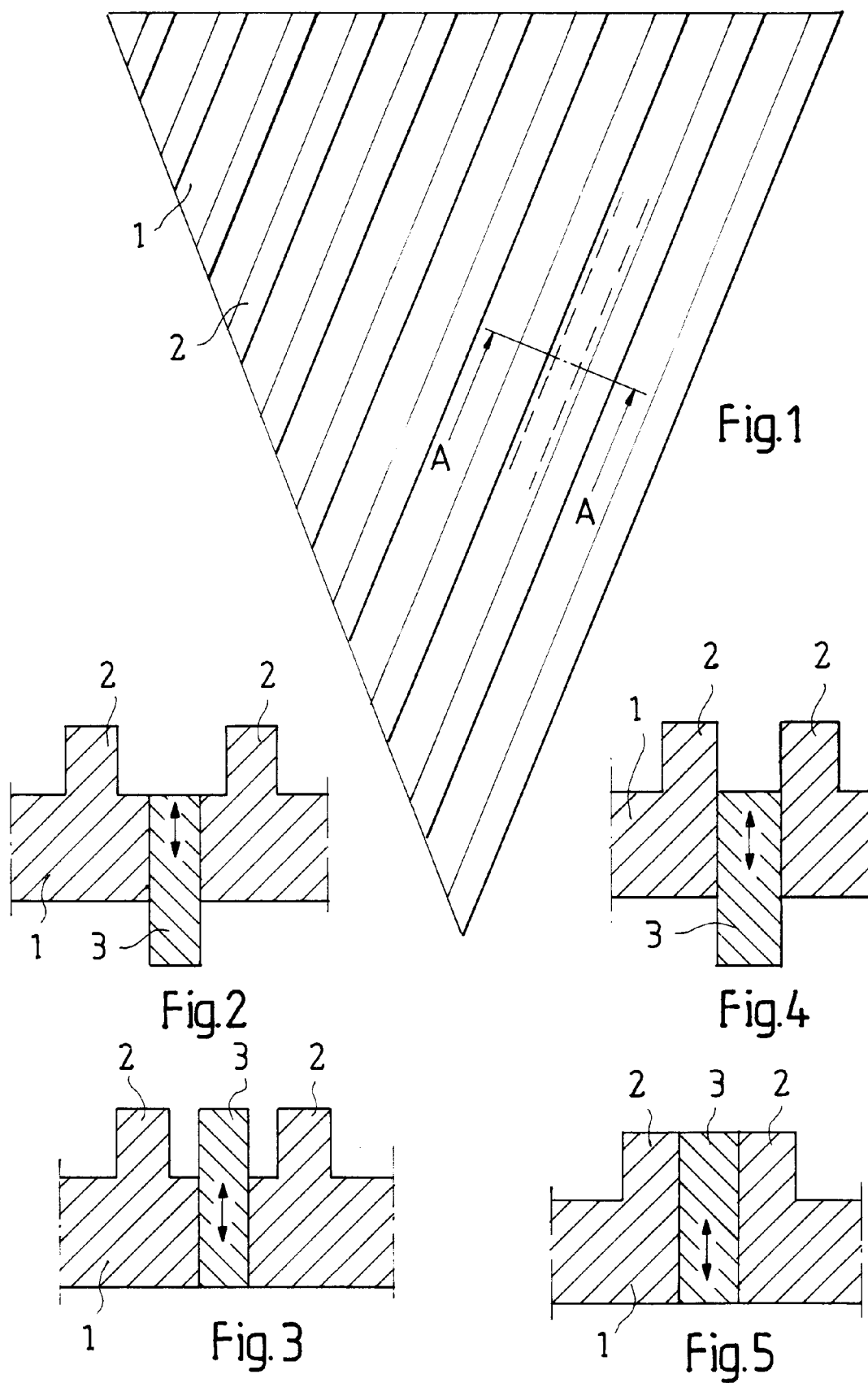
Claims

1. A method for controlling the refining results imparted on stock in refiners used in the pulp and paper industry, said refiner performing refining between opposed refiner blades (1), of which at least one is rotary, and said blades having protruding blade edges (2, 3) on their surface, **characterized** in that the cutting length of the refiner blades (1) is alterable by moving one or a multitude of the blade edges (3) with respect to the other blade edges (2).
2. A method as defined in claim 1, **characterized** in that the cutting length of the refiner blades (1) is alterable by elevating or lowering one or more blade edges (3) in the stator and/or rotor blades in a perpendicular direction to the blade's surface.

3. A method as defined in claim 1, **characterized** in that the cutting length of the refiner blades (1) is alterable by moving one or more blade edges (3) in the stator and/or rotor blades in a direction essentially orthogonal to the length of the other blade edges (2). 5
4. A method as defined in claim 1, **characterized** in that, in order to adjust the refining result, the tip angle of one or more blade edges is alterable in the stator and/or rotor blades. 10
5. A method as defined in any foregoing claim 1...4, **characterized** in that the cutting length of the refiner blades (1) is altered during the running of the refiner motor without causing an essential break in production. 15
6. A refiner blade for refiners used in the pulp and paper industry, said refiner blade (1) having a multitude of protruding blade edges (2, 3), **characterized** in that at least one of the blade edges (3) is arranged to be movable with respect to the other blade edges (2). 20
7. A refiner blade as defined in claim 6, **characterized** in that at least one blade edge (3) is arranged to be elevatable and lowerable in a perpendicular direction to the surface of the blade (1). 25 30
8. A refiner blade as defined in claim 6, **characterized** in that at least one blade edge (3) is arranged to be movable in an orthogonal direction with respect to the other blade edges (2). 35
9. A refiner blade as defined in claim 6, **characterized** in that the tip angle of at least one blade edge (3) is arranged to be alterable with respect to the blade edges (2) of the refiner blade (1). 40
10. A refiner blade as defined in any foregoing claim 6...9, **characterized** in that every second blade edge (2) is stationary, while every second adjacent blade edge (3) is movable. 45

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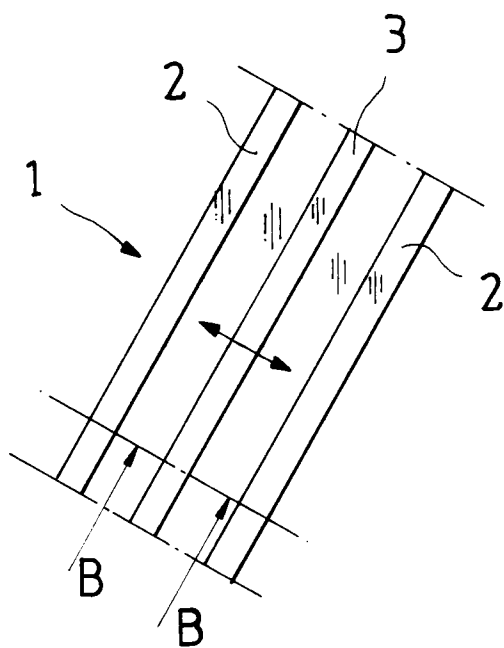


Fig.6

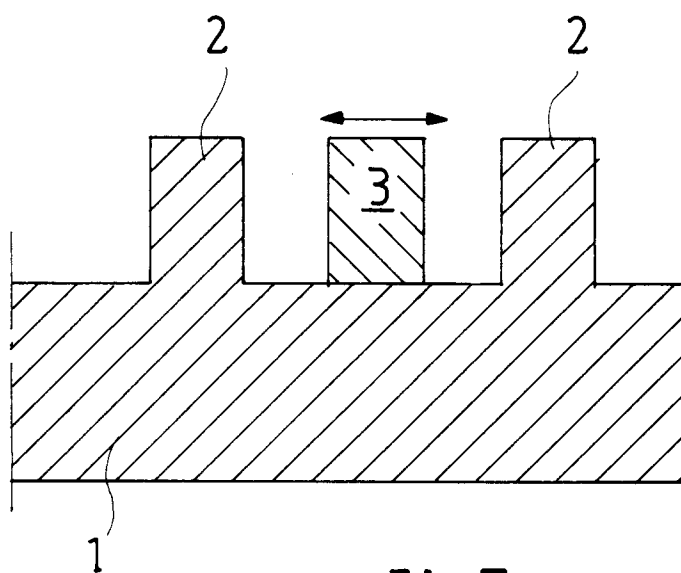


Fig.7

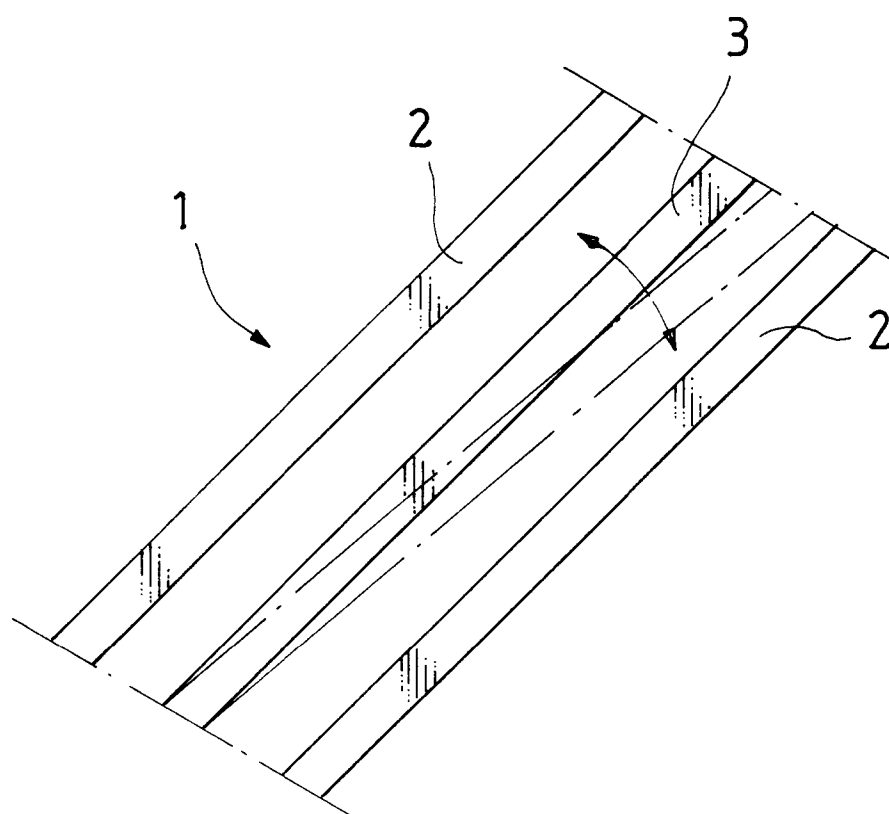


Fig. 8



European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 91 85 0277

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	CH-A-612 706 (MILTON PILAO) * page 4, column 2, line 26 - line 64; figures 6,7 *	1,6,10	D21D1/30 D21D1/20
A	DE-A-3 743 071 (VERWALTUNGS LOHSE GMBH) * the whole document *	1,6	
A	US-A-3 228 274 (CAGEN) * figures 1-11 *	1,6	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			D21D D21B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 06 FEBRUARY 1992	Examiner ELMEROS C.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone V : 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 I : document cited for other reasons & : member of the same patent family, corresponding document			

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