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(54) Method and apparatus in a sheet cutter.

(57) The invention related to a method of preventing overload shocks in a sheet cutter (10), particularly in a pulp dryer, for preventing load shocks caused by an accumulation of material (M) to be cut. In the method, on occurance of an accumulation (T) of material, the cutter drum (11) is allowed to rise freely upwards, and whereby the kinetic energy of the cutter drum is substantially wholly converted into gravitational potential energy. The invention also relates to the cutter used in the method.

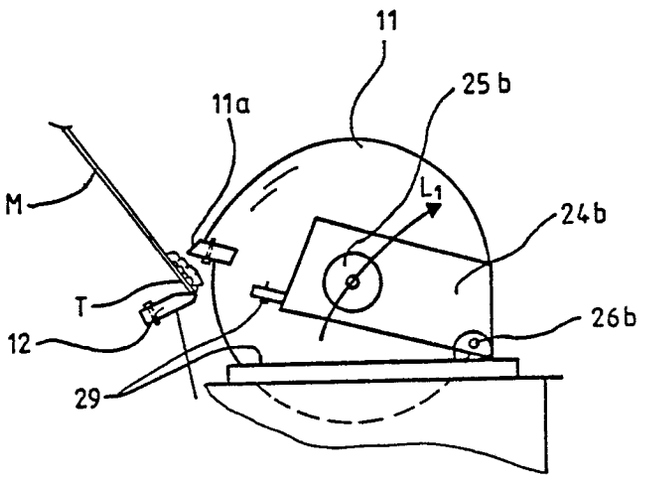

FIG 2

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Method and apparatus in a sheet cutter

The invention relates to a method and an apparatus in a sheet cutter such as used in a pulp dryer for minimizing knife loads caused by an accumulation of material.

In GB Patent 1 108 289, an apparatus is disclosed where the difference in thickness of the material fed through two rotating cutter drums is taken into account. In the arrangement according to GB patent 1 603 999, the upper cutter drum is yieldingly mounted in the machine frame. A sensor responds to the raising of the upper cutter drum and the signal is received by an actuator, which raises the upper cutter further to the height required by the thickness of the material. The said GB patent does not present any solution to how to avoid the problem of knife loads caused by a sudden accumulation of material.

In the sheet cutter of a pulp dryer particularly situations arise where material accumulates between the rotatable knife and the counter knife. This results in an abrupt slowdown of the rotating speed of the cutter drum. This causes a great load on the structures, such as the knives, bearings, etc., which load easily damages the knives as well as the bearing housings.

The invention attemps to overcome or minimize this problem. It has now been discovered to utilize a method wherein the kinetic energy of the rotating drum is controllably converted into gravitational potential energy. Upon an accumulation of material occuring, the rotatable drum is arranged to lift and swing, supported on pivotally mounted bearing housings, or otherwise be displaced. Thus the great kinetic energy of the rotatable knife is substantially converted into potential energy. The lowering of the raised cutter drum is attenuated by means of fluid dampers or other attenuation means.

The method for minimizing loads caused by accumulation of material according to the invention is mainly characterized in that, on occurrance of an accumulation of material, the cutter drum is allowed to rise freely upwards, thus converting the kinetic energy substantially wholly into gravitational potential energy.

The apparatus according to the invention is mainly characterized in that it includes bearing housings allowing the rising of a pivotally mounted cutter drum, which bearing housings are pivotally mounted on pivots, whereby, on an accumulation of material between the movable knife and the counter knife during the cutting operation, the cutter drum is allowed to rise, and the kinetic energy of the cutter drum is converted into gravitational potential energy.

The invention is described below with reference to attached drawings illustrating certain preferred embodiments of the invention, to which the invention is not, by any means, limited.

Fig. 1 is a schematic perpective view of a sheet cutter, particularly in connection with a pulp drying machine.

Fig. 2 is a schematic elevational viewillustrating the raising of a cutter drum, when there is an accumulation of material, seen in the direction of the arrow K in Fig. 1.

Fig. 3 is an elevational view showing the attenuation means used when lowering the drum, viewed in the direction of the arrow K in Fig. 1.

Fig. 4 is a sectional view of a cutter drum schematically illustrating the parameters used in the calculation model in the method in accordance with the invention.

Figure 1 illustrates a sheet cutter 10 which is preferably used in connection with a pulp drying machine (not shown) and which includes a rotatable cutter drum 11 provided with at least one knife 11a. The apparatus comprises a counter knife 12 which is stationary during the cutting operation. A drive motor 13, e.g., an electric or hydraulic motor, rotates the cutter drum 11 through gears 14. An output shaft 15 of the drive motor 13 includes a drive wheel 16, e.g. a cogwheel, on the gears side. The gears 14 include a shaft 18 rotatably mounted in bearings. The shaft 18 includes a drive wheel, preferably a cogwheel 17. Power transmission means, e.g., a chain 19, is attached between wheels 16 and 17. The rotational movement is thus transmitted from the drive motor 15 through the transmission means 19 of the wheel 16 onto the drive wheel 17 of the shaft 18. By this means the shaft 18 is rotated. At its other end shaft 18 has a drive wheel 20, e.g., a belt pulley, which is connected to power transmission means 21, for example a V-belt, which is arranged to connect to a drive wheel 22 connected to a shaft 23 with said drive wheel, preferably also being a belt pulley.

The shaft 23 runs through a bearing housing 24a and is connected to a shaft journal 25a of the rotatable cutter drum 11.

The bearing housing 24a includes a pivot point 26a at one end of the bearing housing. The bearing housing 24a is arranged to swing round or pivot about the pivot point 26a. The bearing housing 24a includes bearing means 27a for the shaft 23.

A pivotally mounted bearing housing 24b is correspondingly connected to the other shaft journal 25b of the rotatable cutter drum 11. The bearing housing 24b includes bearing means 27b for the shaft 25b. The bearing housing 24b is arranged to swing round or pivot about a pivot point 26b

disposed at the corner of the bearing housing. The pivot points 26a and 26b are preferably made up by bearing means, e.g., trunnions. The motor 13 rotates the cutter drum 11, and thus the material M is cut off between the knife 11a of the cutter drum and the counter knife 12.

In the embodiment shown in Fig. 1, the apparatus also includes a shear pin 29, on the breakage of which, the cutter drum 11 rises upwards. This prevents damage to the knives and bearing means.

Fig. 2 illustrates a clogging or jamming situation. The kinetic energy of the rotating cutter drum 11 is converted into potential energy. The rising of the cutter drum 11 is designated by an arrow L_1.

Fig. 3 shows an embodiment of the invention where the dropping of the cutter drum 11 back to its lower position is attenuated by an attenuating means 30. The attenuating means can, for example, be a fluid damper. This type of attenuator 30 allows the knife to rise freely upwards, but in the opposite direction the actuator 30 damps the movement and converts the potential energy of the movement, for example, into heat energy or energy stored in the actuator 30, which energy can be freed after the raising and lowering action, thus bringing the actuator back to the state where it functions as an attenuator. The attenuator can also be a flexible damping cushion or other such means.

In Fig. 4 the method according to the invention is presented as a calculation model. The weight of the cutter drum is 8000 kg and the rotation speed 333 r.p.m.

The kinetic energy is $W = \frac{1}{2} J \omega^2$. When the kinetic energy of the cutter drum is used for lifting the drum to position h in the gravity field, the following equation is obtained:

$mgh = \frac{1}{2} J \omega^2$

Using this equation, it can be calculated what the lifting height should be in order to convert the total kinetic energy into potential energy:

$$h = \frac{\frac{1}{2} J \omega^2}{mg}$$

The following values were used in the calculation carried out:

$J = \frac{1}{2} m (R_1^2 + R_2^2)$ if $R_1 = 36$ cm and $R_2 = 53$ cm

$\omega = 2 = 6.3$ Rad/s $\omega^2 = 40$ $1/5^2$

$J = \frac{1}{2}$ 8000 kg (0.36^2 m^2 + 0.53^2 m^2

$= \frac{1}{2}$ 8000 0.43 kg m^2 = 1720 kg m^2

where J = moment of inertia; R_1 and R_2 are radii of the mantle of the cutter drum; ω = angular speed; m = mass; g = acceleration due to gravity; h = lifting height for the centre of gravity.

The required lifting height calculated with these values is 0.44 m.

If there are two knives, the lifting height with above values will be h = 0.1 m.

Claims

1. A method for avoiding load shocks caused by an accumulation of the material (M) to be cut, in a sheet cutter (10), such as used in a pulp drying machine, **characterized** in that, on occurance of an accumulation of material, the cutter drum (11) is allowed to rise freely upwards, whereby the kinetic energy of the cutter drum is substantially converted into gravitational potential energy.

2. The method according to claim 1, **characterized** in that the dropping-down of the cutter drum (11) back to its lower position is attenuated by a separate attenuator (30).

3. A sheet cutter (10) for carrying out the method of claim 1 comprising a rotatable knife (11a) for cutting material (M), and a counter knife (12) cooperating with the rotatable knife (11a), **characterized** in that bearing housings (24a,24b) are provided for allowing the raising of the cutter drum (11), by the bearing housings (24a,24b) being pivotally mounted on pivots (26a,26b), whereby, on an accumulation of material between the movable knife (11a) and the counter knife (12) during the cutting operation, the cutter drum (11) is able to rise so that the kinetic energy of the cutter drum (11) is converted into potential energy of the gravity field of the earth.

4. The sheet cutter according to claim 3, **characterized** in that the sheet cutter includes a stationary counter knife (12).

5. The sheet cutter according to claim 3 or 4, **characterized** in that the apparatus includes at least one attenuator (30) for attenuating the dropping-down of the cutter drum (11).

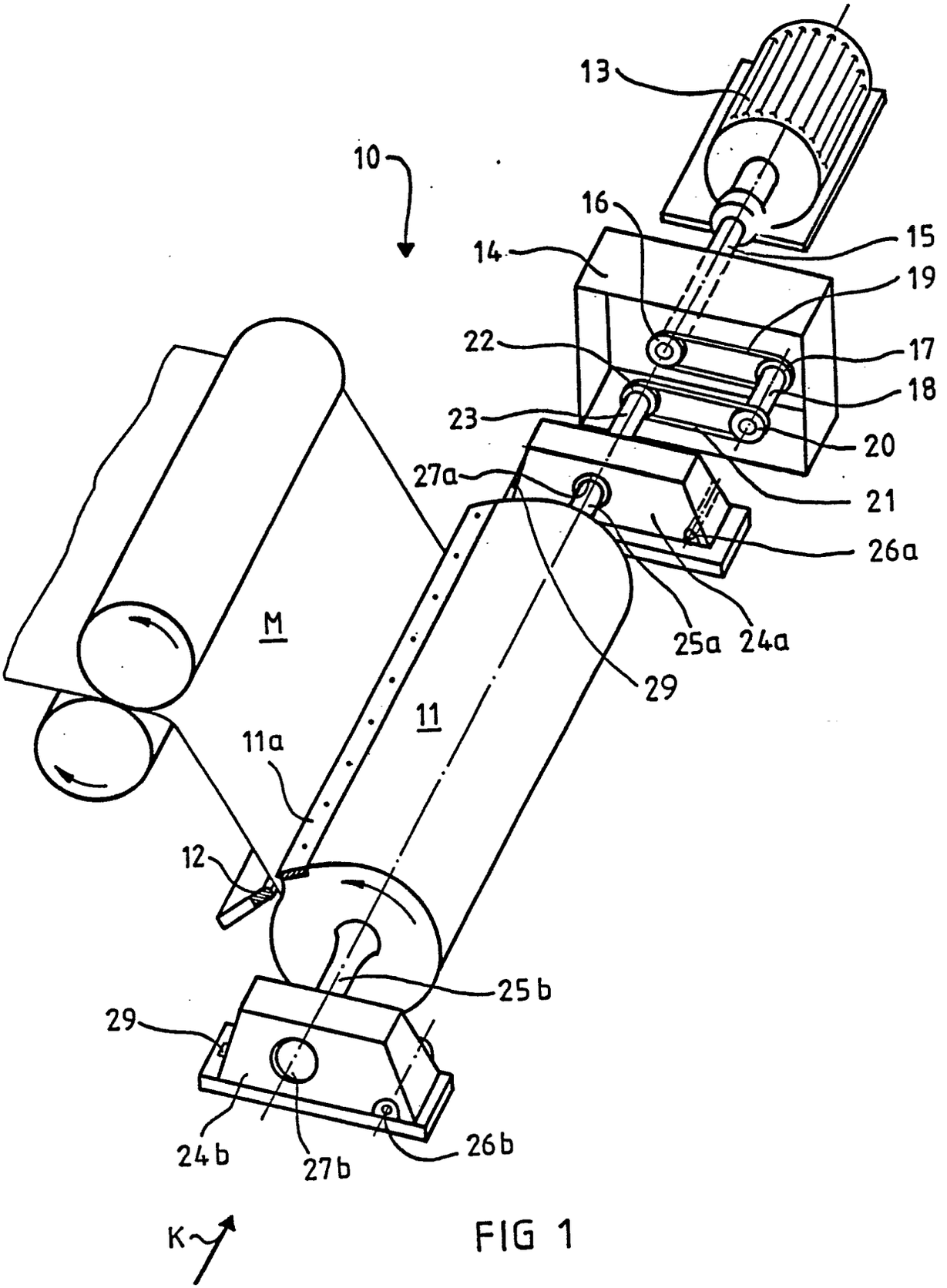
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FIG 1

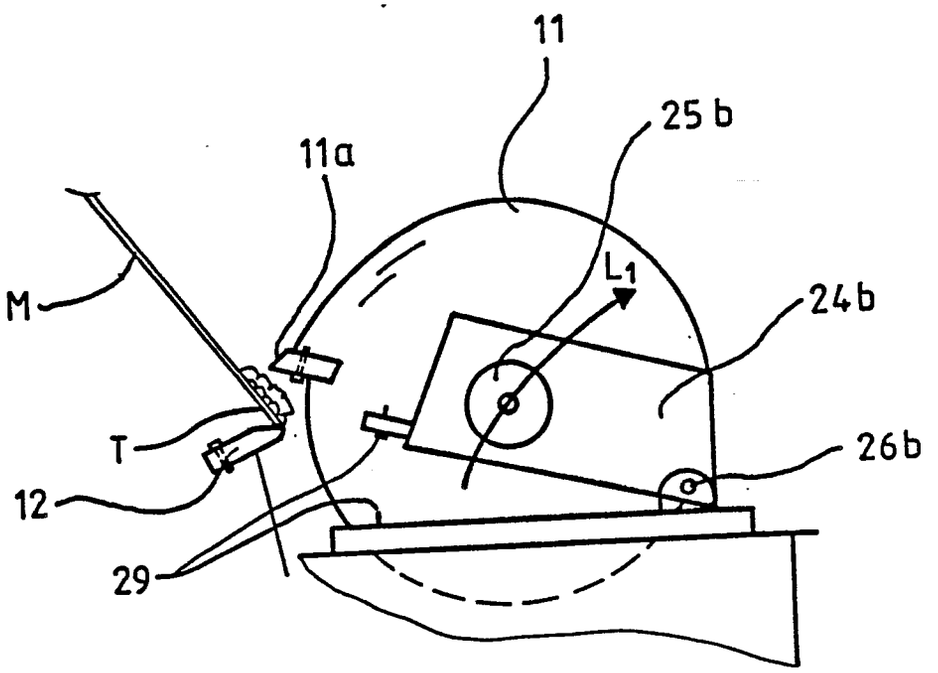

FIG 2

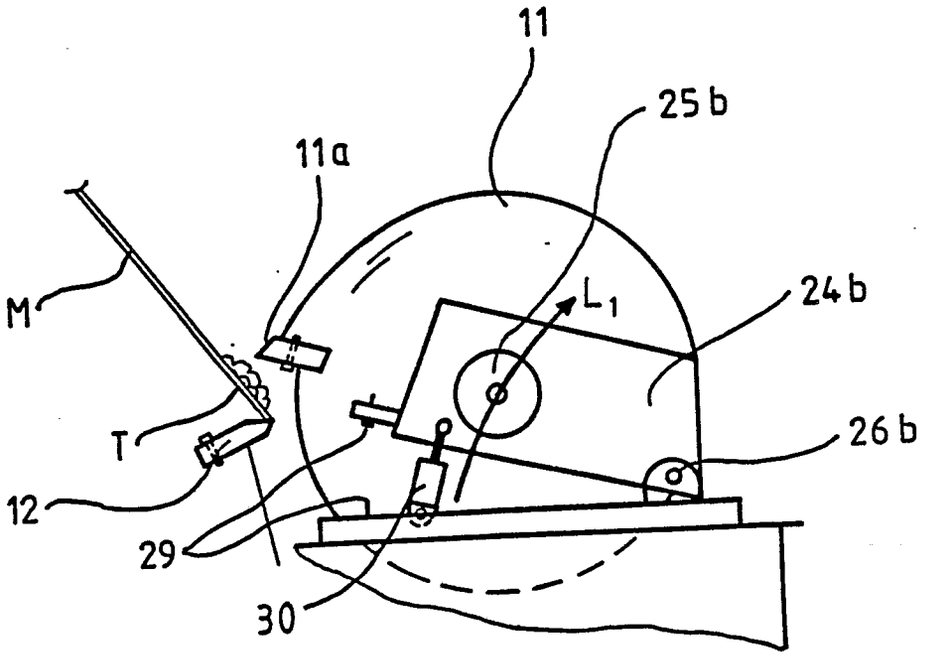

FIG 3

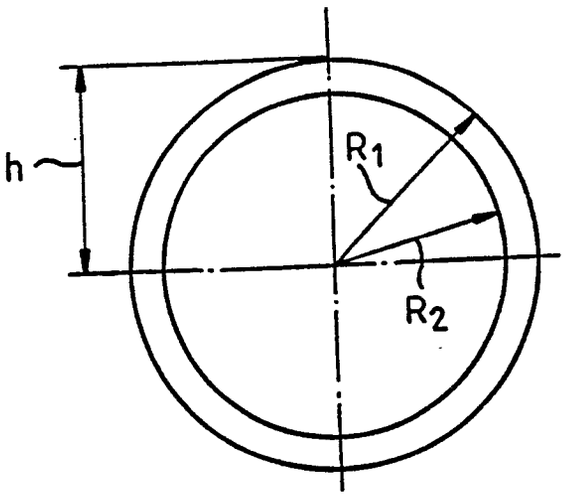

FIG 4

European Patent Office

EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 89307384.1

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4 5)
X,D	GB - A - 1 603 999 (JAGENBERG) * Totality * --	1,3	B 26 D 1/36
X,D	GB - A - 1 108 289 (SERAGNOLI) * Fig. 3,5 * ----	1,3	

TECHNICAL FIELDS SEARCHED (Int. Cl.4 5)

B 26 D
D 21 F 13/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	28-12-1989	TRATTNER

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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