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(54) **Method for manufacturing a starting material suitable for further processing to absorbent products.**

(57) For the purpose of reducing energy consumption when shredding cellulose pulp in sheet form for the manufacture of absorbent products, and to reduce the amount of material consumed, the present invention proposes a method in which dried cellulose pulp web is disintegrated into flakes already in the cellulose pulp mill, and the flakes subsequently compressed into large units, for example bales, having a density of 200-800 kg/m³, preferably 300-700 kg/m³.

Case 1437

Method for manufacturing a starting material suitable
for further processing to absorbent products

The present invention relates to a method for the conversion of web-dried pulps intended for the manufacture of absorbent products. By pulp is meant
5 here and in the following cellulose pulps, such as chemical, chemi-mechanical and mechanical pulps. Examples of such cellulose pulps include sulphite and sulphate pulps, refiner mechanical pulp, and groundwood pulps. The invention can thus be applied to practically
10 all kinds of web-dried pulps.

In the manufacture of absorbent products, pulp fibres produced from different lignocellulosic materials are used in large quantities. The fibres are packed
15 solidly together in sheet form, in bales or reels. The sheets packed in bales normally have a length from 400 to 800 mm, a width of from 300 to 800 mm, a grammage of from 600 to 900 g/m², and a density of from 700 to 900 kg/m³ (bale pulp). In principle, reels comprise extremely
20 long pulp sheets cut into widths which normally vary from 100 mm to 150 mm (reel pulp), with a density of from 600 to 750 kg/m³. It is also known in the manufacture of absorbent products to use as the starting material therefor a pulp which, prior to being dried, is wet shredded
25 into flakes (flake pulp). Prior to being dried, the flakes have a dry solids content of about 50 %. After

drying the flakes to a dry solids content of from 85 to 92 %, they are pressed into decimeter-thick slabs, which because the hemicellulose acts as an adhesive are extremely hard and difficult to break up. The slabs
5 have a density in the order of $550-800 \text{ kg/m}^3$. The flake pulp also contains a large amount of nodules. Flash-dried slabs are delivered in the form of bales having a height which varies from 300 mm to 1200 mm.

10 In the manufacture of absorbent products, the reel pulp or bale pulp is shredded and disintegrated into a voluminous fluff. One problem with the dry shredding of bale pulp is that it is difficult to achieve uniform production. Moreover, it is difficult
15 to obtain a uniform dry solids content, owing to the fact that the bales are made up of relatively large separate units, in the form of sheets or slabs. In the handling of normal bales, powerful shredders are required which, in order to function satisfactorily,
20 demand a given minimum production. Consequently, manufacturers of relatively small quantities of absorbent products can scarcely use bale pulp, but are referred to the more expensive reel pulp. In addition to the requirement of a minimum production for optimal use of
25 the aforesaid shredders, the investment costs involved are unrealistically high in the case of those manufacturers using relatively small quantities of bale pulp.

30 The shredders used to shred reel pulp are simpler than those used to shred bale pulp. Reel pulp functions relatively satisfactorily from the aspect of process techniques. One disadvantage with reel pulp,

however, is that it is costly to produce in the pulp mills, because it requires a longer drying time in order not to be too hard. Reel pulp demands a market price which is about \$100 per ton above that of bale pulp.

The aforementioned problems are solved by means of the present invention. Accordingly, the invention relates to a method for manufacturing a cellulose pulp material suitable for further processing to absorbent products, in which method dried cellulose pulp web is used as basic material. The method is characterized by disintegrating the dried cellulose pulp web to flake form directly in the pulp mill, and by compressing the resultant flakes into large readily handable and transportable units having an apparent density of 200-800 kg/m³, preferably 300-700 kg/m³.

Thus, the obtained flakes are compressed into larger units already in the pulp mill in order to bring them to a form in which they can be readily handled and readily transported to a converting plant.

It has also been found especially suitable for the dried pulp web to have a dry solids content of at least 80 % prior to being disintegrated, disintegration suitably being effected by tearing, so that subsequent to being torn at least 70 % of the pulp is in the form of pieces whose diameter, or length, and width vary between 2 mm and 70 mm, preferably between 3 mm and 40 mm. The remaining parts of the pulp have sizes lying outside these ranges. Prior to the manufacture of the aforementioned absorbent products, the thus produced flake-containing units are shredded in a converting plant in a manner known per se, using known apparatuses.

Because of the good disintegrating properties exhibited by the starting material produced in accordance with the invention, shredding can be effected much more readily than with known bale pulps.

5 When carrying out the method according to the invention it has been found an advantage to cut the dried cellulose pulp web into sheets prior to disintegrating the pulp into flakes, and to stack the sheets loosely on top of each other, whereafter the
10 sheets are cut into strips which, in turn, are disintegrated into flakes, which are then compressed to form larger units. Alternatively, the dried cellulose pulp web can be disintegrated directly upon leaving the drying machine to flake form, i.e. without being
15 cut into sheets, the flakes then being compressed to form larger units. This latter alternative is to advantage insofar as it obviates the need for sheet-manufacturing apparatus and apparatuses for stacking and cutting the sheets.

20 Considerable savings in energy are afforded by the invention compared with the energy consumed when converting bale pulp to fluff using conventional methods. Furthermore, when practising the method
25 according to the invention it is possible to eliminate the customary manufacture of sheets and the pressing of said sheets in the pulp mill, and instead to directly convert the dried pulp web into flakes by means of a simple spiked roller and to then compress the flakes
30 into larger, readily transportable units of desired density. The greater bulk of the starting material produced according to the invention also results in a reduction in the consumption of wood raw materials. The invention also enables small manufacturers of absorbent

products to transfer to the use of less expensive pulp as a starting material, and also obviates the need for certain equipment, such as powerful guillotines and shredders.

5

The invention is illustrated in the following Examples which represent preferred embodiments and each of which is compared with tests carried out in accordance with conventional techniques.

10 Example 1

 In a sulphite mill, in which there was produced a 2-stage-cooked fully bleached spruce sulphite pulp having an intrinsic viscosity of $1100 \text{ cm}^3/\text{g}$ and a brightness of 93 % ISO, there was installed downstream
15 of a drying machine an apparatus, a so-called guillotine, for cutting bales of pulp sheets into strips. The sheets were loosely stacked one upon the other without being compressed, whereafter the sheets were cut into strips by means of the guillotine. The strips had a
20 width of 5 cm and a length of 80 cm. The dry solids content of the pulp immediately after the web dryer was 93 %. The pulp strips were carried on a belt conveyor to a hammer mill, in which the strips were reduced to flakes having an average length of about 20 mm and an
25 average width of about 15 mm. The pulp flakes were passed to a slab press and then to a bale press. In this test large units in the form of bales having a weight of 180 kg bone dry pulp were produced. The bales had straight sides, and a height of 47 cm, a length of
30 91 cm and a width of 65 cm. This resulted in a bale density of 650 kg/m^3 for each bale. After being conditioned for two weeks, the flake bales were transported

to a converting plant for the manufacture of diapers. The bales had a dry solids content of 91.5 %. The bales of flakes were opened in the converting plant and shredded into small pieces by means of a simple peg shredder. These pieces were identical in size and number to the flakes obtained prior to baling in the pulp mill. The pulp flakes were conveyed in a screw conveyor to a disc refiner where they were defibrated into fluff. It was noted during this test that the flake bales could be torn apart with ease and the pulp flakes readily defibrated. It was also noted that problems caused by static electricity were considerably less than normal. During the test, diapers having a weight of about 32 g were manufactured. The diaper weight-spread amounted to ± 1 g, and was fully satisfactory. The bulk of the pulp and its absorption properties were checked prior to manufacturing the diapers. The results are given in Table 1 below.

In order to make a comparison there were taken from the mill pulp sheets which had been stacked and compressed to bale form in a conventional manner and which had the same measurements as those mentioned above. The bales had a weight of 190 kg (bone dry) and a density of 685 kg/m^3 . The dry solids content of the pulp immediately after the web dryer was 93 %. After being conditioned for two weeks, the dry solids content was 92.0 %. The pulp bales were then transported to the converting plant, where they were cut into strips on a guillotine. The strips had a width of 5 cm and a length of 80 cm. The pulp strips were conveyed on a belt conveyor to a hammer mill, where they were reduced to flakes having an average length of about 20 mm and an average width of about 15 mm. The pulp flakes were conveyed

with screw conveyors to a disc refiner, where they were defibrated. No difficulties were experienced in manufacturing diapers from the defibrated fluff pulp, with the exception of certain problems arising from static electricity. During the test, diapers having a weight of about 32 g were manufactured. The diaper weight-spread was ± 1 g.

The bulk of the pulp and its absorption properties were checked directly after the defibrating stage, i.e. just prior to the diaper manufacturing stage. The results are given in the Table below. All measurements have been made according to SCAN-C 33:80.

Table 1

	<u>Comparison Test</u>	<u>Invention</u>
Total energy consumed when shredding and defibrating, kWh/ton of pulp	71	63
Bulk, m ³ /kg	18	20
Absorption rate, sec.	6.0	5.5
Absorption capacity, g H ₂ O /g of pulp	10.0	10.5

As will be seen from the Table, the amount of energy consumed when practising the method according to the invention was surprisingly less than that consumed when practising the conventional method. Although no positive explanation can be given as to why this surprising result was obtained, one possible theory is that in the case of flake-containing bale units produced in accordance with the invention the fibre-to-fibre bonds between the flakes developed during said storage period are weaker and also smaller in number. It will also be seen from the Table that the pulp

manufactured in accordance with the invention has a higher bulk, which makes it possible to manufacture products of unchanged volume but with the use of lesser weight-quantity pulp, i.e. it is possible to save pulp and therewith wood starting materials. Another surprising and positive effect is that the absorption capacity of the pulp is not impaired as a result of the lower number of fibres per unit of volume. The good absorption rate has also been maintained.

10 Example 2

 In the same mill as that referred to in Example 1 the sulphite pulp was mixed with 25 % flash dried spruce groundwood pulp having a freeness CSF of 300 ml and being bleached with hydrogen peroxide to a brightness of 73 % ISO. The groundwood pulp was converted in a pulper to a suspension with a pulp consistency of 3 %, which was diluted and charged to the head box of the wet machine simultaneously with the sulphite pulp, whereafter the mixed pulp was dried in the drying section of the wet machine to a dry solids content of 93 %. The resultant pulp sheets were loosely stacked one upon the other without being compressed, and cut into strips on a guillotine, torn into flakes in a hammer mill and pressed into large units in the form of bales having straight sides in the same manner as in Example 1.

 When admixing 25 % groundwood pulp, the weight of the bales dropped to 150 kg bone dry pulp and the mean density of the bales to 528 kg /m^3 . The bales were stored for conditioning for two weeks, to equalize the moisture contents. The bales were then transported to the converting plant, where diapers were manufactured in the same manner as that described in Example 1. Samples were taken for measuring brightness, bulk,

absorption properties and the average weight of the diapers. The results are set forth in Table 2 below, which also shows the total energy consumed in the tearing and defibrating operations.

5 For comparison purposes, a test was carried out using conventional techniques. In the comparison tests there was used a sulphite pulp similar to that previously used, which was mixed with 25 % of the peroxide-bleached spruce groundwood pulp, which had been flash dried to
10 a dry solids content of 90 % and had the form of bales each containing five slabs, each slab having a height of 9 cm. In mixing one slab of groundwood pulp was stacked on each bale of sulphite pulp. The mixed bale
15 was then cut into strips of 5 x 80 cm in size on the guillotine and conveyed on a belt conveyor to a hammer mill, where the strips were reduced to flakes having a average length of 20 mm and an average width of 15 mm. The flakes were conveyed with a screw conveyor to a
20 disc refiner, where the flakes were defibrated to fluff.

Samples were taken and analysed in accordance with the foregoing. The results obtained are shown in Table 2 below.

Table 2

	<u>Comparison Test Invention</u>	
Total energy consumed, kWh/ton	65	59
Brightness, SCAN-C 11:75, ISO %	85.5	86.0
Bulk, m ³ /kg	19	21
Absorption rate, sec.	6.5	6.0
Absorption capacity, g H ₂ O/g of pulp	10.4	10.8
Diaper weight, average value, g	31.9	32.0
average deviation, g	± 1.5	± 1.0

As will be seen from the Table, less energy was consumed when applying the invention. When compared with the use of solely sulphite pulp, as in Example 1, the admixture of groundwood pulp with sulphite pulp resulted in a surprisingly low energy consumption. As will also be seen from the Table, the qualities of the product produced by the method according to the invention were better throughout. The lower spread in diaper weight obtained was also particularly surprising.

The invention is not restricted to the afore-described embodiments. Thus, subsequent to drying and shredding the pulp it can be mixed with another dried and shredded pulp of different quality, i.e. sulphate pulp or a thermo-mechanical pulp. It is also possible within the scope of the invention to mix the dried and shredded pulp with conventional flash dried pulp. Examples of other types of fibre which can be mixed with the dried and subsequently coarsely shredded pulp include recycled fibres and synthetic fibres.

Large units other than straight-sided bales can also be used in accordance with the invention. Thus, it is also possible to manufacture large units by filling the dried and coarsely-shredded pulp into plastic packages of different shapes and sizes and compress the packages to the density desired.

Example 3

In a sulphite mill, in which there was produced 2-stage-cooked, fully bleached spruce sulphite pulp having an intrinsic viscosity of $1100 \text{ cm}^3/\text{g}$ and a brightness of 93 % ISO, a defibrating means was installed downstream of a drying machine, for disintegrating the pulp web. The defibrating means comprised a rotatable roller provided with sharp pyramidal spikes. The defibrating means is usually called a spiked roller and is normally used for coarsely shredding moist pulp prior to flash drying the same in a conventional manner.

The dry solids content of the pulp during the disintegrating operation was 93.5 %, and flakes were obtained having an average width of about 15 mm and an average length of about 20 mm. The pulp flakes were charged to a slab press and then to a bale press. During the test, large units in the form of straight-sided bales having a weight of 180 kg bone dry pulp were produced. The bales were 47 cm in height, 91 cm in length and 65 cm in width. This gave each bale a density of 650 kg/m^3 . After being conditioned for two weeks, the flake bales were transported to a converting plant for the manufacture of diapers. The bales then had a dry solids content of 91.5 %. The bales containing said flakes were opened in the plant and torn into small pieces by means of a simple peg shredder. The pieces obtained were identical in size and number to the flakes obtained prior to baling in the pulp mill. The pulp flakes were conveyed in a screw conveyor to a disc refiner, in which they were defibrated to fluff form. It could be noted during the test that the pulp bales were readily torn apart and that the pulp flakes were readily defibrated. It was also noted that difficulties due to static electricity were considerably less than normal. Diapers weighing about 32 g were manufactured during the test. The spread in diaper weight was $\pm 1 \text{ g}$, and was fully satisfactory. The bulk and absorption properties of the pulp were checked prior to producing the diapers. The result is given in Table 3 below.

To enable comparisons to be made, pulp sheets were taken from the mill and stacked and compressed in a conventional manner into bales having the aforementioned measurements. The bales weighed 190 kg (bone dry) and their density was 685 kg/m^3 . The dry solids content of the pulp immediately after the web dryer was 93 %. After being conditioned for two weeks,

the dry solids content was 92.0 %. The pulp bales were then transported to the converting plant where they were cut into strips on the guillotine. The strips had a width of 5 cm and a length of 80 cm. The pulp strips were fed on a belt conveyor to a hammer mill, where they were reduced to flakes having an average length of about 20 mm and an average width of about 15 mm. The pulp flakes were conveyed in a screw conveyor to a disc refiner, where the flakes were defibrated to fluff. No difficulties were experienced in manufacturing diapers from the defibrated pulp, with the exception of certain problems with static electricity. Diapers manufactured during the test weighed about 32 g. The diaper weight spread was ± 1 g.

The bulk and absorption properties of the pulp were checked immediately after defibration, i.e. just prior to manufacturing the diapers. The results are given in the Table below. All measurements have been made in accordance with SCAN-C 33:80.

Table 3

	<u>Comparison Test</u>	<u>Invention</u>
Total energy consumption, kWh/ton	71	62
Bulk, m ³ /kg	18	20
Absorption rate, sec	6.0	5.5
Absorption capacity, g H ₂ O /g of pulp	10.0	10.5

As will be seen from the Table, the energy consumed is lower than that consumed when shredding and defibrating pulp according to conventional methods, even when the pulp web is shredded by means of a spiked roller. In addition, there is obtained a better end product.

CLAIMS

1. A method for manufacturing a cellulose pulp material suitable for further processing to absorbent products in a converting plant, whereby dried cellulose pulp web is used as basic material, characterized by disintegrating the dried cellulose pulp web into flakes directly in the pulp mill; and by compressing the resultant flakes into large readily handable and transportable units having an apparent density of 200-800 kg/m³, preferably 300-700 kg/m³.
2. A method according to Claim 1, characterized by disintegrating at least 70% of the dried pulp web into pieces (flakes) having an average width/length or average diameter of 2-70 mm, preferably 3-40 mm.
3. A method according to Claims 1-2, characterized in that the dried pulp web has a dry solids content of at least 80% when leaving the drying machine.
4. A method according to Claims 1-3, characterized by cutting the dried pulp web leaving the drying machine into sheets; stacking the sheets loosely one upon the other; cutting the stack of sheets into strips; disintegrating said strips into flakes, and compressing said flakes to form large units.
5. A method according to Claims 1-3, characterized by disintegrating the dried pulp web into flakes immediately upon leaving the drying machine, and compressing said flakes to form large units.

6. A method according to Claims 1-5, characterized by conditioning the in the pulp mill formed large flake units before their transport to a converting plant for shredding into fluff and manufacture of absorbent products.

7. The use of the cellulose pulp material obtained in the method of any of claims 1-6 for the production of absorbent products in converting plants.



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EUROPEAN SEARCH REPORT

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Application number

EP 82 10 4370

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. 3)
A	GB-A- 507 404 (THORSEN)		D 21 B 1/06
A	FR-A-2 340 517 (AHLSTROM)		
A	FR-A-2 289 669 (OLSSON)		
A	US-A-1 851 390 (KEHOE)		
A	DE-C- 65 699 (SAUER)		
			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
			D 21 B D 21 C D 21 H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20-08-1982	Examiner DE RIJCK F.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : 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 L : document cited for other reasons & : member of the same patent family, corresponding document	