EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
19.06.2002 Bulletin 2002/25

(21) Application number: 98934054.2

(22) Date of filing: 07.07.1998

(54) KRAFT PAPER AND METHOD FOR MAKING THE SAME
KRAFTPAPIER UND VERFAHREN ZU SEINER HERSTELLUNG
PAPIER KRAFT ET SON PROCEDE DE FABRICATION

(84) Designated Contracting States:
AT DE ES FI FR GB IT PT SE
Designated Extension States:
RO

(30) Priority: 09.07.1997 SE 9702656

(43) Date of publication of application:
28.06.2000 Bulletin 2000/26

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• TAPPI, Volume 47, No. 6, June 1964, WILLIAM B. WEST, “High Consistency Refining of Fibers”, page 316.

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Description

Field of the Invention

[0001] The present invention relates to the field of kraft paper and more specifically to a new method for making such paper, which method has been found to provide kraft paper with a unique combination of physical properties. Accordingly, the invention also relates to this new paper as well as to so-called valve sacks made of such a kraft paper.

Background of the Invention

[0002] Kraft paper is a general term for paper with above all good strength properties, for which an important application area is the manufacture of sacks. A representative example of such sacks are so-called valve sacks, e.g. for cement, which must meet high standards primarily with respect to tensile strength (an important part of tensile energy absorption) and porosity (high air permeability). High porosity is required in paper intended for such sacks to enable the sack to let out the air which accompanies the filling material when the sack is being filled. In other words, the sack should retain, and be strong enough to hold, the filling material and at the same time let out said air. In the case of valve sacks, in this context, the air can only escape through the paper, which to this end is provided with perforations. However, this high porosity is not required in open sacks, such as garbage bags and the like, since air can escape through the opening at the top while the sack is being filled.

[0003] Obviously, in connection with the manufacture of kraft paper, one has been aware of the desirability of a good combination of high strength and high porosity, but in general, in this respect, these two properties have been considered to be mutually opposite, so that measures taken to increase the strength have led to a corresponding reduction in porosity and vice versa.

[0004] The measures taken according to the prior art for the purpose of achieving an optimisation of the above-mentioned primary properties of kraft paper can, in short, be described as follows. The pulp intended for kraft paper has been subjected to a first fibre processing with energy being supplied to the fibres when the fibre suspension has a high consistency, generally over 15 % by weight, (HC refining) followed by a second beating with energy being supplied at a low fibre consistency, typically about 4% by weight (LC beating), the energy supplied in connection with said LC beating being at least 100 kWh/tonne of paper. HC refining is an operation which provides kneading of fibre against fibre and micro compressions in the fibre and consequently imparts good stretching properties to the fibre, while LC beating provides shredding of the fibre wall and consequently improves its tensile strength.

[0005] Moreover, in order further to improve its tensile strength, starch, for example, has been added as a strengthening agent to the stock obtained from the beating at one or more points in the process, before the stock is fed onto the wire of the paper machine. The total amount of strengthening agent added has been up to a maximum of approximately 6 kg/tonne of finished paper, in order to maintain satisfactory porosity in the finished paper.


[0007] According to this prior art, the normal combination of tensile strength and porosity has generally been a tensile energy absorption index of 2.9 J/g both in the machine direction (longitudinally) and in the cross direction (transversely), distributed over a tensile index of 75 Nm/g longitudinally and 60 Nm/g transversely with a stretching of up to 8.0%. It has been possible to achieve this at a Gurley value of 18 seconds. Higher tensile strength or higher porosity has been achievable only at the cost of an unacceptable value for the latter of these two properties. Thus, e.g. Fi 81643 discloses a tensile index of at most 2,22 KJ/kg at a Gurley value of 4 seconds.

[0008] According to the present invention, it has been found possible to achieve a unique combination of important properties in one and the same paper. In other words, the paper provided according to the invention exhibits both high porosity and a high tensile energy absorption index, which properties can, in addition, be combined with e.g. good runnability in connection with the production of sacks. A more detailed definition of these properties is given below.

[0009] A first object of the invention is thus to provide a method for making kraft paper with an exceptional combination of tensile energy absorption index and porosity.

[0010] Another object of the invention is to provide a method which produces kraft paper which, in addition, exhibits good runnability in connection with sack production.

[0011] A further object of the invention is to reduce, with the aid of the above-mentioned beneficial properties, the grammage of the kraft paper made by means of the method according to the invention, which in turn can lower costs to the manufacturer and the end consumer and which, moreover, reduces environmental impact with better utilisation of raw materials and fewer shipments.

[0012] In addition to providing a method of the type mentioned above, the invention also has for its object to provide finished kraft paper exhibiting in itself the above-mentioned beneficial properties.

[0013] A further object of the invention is to provide valve sacks made or formed of the above-mentioned kraft paper, a major advantage of the good porosity or air permeability being that the sacks do not need be provided with perfora-
Detailed Description of the Invention

[0015] More specifically, the method according to the present invention is a method for making kraft paper having a grammage of 50-140 g/m² and a tensile energy absorption index of 2.5-3.5 J/g at a Gurley porosity of less than 7 seconds, especially sack paper, such as for valve sacks for e.g. cement, which comprises the steps of subjecting a sulphate pulp to high consistency refining (HC refining) only or to HC refining in combination with low consistency beating (LC beating), and adding a strengthening agent, especially a charged polymer, e.g. starch, to the stock thus obtained, before said stock is fed onto the wire of a paper machine, characterized by maintaining the energy supply in connection with said HC refining at a value of at least 150 kWh per tonne of paper, maintaining the energy supply in connection with said LC beating, when utilized, at a value not exceeding 50 kWh per tonne of paper, in both cases calculated as 100% dry paper, and adding said strengthening agent to the stock in two or more separate points with at least 5 kg thereof at a first point and at least 5 kg thereof at a second point (calculated for starch) per tonne of paper (calculated as 100% dry paper), so that the total amount of strengthening agent will be at least 10 kg (calculated for starch) per tonne of paper (calculated as 100% dry paper).

[0016] What is fundamental in connection with the method according to the invention is thus that the LC beating is carried out at a considerably lower energy supply than was previously the case, or that this LC beating is even omitted, and that the strengthening agent is added in a dose amount which is considerably greater than according to the prior art.

[0017] The method as it will be described herein is a method for making kraft paper with a grammage within the 50 - 140 g/m² range. Where one chooses to be within this range in connection with kraft paper production depends primarily on the application area intended for the paper. A major advantage of the method according to the invention is, of course, that it is possible to make kraft paper exhibiting good tensile strength and good porosity despite a very low grammage, e.g. in the order of 50 - 70 g/m², while in other cases it may, for example, be of great value to have paper with a relatively high grammage, e.g. in the order of 120 - 140 g/m², and to utilise it as a single layer in a bag rather than having to make a similar sack with a plurality of layers of a different grammage with equally good physical properties.

[0018] A preferred application area for the method according to the invention is for making sack kraft paper, since this represents a very large market and since the paper obtained according to the invention exhibits a unique combination of properties which are particularly advantageous in connection with sacks. Primarily, this applies to valve sacks, in which good air permeability is required, as described above, and where the method according to the invention has even made it possible to omit the perforations which previously had to be used in sacks of this type.

[0019] With respect to the term kraft paper, in connection with the invention this refers to bleached or unbleached paper made primarily of sulphate pulp (kraft pulp). For example, in this context, it may refer to unbleached sulphate softwood pulp.

[0020] Naturally, with respect to the method according to the invention, it is understood that further steps are included in the production of the paper in question if one looks at the whole process from the sulphate pulp, which is the starting point, up to the finished paper. One such step is for instance the use of a micro-crêping equipment in order to enhance the stretching of the paper. To achieve a stretching of more than 4% such an equipment is generally used. However, these steps are conventional and, consequently, it should not be necessary to provide a more detailed description of these in this specification.

[0021] With respect to the steps essential to the method according to the invention, the following applies. According to a first alternative, the sulphate pulp, which forms the starting point, is subjected to HC refining only, which is generally carried out at an energy supply in the range of 150 - 400 kWh per tonne of finished kraft paper, which in this case as in every other case in connection with the invention is calculated as 100% dry paper, unless otherwise indicated. A particularly preferred range for HC refining is 200 - 300 kWh per tonne of paper.

[0022] HC refining is generally carried out at a fibre suspension consistency exceeding 15% by weight and usually at an upper limit of 40% by weight, i.e. suitably in the range of 15 - 40% by weight. A preferred consistency of the fibre suspension in connection with HC refining is 28 - 40% by weight, most preferably 30 - 34% by weight.

[0023] According to the second alternative of the method according to the invention, HC refining can be combined with low consistency beating (LC beating), provided that the energy supply in connection with the LC beating is maintained at a value not exceeding 50 kWh per tonne of paper. With respect to HC refining, the above-mentioned general and preferred values concerning energy supply and fibre suspension consistency apply to this alternative as well. With respect to LC beating, it should preferably be carried out at a maximum energy supply of 30, more preferably a maximum of 20, kWh per tonne of finished paper. In the present case, LC beating refers to a fibre suspension consistency in the
Moreover, with respect to both the HC refining and the LC beating, these operations can be carried out independently of one another with the aid of conventional refining and beating apparatus, such as refiners. Nevertheless, a preferred embodiment of the invention involves carrying out at least one, or both, of said operations in a refiner. Furthermore, these two operations must not necessarily be carried out in the form of a single HC refining or a single LC beating. Thus, the terms HC refining and LC beating in connection with the method according to the invention also comprise the cases where either or both of these operations are carried out in several sequentially arranged refining or beating devices. Finally, in connection with the HC and LC operations, it should be added that the energy supply values stated for these operations refer to net values with the idling effect for the respective device having been subtracted.

It can be seen from the above that another important feature of the method according to the invention is the adding of a strengthening agent in a certain minimum amount before the stock is fed onto the wire of the paper machine. In this connection, starch is a suitable strengthening agent, the term starch being interpreted broadly as comprising all conceivable types or fractions of starch which provide the desired effect. However, the choice of strengthening agent as such is not of primary importance in connection with the invention, which means that the choice per se can be made on the basis of prior art in the field of strengthening agents. Specifically, this agent is chosen among charged polymers in accordance with common practice.

In principle, the adding of a strengthening agent to the stock can be carried out at any point in the process from the time the latter leaves the refining or the beating until it is fed onto the wire of the paper machine. In addition, it can be carried out at two or more separate points, the use of two points having been found particularly advantageous. In this context, for a more or less optimal effect, it has been found particularly advantageous to carry out a first addition of a strengthening agent in connection with the machine chest of the paper machine. An advantageous point for the second addition of a strengthening agent has been found to be at or in connection with the mixing pump utilised for the paper machine, preferably on its suction side. In this context, the function of the strengthening agent at the latter point is not only strength enhancing but the agent in question is also, as is known per se in the field, active in retaining and distributing the fine material in the sheet.

According to the above, the total minimum amount of the strengthening agent in question is 10 kg per tonne of paper and the maximum amount is usually a total of at most 20 kg per tonne of paper, the amount being calculated on the basis of starch with DS 0.035, as can be seen above. According to the preferred embodiment where the adding is carried out at two or more separate points, 5-10 kg of strengthening agent per tonne of paper are preferably added in a first addition and an amount of the agent in question in the same range, i.e. 5-10 kg per tonne of paper, is added in a second addition. Particularly preferred ranges in both of these cases are 5-8 kg per tonne of paper.

A variant of the method according to the invention comprises the adding of essentially an equal amount by weight of the strengthening agent, within the range stated above, in connection with two additions of said agent.

Another embodiment of the method comprises adding a maximum of 6 kg per tonne of paper in a first addition and more than 6 kg per tonne of paper in a second addition, i.e. a greater amount of strengthening agent in the second addition than in the first. In this connection, a particularly preferred range for the first addition is 5-6 kg per tonne of paper, while a particularly preferred range for the second addition is more than 6 kg and up to 8 kg per tonne of paper.

As mentioned above, the kraft paper obtained in connection with the above method exhibits a unique combination of above all tensile strength and porosity or more specifically tensile energy absorption index and porosity. In this field, the tensile energy absorption index is defined as energy absorbed per weight of paper during stretching to initial rupture in connection with tensile testing, (at standard testing conditions). In this context, the porosity is measured in the Gurley unit, which is defined as the time required for 100 ml of air to pass a circle of the sample with a diameter of 28.7 mm.

More specifically, it has been found possible by means of the method according to the invention to achieve the following combination of values for tensile energy absorption index and porosity: tensile energy absorption index 2.5-3.5 J/g, especially 2.7-3.5 J/g, at a Gurley porosity of less than 7 seconds. More specifically, at a Gurley value of 5 seconds, a paper having a tensile energy absorption index of 3.1 longitudinally and 3.0 transversely has been achieved. However, if not specifically stated, the reference to a single tensile energy absorption index value means the average of the longitudinal and transverse values, i.e. MD(machine direction)-value + CD(cross direction)-value divided by 2.

In addition, a kraft paper is provided with the aid of the method according to the invention, which in itself exhibits good runnability in connection with sack production. In this context, "runnability" refers to the fact that the sack manufacturer's tube and bottom machines can be run at a high speed and produce high quality sacks. If the paper is flimsy, pulls to one side, etc., one talks of poor runnability. This advantageous characteristic is in itself a result of good tensile strength at a suitable grammage, but according to a preferred embodiment of the method according to the invention, it has also been found that this runnability can be improved considerably if, in connection with the drying of
the paper web leaving the wire of the paper machine, the paper web is subjected to embossing with the aid of embossing
equipment comprising e.g. an embossing wire.

According to a preferred variant of this embossing, the embossing wire utilised is driven separately in relation
to the paper web, the embossing wire preferably being driven slower or faster than the paper web.

In this way, according to the invention, it has proved possible to achieve equally good runnability of, i.e. equally
high speed (sacks/min) when making sacks from embossed 60 g/m² paper as with unembossed “ordinary” (=previously
known) 80 g/m² paper.

The embossing is carried out by the wire being pressed against the paper and resulting in a pattern. In this
connection, the paper is lying against a soft underlay, which means that the pattern being pressed into the paper
increases the thickness of the same. The pattern redistributes tensions in the paper and makes it more “tensionless”.

Because of the high strength and the high porosity of the paper according to the invention, the embossing can be
utilised to a maximum extent on lower grammages; i.e. to lower the grammage of the paper utilised by the customer.

Generally, it can also be added that the tensile energy absorption index value is somewhat lower for a bleached
than for an unbleached kraft paper, such as approximately 10% lower.

In addition, this kraft paper preferably exhibits equally good runnability as previously known 70 g/m² paper,
most preferably as 80 g/m² paper.

A second aspect of the invention relates to a valve sack made of one or more layers of the kraft paper man-
ufactured as defined above, since valve sacks in particular have proven an exceptionally advantageous application of
the new kraft paper because of its combination of properties.

As mentioned above, a preferred embodiment of such a valve sack, for e.g. 50 kg cement, means that it can be
made entirely without perforations.

Another preferred variant of a valve sack, specifically for a content of 50 kg, is that it can be made of only two
layers of kraft paper with a low grammage, specifically a maximum grammage not exceeding 70 g/m².

Another interesting variant of the valve sack is the kind formed of a single layer of the kraft paper in question
with a relatively low grammage value for such a single layer construction, specifically not exceeding 120 g/m².

**Drawings**

The invention will be described in more detail below in the form of concrete embodiments of the method,
which also comprise comparative examples, with reference to the accompanying drawings, to which the following
applies.

Fig. 1 shows a flow chart relating to the part of the method comprising the essential features of refining/beating
and addition of a strengthening agent, more specifically, starting with a sulphate pulp and up to the operation where
the stock is to be fed to a paper machine (not shown); and

Fig. 2 shows an outline diagram of an embodiment of an embossing device in connection with a drying cylinder
included in the drying section of a paper machine.

More specifically, Fig. 1 shows an arrow 1 indicating the feeding of sulphate pulp into a so-called HC (high
consistency) tower 2, in which the pulp is stored before being fed into an HC press 3 for adjusting (increasing) its
consistency to the desired value. From this press 3, the pulp moves on to an HC refiner 4 for high consistency refining.

The pulp suspension is then fed by the intermediary of a buffer vat 5 to a first set of LC refiners 6 in which it is subjected
to a first LC beating. By the intermediary of a second buffer vat 7, a new LC beating follows in a second set of LC
refiners 8 (machine beaters). The purpose of the storing in the buffer vats 5 and 7 is to enable equalisation of any flow
fluctuations from prior steps in the process.

The beaten pulp leaving the second set of LC beaters 8 then goes to a machine chest 9, in which the pulp is
mixed with starch added at the arrow 10. In the machine chest, sulphuric acid is also added for pH regulation according
to prior art. By the intermediary of a pump 11, a grammage box 12, and a centricleaner 13, the pulp is then conducted
to a mixing pump 14, on whose suction side further starch is added (indicated by the arrow 15). Subsequent to this
mixing, the stock is fed onwards by the intermediary of a pressurised screen 16 to a paper machine (indicated by the
arrow 17). This paper machine is of the conventional type for making kraft paper for e.g. sacks and, consequently,
need not be described here.

Moreover, the Figure shows the addition of, in this context, the conventional additives alum (auxiliary chemical)
at 18, rosin size (hydrophobising) at 19 and WS agent (wet strength) at 20.

The embossing device shown in Fig. 2 comprises an embossing roller 21 with an associated embossing wire
22. The figure also shows a number of drying cylinders 23 included in the drying section of the paper machine. A drying
wire 24 and a paper web 25 resting thereupon run above these drying cylinders.

In the embodiment shown, the embossing wire 22 is driven separately in relation to the paper web 25 and
preferably with a speed which deviates from the speed of the paper web. By means of this embossing device, the
paper is given the desired embossing pattern, which in connection with the invention has been found to provide ex-
cepcionally good runnability when producing sacks from the kraft paper according to the invention.

EXAMPLES

[0051] A number of tests were carried out with the aid of the device shown in Fig. 1, viz. three tests with respect to the method according to the invention (= test Nos. 4, 5, and 6) and three comparative tests (test Nos. 1, 2 and 3) carried out in connection with LC beating other than according to the invention and with a different addition of strengthening agent than according to the invention.

[0052] The test conditions were as follows (with the reference numerals for the respective devices indicated in brackets).

<table>
<thead>
<tr>
<th>Table 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test No.</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>HC-ref. (4)</td>
</tr>
<tr>
<td>220</td>
</tr>
</tbody>
</table>

| LC beating (6) | kWh/tonne | % by weight |
| 60 | 4 | 50 | 3.9 | 55 | 4 | 0 | 4 | 0 | 4 | 0 | 4 |

| LC beating (8) | kWh/tonne | % by weight |
| 35 | 4 | 40 | 3.9 | 40 | 4 | 35 | 4 | 20 | 4 | 0 | 3.9 |

| Starch (9) kg/tonne |
| 2.0 | 2.5 | 0 | 7.0 | 5 | 5 |

| Starch (15) kg/tonne |
| 4.0 | 4.5 | 4.5 | 5.0 | 7.0 | 6.5 |

[0053] The results obtained in these tests are compiled in Table 2 below. The properties indicated have been measured in accordance with the methods stated in the right-hand column of the Table.
<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
<th>Test No.</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Grammage</td>
<td>g/m²</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>Tensile Index</td>
<td>Nm/g</td>
<td>L</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T</td>
<td>60</td>
</tr>
<tr>
<td>Stretching</td>
<td>%</td>
<td>L</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T</td>
<td>8.2</td>
</tr>
<tr>
<td>Tensile Energy Absorption Index</td>
<td>J/g</td>
<td>L</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T</td>
<td>3.0</td>
</tr>
<tr>
<td>Tear Index</td>
<td>mNm²/g</td>
<td>L</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T</td>
<td>12</td>
</tr>
<tr>
<td>Cobb 60 S</td>
<td>g/m²</td>
<td>TS</td>
<td>30</td>
</tr>
<tr>
<td>Moisture Content</td>
<td>%</td>
<td>7.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Gurley Value</td>
<td>S</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Friction Coefficient Static</td>
<td></td>
<td>WS</td>
<td>0.6</td>
</tr>
</tbody>
</table>

L = Machine Direction; T = Cross Direction; TS = Top Side; WS = Wire Side
Conditioning and testing atmosphere 50% RH, 23°C
The table shows that the paper made according to the invention exhibits a unique combination of tensile energy absorption index and Gurley value in relation to the comparative examples at otherwise comparable property values. A lowering of the Gurley value from about 18 s to about 5 s at comparable, or even somewhat enhanced, values for the tensile energy absorption index thus represents an exceptionally valuable development in this field.

Claims

1. A method for making kraft paper having a grammage of 50-140 g/m² and a tensile energy absorption index of 2.5-3.5 J/g at a Gurley porosity of less than 7 seconds, especially sack paper, such as for valve sacks for e.g. cement, which comprises the steps of subjecting a sulphate pulp to high consistency refining, HC refining, only or to HC refining in combination with low consistency beating, LC beating, and adding a strengthening agent, especially a charged polymer, e.g. starch, to the stock thus obtained, before said stock is fed onto the wire of a paper machine, characterized by maintaining the energy supply in connection with said HC refining at a value of at least 150 kWh per tonne of paper, maintaining the energy supply in connection with said LC beating, when utilized, at a value not exceeding 50 kWh per tonne of paper, in both cases calculated as 100% dry paper, and adding said strengthening agent to the stock in two or more separate points with at least 5 kg thereof at a first point and at least 5 kg thereof at a second point calculated for starch per tonne of paper calculated as 100% dry paper, so that the total amount of strengthening agent will be at least 10 kg calculated for starch per tonne of paper calculated as 100% dry paper.

2. A method according to claim 1, characterized by carrying out a first addition of said strengthening agent in connection with the machine chest of the paper machine.

3. A method according to claim 1 or 2 characterized by carrying out a second addition of said strengthening agent at or in connection with the mixing pump of the paper machine, preferably on its suction side.

4. A method according to any one of the preceding claims, characterized by carrying out the HC refining at a fibre suspension consistency exceeding 15% by weight, preferably 15-40% by weight.

5. A method according to claim 4, characterized by maintaining the consistency in connection with said HC refining at 28-40% by weight, preferably 30-34% by weight.

6. A method according to any one of the preceding claims, characterized by carrying out the LC beating at a fibre suspension consistency in the range of 2-10% by weight, preferably 3-6% by weight, especially about 4% by weight.

7. A method according to any one of the preceding claims, characterized by carrying out the HC refining and/or LC beating in a refiner.

8. A method according to any one of the preceding claims, characterized by maintaining the energy supply in connection with said LC beating at a value not exceeding 30, preferably not exceeding 20, kWh per tonne of paper.

9. A method according to any one of the preceding claims, characterized by maintaining the energy supply in connection with said HC refining at a value in the range of 150-400, preferably 200-300, kWh per tonne paper, calculated as 100% dry paper.

10. A method according to any one of the preceding claims, characterized by adding a maximum of 20 kg in total of said strengthening agent per tonne of paper.

11. A method according to any one of the preceding claims, characterized by adding 5-10, preferably 5-8, kg of said strengthening agent per tonne of paper in a first addition.

12. A method according to any one of the preceding claims, characterized by adding 5-10, preferably 5-8, kg of said strengthening agent per tonne of paper in a second addition.

13. A method according to any one of the preceding claims, characterized by adding an essentially equal amount by weight of said strengthening agent per tonne of paper in two additions of said strengthening agent.
14. A method according to any one of the preceding claims, characterized by adding a maximum of 6 kg in a first addition of said strengthening agent and adding more than 6 kg, preferably up to 8 kg, per tonne of paper in a second addition of said strengthening agent.

15. A method according to any one of the preceding claims, characterized by subjecting, in connection with drying of the paper web leaving the wire of the paper machine, the paper web to embossing by means of embossing equipment comprising an embossing wire.

16. A method according to claim 15, characterized by driving the embossing wire separately in relation to the paper web, the embossing wire preferably being driven slower or faster than the paper web.

17. A method according to any one of the preceding claims, characterized by making a kraft paper having a tensile energy absorption index of 2.7-3.5 J/g at a Gurley porosity of less than 7 seconds, preferably at least 3 J/g at a Gurley porosity of at most 5 seconds, especially for an unbleached paper.

18. A valve sack made of one or more layers of a kraft paper made according to any one of claims 1-17.

19. A valve sack according to claim 18, characterized in that it lacks perforations.

20. A valve sack according to claim 18 or 19, characterized in that it is formed of two layers of said kraft paper, the layers each having a maximum grammage of 70 g/m².

21. A valve sack according to claim 19 or 20, characterized in that it is formed of one layer only of said kraft paper, the layer having a maximum grammage of 120 g/m².

Patentansprüche

1. Verfahren zum Herstellen von Kraftpapier mit einem Quadratmetergewicht von 50-140 g/m² und einem Zugenergieabsorptionsindex von 2,5-3,5 J/g bei einer Gurley-Porosität von weniger als 7 Sekunden, insbesondere Sackpapier, so beispielsweise für Ventilsäcke, z.B. für Zement, das die Schritte umfasst, bei denen ein Sulfatzellstoff nur Dickstoffmahlung oder Dickstoffmahlung in Kombination mit Dünnstoffmahlung unterzogen wird und ein Verstärkungswirkstoff, insbesondere ein geladenes Polymer, z.B. Stärke, dem so hergestellten Rohstoff zugesetzt wird, bevor der Rohstoff auf das Sieb einer Papiermaschine geleitet wird, dadurch gekennzeichnet, dass die Energiezufuhr bei der Dickstoffmahlung auf einem Wert von wenigstens 150 kWh pro Tonne Papier gehalten wird, die Energiezufuhr bei dem Dünnstoffmahlen, wenn es eingesetzt wird, auf einem Wert gehalten wird, der 50 kWh pro Tonne Papier nicht übersteigt, welches in beiden Fällen als 100 % trockenes Papier gerechnet wird, und der Verstärkungswirkstoff dem Rohstoff an zwei oder mehr separaten Punkten zugesetzt wird, und zwar wenigstens 5 kg dessen an einem ersten Punkt und wenigstens 5 kg dessen an einem zweiten Punkt, gerechnet für Stärke, pro Tonne Papier, gerechnet als 100 % trockenes Papier, so dass die Gesamtmenge des Verstärkungswirkstoffs wenigstens 10 kg, gerechnet für Stärke, pro Tonne Papier, gerechnet als 100 % trockenes Papier, beträgt.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass ein erster Zusatz des Verstärkungswirkstoffs in Verbindung mit der Maschinenbütte der Papiermaschine ausgeführt wird.


6. Verfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, dass die Dünnstoffmahlung...

7. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Dickstoffmahlung und/oder die Dünnstoffmahlung in einer Kegelmühle ausgeführt wird.

8. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Energiezufuhr in Zusammenhang mit der Dünnstoffmahlung auf einem Wert nicht über 30, vorzugsweise nicht über 20 kWh pro Tonne Papier, gehalten wird.

9. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Energiezufuhr bei der Stickstoffmahlung auf einem Wert im Bereich von 150-400, vorzugsweise 200-300 kWh pro Tonne Papier, gerechnet als 100 % trockenes Papier, gehalten wird.

10. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** maximal insgesamt 20 kg des Verstärkungswirkstoffs pro Tonne Papier zugesetzt werden.

11. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** bei einem ersten Zusatz 5-10, vorzugsweise 5-8 kg des Verstärkungswirkstoffs pro Tonne Papier zugesetzt werden.

12. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** bei einem zweiten Zusatz 5-10, vorzugsweise 5-8 kg des Verstärkungswirkstoffs pro Tonne Papier zugesetzt werden.

13. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** bei zwei Zusätzen des Verstärkungswirkstoffs ein im Wesentlichen gleicher Gewichtsanteil des Verstärkungswirkstoffs pro Tonne Papier zugesetzt wird.

14. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** bei einem ersten Zusatz des Verstärkungswirkstoffs maximal 6 kg zugesetzt werden und bei einem zweiten Zusatz des Verstärkungswirkstoffs mehr als 6 kg, vorzugsweise bis zu 8 kg pro Tonne Papier zugesetzt werden.

15. Verfahren nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** beim Trocknen der Papierbahn, die das Sieb der Papiermaschine verlässt, die Papierbahn mit einer Prägeeinrichtung, die ein Prägesieb umfasst, geprägt wird.

16. Verfahren nach Anspruch 15, **dadurch gekennzeichnet, dass** das Prägesieb in Bezug auf die Papierbahn separat angetrieben wird, wobei das Prägesieb vorzugsweise langsamer oder schneller angetrieben wird als die Papierbahn.

17. Verfahren nach einem der vorangehenden Ansprüche, **gekennzeichnet durch** das Herstellen eines Kraftpapiers mit einem Zugenergieabsorptionsindex von 2,7-3,5 J/g bei einer Gurley-Porosität von weniger als 7 Sekunden, vorzugsweise wenigstens 3 J/g bei einer Gurley-Porosität von höchstens 5 Sekunden, insbesondere bei einem ungeblichen Papier.

18. Ventilsack, der aus einer oder mehreren Schichten aus Kraftpapier besteht, das nach einem der Ansprüche 1-17 hergestellt wird.

19. Ventilsack nach Anspruch 18, **dadurch gekennzeichnet, dass** er keine Perforationen aufweist.

20. Ventilsack nach Anspruch 18 oder 19, **dadurch gekennzeichnet, dass** er aus zwei Schichten des Kraftpapiers besteht, wobei die Schichten jeweils ein maximales Quadratmetergewicht von 70 g/m² haben.

21. Ventilsack nach Anspruch 19 oder 20, **dadurch gekennzeichnet, dass** er aus lediglich einer Schicht des Kraftpapiers besteht, wobei die Schicht ein maximales Quadratmetergewicht von 120 g/m² hat.
Revendications

1. Procédé pour produire du papier kraft ayant un grammage de 50-140 g/m² et un indice d'absorption d'énergie de traction de 2,5-3,5 J/g à une porosité Gurley inférieure à 7 s, en particulier du papier à sacs, par exemple pour des sacs à valve pour ciment par exemple, qui comprend les étapes de soumission d'une pâte au sulfate à une trituration à haute consistance, trituration HC, seulement ou à une trituration HC en combinaison avec un raffinage à basse consistance, raffinage BC, et d'addition d'un agent de renforcement, en particulier un polymère chargé, par exemple l'amidon, au matériau obtenu alors, avant que le matériau soit amené sur la toile sans fin d'une machine à papier, caractérisé par le maintien de l'apport d'énergie en liaison avec la trituration HC à une valeur d'au moins 150 kWh par tonne de papier, le maintien de l'apport d'énergie en liaison avec ledit raffinage BC, quand il est utilisé, à une valeur ne dépassant pas 50 kWh par tonne de papier, dans les deux cas calculé en papier sec à 100 %, et l'addition dudit agent de renforcement au matériau en deux ou plusieurs points séparés avec au moins 5 kg en un premier point et au moins 5 kg en un second point calculé pour l'amidon par tonne de papier calculée en papier sec à 100 %, de sorte que la quantité totale d'agent de renforcement soit d'au moins 10 kg calculée pour l'amidon par tonne de papier calculée en papier sec à 100%.

2. Procédé selon la revendication 1 caractérisé par la mise en oeuvre d'une première addition dudit agent de renforcement en liaison avec le cuvier de machine de la machine à papier.

3. Procédé selon la revendication 1 ou 2 caractérisé par la mise en oeuvre d'une seconde addition dudit agent de renforcement au niveau de ou en liaison avec la pompe mélanèuse de la machine à papier, de préférence du côté aspiration de celle-ci.

4. Procédé selon l'une quelconque des revendications précédentes caractérisé par la mise en oeuvre de la trituration HC à une consistance de la suspension de fibres dépassant 15% en masse, de préférence de 15-40% en masse.

5. Procédé selon la revendication 4 caractérisé par le maintien de la consistance en liaison avec ladite trituration HC à 28-40% en masse, de préférence 30-34% en masse.

6. Procédé selon l'une quelconque des revendications précédentes caractérisé par la mise en oeuvre du raffinage BC à une consistance de la suspension de fibres dans le domaine de 2-10% en masse, de préférence de 3-6% en masse, en particulier d'environ 4% en masse.

7. Procédé selon l'une quelconque des revendications précédentes caractérisé par la mise en oeuvre de la trituration HC et/ou du raffinage BC dans un raffineur.

8. Procédé selon l'une quelconque des revendications précédentes caractérisé par le maintien de l'apport d'énergie en liaison avec ladite trituration HC à une valeur ne dépassant pas 30, en particulier ne dépassant pas 20, kWh par tonne de papier.

9. Procédé selon l'une quelconque des revendications précédentes caractérisé par le maintien de l'apport d'énergie en liaison avec ladite trituration HC à une valeur dans le domaine de 150-400, de préférence de 200-300, kWh par tonne de papier, calculée en papier sec à 100%.

10. Procédé selon l'une quelconque des revendications précédentes caractérisé par l'addition d'un maximum de 20 kg au total dudit agent de renforcement par tonne de papier.

11. Procédé selon l'une quelconque des revendications précédentes caractérisé par l'addition de 5-10, de préférence 5-8, kg dudit agent de renforcement par tonne de papier dans une première addition.

12. Procédé selon l'une quelconque des revendications précédentes caractérisé par l'addition de 5-10, de préférence 5-8, kg dudit agent de renforcement par tonne de papier dans une seconde addition.

13. Procédé selon l'une quelconque des revendications précédentes caractérisé par l'addition d'une quantité sensiblement égale en masse dudit agent de renforcement par tonne de papier en deux additions dudit agent de renforcement.

14. Procédé selon l'une quelconque des revendications précédentes caractérisé par l'addition d'un maximum de 6
kg dans une première addition dudit agent de renforcement et l’addition de plus de 6 kg, de préférence jusqu’à 8 kg, par tonne de papier dans une seconde addition dudit agent de renforcement.

15. Procédé selon l’une quelconque des revendications précédentes caractérisé par la soumission, en liaison avec le séchage de la bande de papier quittant la toile sans fin de la machine à papier, de la bande de papier à un gaufrage au moyen d’un appareil de gaufrage comprenant une toile de gaufrage.

16. Procédé selon la revendication 15 caractérisé par l’entraînement de la toile de gaufrage séparément par rapport à la bande de papier, la toile de gaufrage étant de préférence entraînée plus lentement ou plus rapidement que la bande de papier.

17. Procédé selon l’une quelconque des revendications précédentes caractérisé par la production d’un papier kraft ayant un indice d’absorption de l’énergie de traction de 2,7-3,5 J/g à une porosité Gurley inférieure à 7 secondes, de préférence d’au moins 3 J/g à une porosité Gurley d’au plus 5 secondes, en particulier pour un papier non blanchi.


19. Sac à valve selon la revendication 18 caractérisé en ce qu’il est dépourvu de perforations.

20. Sac à valve selon la revendication 18 ou 19 caractérisé en ce qu’il est formé de deux couches dudit papier kraft, les couches ayant chacune un grammage maximum de 70 g/m².

21. Sac à valve selon la revendication 19 ou 20 caractérisé en ce qu’il est formé d’une couche seulement dudit papier kraft, la couche ayant un grammage maximum de 120 g/m².