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(71) Applicant: **Boliden Aktiebolag**
Box 5508
S-114 85 Stockholm(SE)

(72) Inventor: **Ranhagen, Ernst Gustaf Rane**
Meteorvägen 60
S-183 33 Täby(SE)

(74) Representative: **Inger, Lars Ulf Bosson et al,**
Boliden AB Patent & Trade Marks Box 5508
S-114 85 Stockholm(SE)

(54) **A fibre product-manufacture.**

(57) A fibre product such as paper, board, cardboard comprising 95 to 50 per cent High Yield Cellulosic Pulp, 5 to 50 per cent mica having a diameter of at most 300 µm and a flakiness of 10-100, optionally added with conventional paper fillers, and up to 2 per cent binder.

The mica may be added to the pulp before sheet forming or may be used as ingredient in a paper coating formulation.

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A FIBRE PRODUCT-MANUFACTURE

DESCRIPTION

Technical Field

The present invention relates to a fibre product, such as paper, cardbord, and board, for example chipboard, blockboard, etc., comprising part fibre and part mineral as well as a binding part, and to a method for manufacturing the product.

The object of the present invention is to provide a possibility of improving the mechanical and optical properties of such fibre products, at the use of minerals as filling or coating agents.

A further object of the present invention is to provide a possibility of improving the processability when preparing the above mentioned product, whereby retention, dewatering, and formation are essential features.

Background Art

It is known to produce fibrous products, such as paper, from cellulosic fibres admixed with a mineral filler, such as kaolin and chalk, the purpose of which is primarily to extend the cellulosic fibre, so as to reduce the amount of wood substance required. In this respect, the filler is used mainly for printing paper and writing paper, such as newsprint and fine paper. In respect of newsprint, the filler is present in an amount of 20-25% by weight, and in fine paper in an amount of 10-25% by weight.

Talc (magnesium silicate) can also be used, in addition to kaolin and chalk (calcium carbonate). In this respect, the chalk is restricted to neutral-sized papers, while the other fillers can be used with both acid and neutral sizing processes.

The requirements placed on the use of such fillers are related firstly to the behaviour of the filler in the paper manufacturing process, primarily with regard to retention and wear on the wire, and secondly to the demands placed on the final product. Retention is dependent, among other things, on the particle size of the filler. The particle size distribution and the brightness of the filler, and also the form in which it is used, are all significant to the quality of the paper. Newsprint and writing paper are normally white, and so brightness and opacity are essential features of the product. The degree of brightness and of the opacity of a product are determined by the extent to which the product spreads and absorbs light, i.e. the respective S-value and K-value of the product. The K-value of a paper is determined additively, from the K-values of the ingoing components. This additivity does not apply to the S-value, due to the exchange effects between filler and pulp. The relationships between S-values and K-values are such that a high degree of brightness gives high S-values and low K-values, while high opacity gives both a high S-value and a high K-value.

Normally, the addition of a filler lowers the strenght and stiffness of the paper, the strength properties of the paper being lowered to a greater extent than the saving in fibre material afforded by the filler. In this respect, fillers which comprise fine particles have a greater strengthreducing effect on paper than do fillers which comprise coarse particles. Such strength properties as tensile and tear strength are often critical with regard to newsprint, while being less critical with regard to writing paper, the stiffness of the paper being more critical in this latter case. The surface strength and the dust-creating properties are also important factors, the amount of dust created increasing with higher filling contents and affecting the surface properties of the paper.

The retention of the filler to the paper and the intrinsic retention of the paper fibres are dependent upon several factors, of which flocculation with the retention agent is the most essential for obtaining good retention. Polyaluminium hydroxy-complexes, polyacryl-

amide, or cationic starch, or other more complicated systems, such as cationic starch-anionic polymers hardened with inorganic polymers or salt are used as retention agents.

It is also known to manufacture so-called electro insulating paper for insulating purposes. This paper has a high dielectric constant, and is free from pin holes and electrically conductive substances. Such paper consists of mica, a collective name for different mica qualities, and inorganic fibres, such as glass fibres. Other fibre products used within the electro-industry are cable paper, which includes a mica and aromatic polyamides having a mica to polyamide ratio of 10/90-60/40, in order to completely cover each mica particle. This mica-polyamide mixture is admixed with further polyamide resin, to provide a continuous resin phase, whereafter the mixture is mixed with wood pulp, to provide a mica to pulp ratio of 20/80-80/20, and formed into sheets. The mica-particles have a particle size smaller than 60 mesh (= 250 µm) (JP Kokai 99304/77, = Japanese Patent Application 13261/76).

It is also known (US,A, 4 180 434) to produce an electrically insulating mica paper containing cellulose in an amount of 10 to 50% by weight, preferably 20 to 30% by weight, which cellulose fibres have a freeness of 20 to 60 on the Schopper-Riegler scale.

It has now been found possible to avoid several of the disadvantages associated with previously known filler-based papers, and therewith to improve the tensile strength, dust-creating properties, retention, stretchability, shape permanance (reduced shrinkage), stiffness, air permeability and ease of mill-handling, when manufacturing the paper in accordance with the present invention.

Description of the Invention

The present invention relates to a fibre product, such as paper, cardboard or board, comprising a fibre part, a mineral part and a binding part, the invention being characterized in that the fibre

part consists of a wood pulp obtained by processing wood in such a way that besides the cellulose part remaining components such as lignine, hemicellulose and other non-chemically dissolved wood constituents have been retained completely or partly, whereby the fibre yield is 55 to 95 per cent of the total wood yield; that the mineral part comprises mica and optionally further known mineral paper filler such as kaoline, chalk, titanium dioxide, talc and similar; that the binding part comprises known binding agents used in the manufacture of above given products, such as rosin resin, aluminium sulphate, caseine, synthetic resins, starches, and animalic glue; that the fibre part comprises 95 to 50 per cent of the product, that the mineral part comprises 5 to 50 per cent of the product, that the binding agent comprises up to 2 per cent of the product; and that the mica used has a particle size of at most 300 μm obtained at the determination using standard sieve, whereby K_{70} is less than 200 μm, and that it has a thickness of preferably less than 10 μm, and a flakiness (aspect ratio) of 10 to 100, preferably above 20.

The diameter of the mica can also be determined using the Coulter-Counter principle, whereby in general the diameter obtained using said method corresponds to half or a third the diameter obtained using a standard sieve determination.

When measuring the diameter in accordance with the Coulter-Counter--principle, the following information can be obtained

i) diameter based on volume distribution, so-called weight mean-value

$$D_V = \frac{\Sigma n_i D_i^4}{\Sigma n_i D_i}$$

ii) diameter based on number distribution

$$D_n = \frac{\Sigma n_i D_i}{\Sigma n_i}$$

iii) diameter based on area distribution

$$D_a = \frac{\Sigma n_i D_i^3}{\Sigma n_i D_i^2}$$

Hereinafter it is assumed that the particles are spherical, and hence the following relationship applies;

$$D = \sqrt[3]{\frac{2\alpha}{3} \cdot D_{P\cdot D}}$$

in which D is the mean diameter of the particles, $D_{P\cdot D}$ is the diameter from measurements, $\alpha = \frac{D}{d}$ is the flakiness (aspect ratio).

The mica used in accordance with the present invention has a diameter of up to 25 µm, preferably up to 20 µm, the mica having a volume distribution maximum at 8 µm and a number distribution maximum at 4 µm.

Other characteristic features and aspects of the invention are set forth in the following claims.

Mica is the collective term for a mineral group which includes nine different minerals, these being, inter alia, muscovite, phlogopite, biotite, vermiculite and lepidolite. The firstmentioned minerals are those usually meant when referring to mica.

Muscovite is a potassium aluminium silicate of the formula $K_{2,3}\ Al_{4,6}\ (Al_{1,8}\ Si_{6,2}\ O_{20})\ (OH)_4$; phlogopite is $K_2\ (MgFe)_6\ (Al_{1,8}\ Si_{6,2}\ O_{20})\ (OH,F)_4$; and biotite is $K_2\ (MgFe)_6\ (Al_{1,8}\ Si_{6,2}\ O_{20})\ (OH)_4$, all having up to 5% bound water.

The mineral comprises thin, leafy crystals, which lie closely packed against each other.

Chemically, the mica crystals comprise a double layer of SiO_4 tetrahederons arranged in hexagonal rings with the apices of the two layers opposing each other and bound by intermediate aluminium ions and by hydrogen bridges between the hydroxyl groups bound with opposing layers. These double layers form flakes which are held together by cations, preferably potassium.

Of the aforementioned types of mica, the minerals preferred are muscovite and biotite, whereupon, because of its low iron content and its higher degree of whiteness, muscovite is preferred when manufacturing newsprint and writing paper and with regard to other white qualities of the fibre products according to the invention.

The fibre part used in a product of the present invention is a so called High Yield Pulp i.e. a pulp containing 50 to 98 per cent of the total wood contents. Different pulps under this heading is thermomechanical pulp (TMP; yield 80 to 90%); chemico mechanical pulp (CMP; yield 60 to 70%); ground mechanical pulp (GWP, yield 90 to 98%); raffineur pulp (RP; yield about 90%); and high pressure ground pulp (HPP; yield above 90%), optionally in combination with cellulose fibres obtained by e.g. craft or sulphite methods, optionally bleached.

With cellulose fibres is thereby per definition meant fibres obtained by chemical pulp methods, i.e. obtained by means of the so called sulphite and craft methods mentioned above, as well as a soda method.

Using mica the product obtained will show a better surface properties, such as smoothness, structure, and printability; the same or better tensile strength compared with a paper containing the same amount of mineral filler, whereby a more porous paper with the same strength, or a stronger paper having the same porousity is obtained; a higher opacity compared with a paper having the same

mineral filler contents, particularly after calendering, whereby the capacity is lesss reduced using mica in the paper than other mineral fillers, after calendering.

In the process defined in the accompanying claims a better processability is obtained already when using 2 per cent mica or more. The process improvements obtained are better dewatering in the wet part of the paper making machine; a better formulation (i.e. less flocs are recognizable looking at the paper); higher retention with regard to fibre retention as well as mica and additional mineral filler retention, i.e. an overall improvement in retention, which in turn leads to a cleaner white water.

In order to improve processability as well as the product the mica can be ground immediately prior to addition to the stock. Such grinding is preferred in order to obtain fresh surfaces, which are more active than non-fresh surfaces. The number of unsaturated electrical charges available on the surfaces affects the binding capacity to the fibres present.

As the fibres present are positively charged and the plain surfaces of the mica are negatively charged the mica can work as a retention agent. This will also explain the high retention values obtained as well as the ability of the mica to aggregate even the very fine fibres present in the stock.

All types of paper making processes, as well as cardboard and board manufacturing processes can use mica as filler and processing agent, including processes for laminated products as laminated craft liner produced on a Hatschek-machine in which the mica will be orientated. Other types of machines for laminated products are multiple wire machines.

EXAMPLE 1

A paper having a surface weight of 60 g/m^2 was produced on a paper-making machine having a web width of 600 mm, from a stock comprising 80% mechanical pulp and 20% chemical pulp (newsprint). For comparison purposes two stock batches were prepared, one having kaolin as the filler and the other having a muscovite filler. The amount of filler used was varied in both instances, from 0-36%

The retention agent used was a polyacrylamide of standard quality having known properties.

Because of its softness and low sheet-strength, the kaolin-based paper gave trouble on the paper-making machine, even with a manufacturing speed as low as 40 m/min. On the other hand, there was not a single break in the mica-based paper, even with a 36% filler content.

There was no difference between the resultant papers with respect to tensile strength, with the exception of what is stated below.

The stiffness of the paper varied, however, and with a 20% filler content in both cases, the kaolin paper had a stiffness of about 37mN and the mica paper a stiffness of 42mN.

When studying the density and air-permeability vis-a-vis the filler content, it was found that the mica paper at a given filler content had a much higher air-permeability and a lower density than the kaolin paper with the same filler content.

When studying the filler content throughout the whole of the paper, it was established that the mica filler was more uniformly distributed in the paper than was the kaolin filler, which was found to have collected in the centre.

When studying the printing properties of the papers in a standard test, it was found that the quality of the papers was approximately the same

on the printed side thereof. With respect to the back side of the papers, however, certain differences were noticed, to the advantage of the mica paper, i.e. less printing ink penetrated the mica paper.

When studying the filler-fibre bonds, it was found that kaolin had no great affinity with the cellulose fibre, while the mica showed a high affinity.

When studying the tensile strength vis-a-vis density, it was found that the mica-based paper at a given tensile strength had a lower density than the kaolin paper, indicating, inter alia, that the paper shrank to a lesser extent during the drying stage, which also corresponds to the filler-fibre bonding differences.

The characteristic features of the mica paper can possibly be explained by the fact that fibres and mica have the mutual attraction attributed in Page's theory on fibre bonds.

EXAMPLE 2

In a further experiment carried out with respect to the manufacture of writing paper, unsized and sized paper having kaolin and mica as filling agents were prepared. The kaolin used was of the kaolin M grade, and the mica had a diameter according to Coulter-Counter of up to 20 µm (95%). The pulp consisted of a bleached wood pulp, comprising 50% hardwood pulp and 50% (sulphate) pulp. The kaolin and the mica constituted 16% of the stock. Subsequent to producing sheets of paper on a test paper-making machine having a 600 mm web, it was established that retention was poorer in the case of kaolin than in the case of mica. The total retention when producing the kaolin paper was 85%, the fibre retention being 95% and the kaolin retention being 50%. The combined retention when producing the mica paper was 91%, the fibre retention being 98% and the mica retention being 63%, meaning that the kaolin paper contained 9.2% kaolin and the mica paper containing 12.3% mica. Despite a 3% higher filler content in the mica paper, which should normally result in a 3% worsening of the tensile strength, the mica paper was 20% stronger than the kaolin paper. Normally,

kaolin does not contribute to paper strength, and a 9% content will normally result in a 9% lowering of the tensile strength compared with paper having no filler. The tensile strength of the kaolin paper (unsized) was 42.8 Nm/g, and for the mica paper (unsized) 50.4 Nm/g, whereby a non-filler paper should have a tensile strength of 46.5 Nm/g. The difference in tensile strength between unsized and sized kaolin paper was greater than the difference between unsized and sized mica paper.

The stretchability of the mica paper was also 20% higher than that of the kaolin paper.

The kaolin paper and mica paper had the same tear strength, while the tensile energy absorption was 28% higher for the mica paper.

When subjected to a Dennison wax pick test, the mica paper also exhibited a 30% higher picking resistance due to a greater z-strength.

It has also been determined in comparative tests between processes for the production of a paper containing mica and a paper containing kaoline that 50 per cent less energy consumption is required running the wire part when producing the paper containing mica than running the wire part using the same amount of kaoline as a filler.

It has also been noted in the production of fine paper that the fibre retention is improved with 25 per cent when mica is used instead of kaoline.

Certain fibre products, such as products for binding large quantities of water or metal ions, for example diaper-fillers, artificial potting soils; fire-resistant products; fibres having ion-exchange activity; products having biological resistance; or products exhibiting water--repelling surfaces, are manufactured by means of a graft polymerization process. In accordance with one method there is initially prepared a cellulose-fibre stock (0.5-1.0%), to which is added an iron ammonium

sulphate (0.5-1%) in water. An ion-exchange of acid groups then takes place (over a period of 5 minutes), and divalent iron is introduced into the fibres. Excess iron salt is filtered and washed away, whereafter the fibres are redisbursed in water. There is then added a monomer, which may be hydrolizable, and a peroxide (for example H_2O_2) with a quantity ratio of monomer to peroxide of 100:1. Polymerization then takes place at temperatures of up to 90°C, iron (II) ions-peroxide constituting the redox system. When all monomers have been consumed, the fibre is washed and dried, and then optionally hydrolized. If the monomer is ethylacrylate, the ethyl groups are washed away, to leave carboxyl groups. Acrylonitrile which has been graft polymerized gives polyacrylamid followed by a second stage with polyacrylic acid as grafted chains. Paper fibre treated in accordance with this method is so inexpensive that it can be used as artificial potting soil, said soil being resistant to enzymatic degradation.

Another, known graft polymerization method takes its starting point from cellulose fibres, to which dilute sodium hydroxide is added and the excess drawn off. The alkali cellulose is then reacted with gaseous sulphide, there being obtained hydrosulphide groups which are subjected to ion-exchange with iron-ions, which are bound to the mercapto groups. The fibres are washed, whereafter a monomer is added together with a minor quantity of peroxide. Upon completion of the polymerization process, the fibres are washed and dried, there being obtained a fibre in which sulphur remains in the bridges between cellulose and polymer.

In a modified form, the sulphur is removed. In this case, the method commences from cellulose xantate groups, the monomers used only polymerizing where the xantate groups have sat.

The weight of the fibre can be increased by up to 100% by means of these methods. The fibre can also be reinforced with mica, it being possible to cause the mica to take part chemically in the polymerization process, especially when an ion-exchanged/mica is used.

The mica used contains potassium ions, which can readily be exchanged with hydrogen ions, by washing with an acid, such as sulphuric acid or hydrochloric acid. Mica containing hydrogen ions can either be used as such, or may even be used as cation exchangers, or the mica may be subjected to a cation-exchange with aluminium, to raise the aluminium content.

Board, fibre sheets, etc., can also be manufactured in accordance with dry processes, in which a fibre pulp is admixed in different ways with an adhesive and rolled-out, whereafter the adhesive is permitted to set. It is known, however, that different boards have limited bending strengths. The bending or flexural strength of board can be improved radically, however, by mixing mica with the adhesive. In this respect, the darker biotite can be used to advantage. The adhesive, glue extender, may contain up to 60% by weight mica.

Paper is often coated, to give to the paper various properties, such as stiffness, hydrophobicity, brightness, reflectance etc. In this respect, various pigments are often used, such as titanium dioxide, aluminium silicate. It has been found that mica is a splendid material, particularly with respect to its flakiness, providing an extremely smooth paper having a particular surface structure, especially when calendering. Furthermore, muscovite contains so litte iron as to exclude the dirtying of bright paper.

When coating the paper, there is used a substance comprising a pigment, dispersion agent and binding agent. The dispersion agents used are normally polyphosphates, sulphonized naphtalene formaldehydes, sodium terpolymers, phosphated potassium copolymers, and others. Caseine, soya-protein and oxidized starch can also be used as dispersing agents. The amount of dispersion agent used is dependent upon the pigment, the smallest amount of dispersion agent used being that amount which disperses all of the pigment. The binding agent may be a maize starch and potato starch, and also casein. Soya bean protein and animal glue can also be used. Synthetic binders in the form of polyvinyl alchohol,

latex grades, such as styrene-butadiene, acrylates, vinyl acetates, or methyl cellulose, carboxymethylcellulose, hydroxyethylcellulose, polyvinylpyrrolidone can also be used.

Various, typical coating agents are listed below.

For offset paper:

1000 kg	mica
3 kg	Na-hexametaphosphate
200 kg	oxidized starch
50 kg	dimethylolurea
5 kg	ammonium sulphate
20 kg	ammonium stearate

together with water in an amount sufficient to form a suitable consistency (about 50% dry substance).

For cardboard:

1100 kg	mica
200 kg	titanium dioxide
2 kg	Na-tetraphosphate
5 kg	soda ash
200 kg	caseine
30 kg	ammonia
80 kg	wax emulsion

together with water in an amount sufficient to form a suitable consistency (about 55% dry substance).

The coating preparation is used primarily when manufacturing fine paper and cardboards for foodstuffs.

When producing fibre products by means of wet methods, i.e. via a stock, mica suspended in water can be added directly to the stock. But it is also possible, and even preferably to first add the mica to white water, i.e. water drained from the wire, and to permit the mica to associate with the fine fraction present in the white water, i.e. secondary fibres which have not been retained, and then to charge the associated product to the stock in metered quantities.

The aforesaid fine-fibre fraction can also be obtained from the fibre-recovery system of a paper mill or a pulping mill. The mica may also constitute an active part in a fibre-recovery flotation process.

The mica may also be incorporated in retention systems comprising cationic starch; cationic polymers; or cationic starch-anionic polymer-slime structures which are hardened with aluminium sulphate, poly-aluminium hydroxy complexes and/or polysilica, which is then added to the (cellulose) fibre stock.

Mica is a mineral which when ground requires a high energy input. Consequently, in order to improve the energy yield the mica can be added to the wood raw-material, for example, when manufacturing fibre-board, before the wood material is defibrated, and to produce, in a manner known per se, a stock for producing a fibre web. In the defibrating process, fresh reactive surfaces are formed in situ, which improve the affinity between mica and fibres.

Other fibre products where mica according to the invention will enhance the quality of the product include pressboard or fullerboard, which is a thick fibrous product often subjected to high surface pressures and thereby often deformed.

Paper containing mica can be manufactured by means of both dry and wet processes, similarly to various types of board and chipboard (particle board).

Mica is also a splendid additive for use when manufacturing ageing-resistant paper, such as archival paper, and prevents modern chemical additives from having a destructive effect on the papers.

As will also be understood, mica can be combined with other known fillers, such as kaolin, chalk, talc and titaniumdioxide, to enable higher contents of such fillers to be used and/or to improve their properties, inter alia on the basis of the shape-permanence promoting properties of the mica.

CLAIMS

1. A fibre product such as paper, board, cardboard, comprising part fibre, part mineral filler, and part binding agent, characterized in that the fibre part consists of a wood pulp obtained by processing wood in such a way that besides the cellulose part remaining components such as lignine, hemicellulose and other non-chemically dissolved wood constituents have been retained completely or partly, whereby the fibre yield is 55 to 95 per cent of the total wood yield; that the mineral part comprises mica, and optionally further known mineral, paper filler such as kaoline, chalk, titanium dioxide, talc and similar; that the binding part comprises known binding agents used in the manufacture of above given products, such as rosin resin, aluminium sulphate, caseine, synthetis resins, starches, and animalic glue; that the fibre part comprises 95 to 50 per cent of the product, that the mineral part comprises 5 to 50 per cent of the product; that the binding agent comprises up to 2 per cent of the product; and that the mica used has a particle size of at most 300 μm obtained at the determination using standard sieve, whereby K_{70} is less than 200 μm, and that it has a thickness of preferably less than 10 μm, and a flakiness (aspect ratio) of 10 to 100, preferably above 20.

2. A fibre product according to Claim 1, characterized in that the mica constitutes a filler between two layers of fibres.

3. A fibre product according to Claim 1, characterized in that the mica constitutes a filler in an adhesive component intended for binding the fibre product together.

4. A fibre product according to Claim 1, characterized in that the product comprises a coated product, the coating agent including mica as pigment.

5. A fibre product according to Claims 1 - 4, characterized in that the mica incorporated therein comprises an acid-washed mica having a

reduced content of free cations, preferably potassium, and an increased content of hydrogen ions.

6. A fibre product according to Claim 5, characterized in that the hydrogen ions have been replaced with other cations, such as aluminium ions, suitable to the fibre product and its manufacture.

7. A method at the manufacture of wood fibre containing products in the form of paper, cardboard, and board comprising part fibre, part mineral, and part binding agent, characterized in that a fibre part consisting of a wood pulp obtained by processing wood in such a way that besides the cellulose part remaining components, such as lignine, hemicellulose, and other non-chemically dissolved wood constituents, have been retained completely or partly, whereby the fibre yield is 55 to 95 per cent of the total wood yield; that a mineral part comprising mica, and optionally further, known mineral paper filler; that a binding part comprising known binding agents used in the manufacture of said products; are mixed together optionally with water to form a stock, whereby the fibre part comprises 95 to 50 per cent of a final product, the mica part comprises 2 to 50 per cent of a final product, whereby the mica used has a particle size of at most 300 μm obtained at the sieving using a standard sieve and having a K_{70} of less than 200 μm, and having a thickness of preferably less than 10 μm, and a flakiness (aspect ratio) of 10-100, preferably above 20; and that said stock is processed in a manner known per se to produce said products.

8. A method according to Claim 7, characterized by metering a mica suspension to a stock for manufacturing a fibre web, optionally subsequent to having reacted the suspension with white water obtained from a paper-making machine and a fine-fibre fraction contained in said white water, and then separating the mica together with associated fine-fibre fraction from said white water.

9. A method according to Claim 7, characterized by treating the mica with a cationic polymer, a cationic starch, or a system of cationic starch-anionic polymer, prior to introducing the mica to said stock.

10. A method according to Claim 8, characterized in that the mica is reacted with a fine-fibre fraction obtained from a paper manufacturing mill and/or a paper-making pulp mill, connected to a fibre-recovery plant, prior to metering said mica to the stock.

11. A method according to Claim 10, characterized in that the mica is charged to and reacted with the fine-fibre fraction in the fibre--recovery plant, separated therefrom and then charged to the stock.

12. A method according to Claim 7, characterized by adding mica to the fibrous material, subjecting said material to a grinding process to defibrate said material, and producing a stock from said defibrated material, to form a fibre web.

13. A method according to Claim 7, characterized by graft polymerizing a graft-polymerization sensitive monomer and/or polymer, mica, and fibres, preferably cellulose fibres, in which acid groups have been replaced with divalent metal ions, to form a fibre product, and optionally subjecting the product to further treatment prior to use.

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 83 85 0119

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	US-A-3 453 373 (T. YAMAMOTO et al.) * Figures 1-5; claims 1-3; column 2, line 52 - column 4, line 37 *	1,5,7	D 21 H 5/00 D 21 H 1/02 D 21 H 1/22
A	US-A-3 508 952 (R.W. EYKAMP et al.) * Column 1, lines 10-62; column 2, line 31 - column 5, line 15 *	1,4-6	
A	ABSTRACT BULLETIN OF THE INSTITUTE OF PAPER CHEMISTRY, vol. 51, no. 1, July 1980, page 59, no. 339, Appleton, Wisconsin, USA E. HUUSARI et al.: "TMP and talc - An ideal combination for uncoated high-quality magazine paper" & TAPPI/CPPA INTERN. MECH. PULPING CONF. (TORONTO), 231-236, (June 11-14, 1979)	1,7	
D,A	US-A-4 180 434 (J.A. CIANI et al.)		C 04 B D 21 H

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	03-08-1983	NESTBY K.

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
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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
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