

Organización CSA Ltda



SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
INVENTARIO

78

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División de Nuevas Creaciones

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54. TITULO METODO DE RECICLADO DE MATERIALES FIBROSOS UNIDOS Y FIBRAS
SINTETICAS Y MATERIALES SIMILARES A FIBRAS PRODUCIDOS CON ELLOS

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71. SOLICITANTE COLOMBIANA KIMBERLY COLPAPEL S.A.

DOMICILIO MEDELLIN, ANTIOQUIA, COLOMBIA

74. APODERADO RAMIRO CASTRO DUQUE

22. SANTAFE DE BOGOTA, D.C.

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FORMULARIO ÚNICO DE SOLICITUD DE PATENTE
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ENTRADA EN FASE NACIONAL

1

SOLICITUD DE:



Patente de Invención.



Patente de Modelo de Utilidad.



Capítulo I.



Capítulo II.

2

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IDENTIFICACION

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Otro ☐

Cual _____

Número _____

3

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Número 170.322 TP 1003

4

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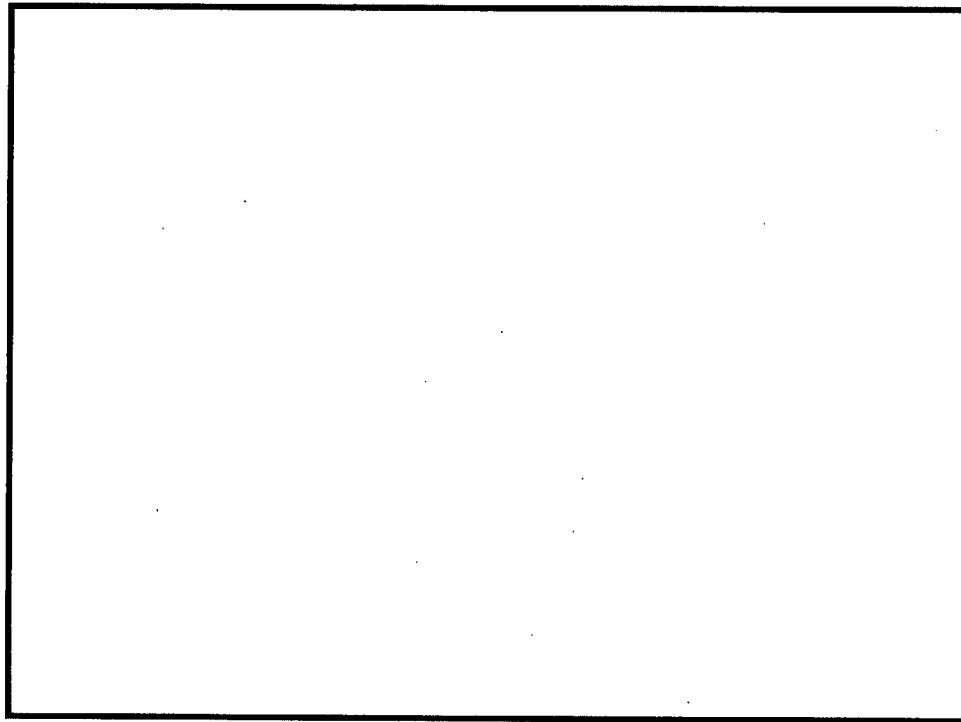
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10

ANEXOS

- ☒ Comprobante de pago de la tasa de presentación de la solicitud. \$400.000
- ☐ Comprobante de pago por reivindicación de prioridad.
- ☐ Documento que acredite la existencia y representación legal cuando el solicitante sea persona jurídica.
- ☒ Poderes, si fuere el caso. ~~Protocolo No. 17387~~
- ☐ Documento de cesión del inventor al solicitante o a su causante.
- ☐ Declaraciones
- ☒ Copia de la solicitud internacional. (Resumen, descripción, reivindicaciones, dibujos)
- ☒ Traducción de la solicitud internacional al castellano. (Resumen, descripción, reivindicaciones, dibujos)
- ☒ Copia del examen preliminar efectuado por la IPEA.
- ☐ Traducción del examen preliminar efectuado por la IPEA.
- ☐ De ser el caso, copia del contrato de acceso.
- ☐ De ser el caso, documento que acredite la licencia o autorización de uso de conocimientos tradicionales de las comunidades indígenas.
- ☐ De ser el caso, certificado de depósito del material biológico.
- ☐ Arte final 12x12.
- ☐ De ser el caso, información sobre otras solicitudes de patente o títulos obtenidos en el extranjero por el mismo titular o su causante, relacionadas parcial o totalmente con la invención de esta solicitud.
- ☐ Otros

11 FIGURA CARACTERÍSTICA:



12 Solicito la concesión de la patente.

NOMBRE: RAMIRO CASTRO DUQUE

FIRMA:

C.C. 170.322 de Bogotá T.P. 1003 del C.S.J.

Instrucciones para la presentación de los anexos, ver reverso de esta página.

3

SUPERINDUSTRIA Y COMERCIO

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***** CONCEPTO *****

CANT.	RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1	50005-01-01	SOLICITUDES	
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60/247,321 10 November 2000 (10.11.2000) US
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- (72) Inventors: PALACIO, Gustavo; Carrera 38 No.11 - 19, Edificio Casaclara, Apto 701, Medellin (CO). GARCIA, Maria, Clara; Calle 38 64A - 39, Barrio Conquistadores, Medellin (CO). RAMIREZ, Pablo; Calle 9A Sur 25 - 33, Bosques de Madeira, Apto 208, Medellin (CO). VANE-GAS, Bernardo; Calle 20 19A - 27, Barbosa, Antioquia (CO).
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(54) Title: METHOD OF RECYCLING BONDED FIBROUS MATERIALS AND SYNTHETIC FIBERS AND FIBER-LIKE MATERIALS PRODUCED THEREOF

(57) Abstract: A method of recycling bonded fibrous materials, the method includes the steps of: providing pieces of bonded fibrous materials, the pieces having sizes that are adapted for suspension in a liquid; suspending the discrete pieces of bonded fibrous materials in a liquid; applying mechanical work to the liquid suspension of discrete pieces to generate hydraulic pressure and mechanical shear stress conditions sufficient to hydraulically fragment the bonded fibrous materials into fibers and fiber-like components; and separating substantially individual fibers and fiber-like components from the liquid. The method is used to produce recycled synthetic fibers and fiber-like materials that have at least one thread element composed of synthetic material having at least one irregular distortion generated by hydraulic fracture of the thread element to separate it from a bonded fibrous material while the bonded fibrous material is suspended in a liquid.

METHOD OF RECYCLING BONDED FIBROUS MATERIALS AND SYNTHETIC
FIBERS AND FIBER-LIKE MATERIALS PRODUCED THEREOF

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FIELD OF THE INVENTION

The present invention relates to recycling techniques and the materials produced utilizing such techniques.

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BACKGROUND

Paper and textile materials made entirely of natural fibers (e.g., animal or vegetable fibers) and/or cellulosic fibers (e.g., pulp fibers) are frequently recycled. Techniques to recycle these materials have been developed to break them
15 down into fibers or fiber-like material and then reform the materials to provide paper and paper-like products. Natural fiber textiles and/or paper are dispersed in water by a pulping operation to create a slurry of individual fibers. The fibers may be cleaned and or treated to remove ink, adhesives
20 or other contaminants. The treated fibers may be further refined and/or fractionated before being formed into a wet-laid web. In conventional recycling operations, synthetic materials are considered contaminants and are typically removed. The synthetic material may be present in the form of
25 synthetic or manufactured fibers and/or filaments or in the form of adhesives, binders or the like.

Woven and nonwoven fabrics composed partially or entirely of synthetic or manufactured fibers have generated problems for conventional processes focused on recycling natural and/or
30 cellulosic fibers. In addition, high-strength natural and/or cellulosic fiber based fabrics that utilize adhesives, binders and/or mechanical entangling, such as hydraulic entangling, also provide problems for conventional recycling processes.

These types of fabrics are generally difficult or
35 impossible to disperse into individual fibers in a wet process such as a pulping operation. This is particularly apparent if

the fabric is formed of synthetic fibers joined by thermal or adhesive bonding. In some cases, fiber or filament "ropes" may form. If the synthetic material is thermoplastic, mechanical work from the processes used to break-up or shred the material may generate sufficient heat to cause the material to melt into unusable globs and clumps.

Generally speaking, fabrics composed of synthetic materials or composites containing synthetic and natural materials are recycled utilizing one of two methods. In the first method, fabrics composed entirely of synthetic thermoplastic material are cleaned, melted and then extruded or formed into staple fibers, continuous filaments or films. If the fabric is a composite containing synthetic thermoplastic materials and natural (or non-thermoplastic synthetic material), the natural (or non-thermoplastic synthetic) materials must first separated from the thermoplastic materials before further processing. This is often impractical because thermal, mechanical and/or adhesive bonding between the components of the composite make separation difficult. Even if separation is possible, the method requires multiple processing steps and energy to melt and reform the material. While the resulting fibers, filaments or films may contain recycled materials, the fibers, filaments or films may be characterized as "manufactured" or "extruded" from recycled polymer feedstock.

The second method involves mechanically breaking up a fabric into smaller pieces such as fiber bundles, threads and/or individual fibers. This is normally accomplished by mechanical tearing and shredding dry material. For example, International Application PCT/SE95/00938 states that it is known to mechanically shred dry nonwoven and textile waste and that dry mixed waste containing both synthetic and natural fibers may be used. According to PCT/SE95/00938, a significant feature of shredding and tearing techniques is that the

tearing or shredding operation is often incomplete so that recycled fibers are present partly in the form of discrete bits of the original fabric that may be characterized as "flocks" or fiber bundles. These flocks are described as providing non-uniformities that give webs containing such flocks a textile-like appearance.

Flocks and bits of fabric are difficult to process in subsequent operations such as, for example, a wet-laying process, air-laying process, hydraulic entangling process or other web-forming processes. Presence of these non-uniformities may reduce the value of the recycled fibers as well as degrade the appearance, strength, uniformity and other desirable properties of a web or fabric made with the recycled fibers. Removing the non-uniformities by screening or other techniques reduces the efficiency of the fiber recovery. Additional dry mechanical chopping, shredding, tearing, garnetting or picking operations to reduce the fiber bundles or flocks into fibers or fiber-like material having a length of less than 5 millimeters may be impractical. In addition, the additional mechanical work may transfer so much energy in the form of heat that the dry material may melt into unusable clumps and may diminish or eliminate any environmental or economic advantages initially presented by recycling the material.

While previous techniques may be of interest to those seeking to recycle thermoplastic material into polymer feedstock for reprocessing as well as those seeking to mechanically tear or shred dry waste fabrics into smaller pieces, they fail to address many existing needs. For example, previous techniques fail to address the need for a wet process to substantially isolate or individualize fibers and/or filaments from a textile or nonwoven fabric. As another example, previous techniques fail to address the need for a wet process to produce usable fibers and fiber-like material

from thermally bonded, adhesively bonded and/or mechanically entangled fabrics such as textiles and nonwoven webs.

Previous techniques fail to address the need for a wet process to convert fabrics into individualized fibers and/or filaments having dimensions similar to cellulosic pulps and short natural fibers such as, for example, lengths less than five millimeters. For example, previous techniques fail to address the need for a process to convert fabrics into individualized fibers and/or filaments having dimensions similar to conventional cellulosic pulps and short natural fibers such as, for example, lengths less than five millimeters.

There is still a need for an inexpensive recycled fiber or fiber-like material that may be easily processed into a uniform sheet or web. For example, there is a need for an inexpensive recycled fiber or fiber-like material that may be processed into a uniform sheet or web utilizing conventional wet-forming or dry-forming techniques. This is also a need for a uniform sheet or web that may include at least a portion of an inexpensive recycled fiber or fiber-like material.

There is also a need for a high strength sheet or wiper that is able to quickly absorb several times its weight in water, aqueous liquid or oil. A need exists for a sheet or wiper that contains an inexpensive recycled fiber or fiber-like material and which is able to quickly absorb several times its weight in water, aqueous liquid or oil. A need exists for a sheet or wiper that contains an inexpensive recycled fiber or fiber-like material and that can be used as a wiper or as a fluid distribution layer and/or absorbent component of an absorbent product. Meeting this need is important since it is both economically and environmentally desirable to substitute recycled fiber or fiber-like materials for high-quality virgin wood fiber pulp and/or new synthetic fibers or filaments and still provide a product that can be

used as a wiper or as a fluid distribution layer and/or absorbent component of an absorbent product.

SUMMARY OF THE INVENTION

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The problems identified above have been addressed by the present invention which is directed to a method of recycling bonded fibrous materials. The method includes the steps of:

- (a) providing pieces of bonded fibrous materials, the pieces
10 having sizes that are adapted for suspension in a liquid; (b) suspending the discrete pieces of bonded fibrous materials in a liquid; (c) applying mechanical work to the liquid suspension of discrete pieces to generate hydraulic pressure and mechanical shear stress conditions sufficient to
15 hydraulically fragment the bonded fibrous materials into fibers and fiber-like components; and (4) separating substantially individual fibers and fiber-like components from the liquid.

Generally speaking, the pieces of bonded fibrous
20 material may have a length ranging from about 10 to about 350 millimeters and a width ranging from about 3 to about 70 millimeters. More desirably, the pieces may have a length ranging from about 10 to about 100 millimeters and a width ranging from about 3 to about 20 millimeters. Importantly,
25 the pieces should be sized so they can be suspended in a liquid such as water. It is contemplated that aqueous solutions, solvents, emulsions and the like may also be used.

In an aspect of the invention, the step of providing discrete pieces of bonded fibrous materials include a process
30 operation to reduce the size of unitary bonded fibrous materials such as large fabrics, textiles, webs and the like or large segments or scraps of such fabrics, textiles, webs, etc. into discrete pieces that are adapted for suspension in a liquid. The operation may be a conventional operation such

as, for example, mechanical shredding, mechanical cutting, mechanical tearing, mechanical grinding, water jet cutting, laser cutting, garnetting and combinations thereof.

5 In another aspect of the invention, the mechanical work may be applied to the liquid suspension utilizing a combination of blades mounted on a rotating roll and blades mounted on a fixed plate to generate areas of very high hydraulic pressure and mechanical shear stress. Such a combination may be found in equipment for processing fiber
10 slurries such as, for example, beaters and refiners, that can supply sufficient energy to the suspension to control fiber length under conditions that provide a high level of fiber to metal interaction.

The blades may be mounted on the fixed plate that can be
15 aligned at an angle in at least one dimension with respect to the direction or plane of rotation of the rotating blades. For example, the fixed blades may be mounted so they are at an angle of between about 5 degrees and 70 degrees to the direction or plane of rotation of the rotating blades.
20 Desirably, the fixed blades may be mounted so they are at an angle of between about 15 and 55 degrees. More desirably, the fixed blades may be mounted so they are at an angle of between about 40 and 50 degrees. Even more desirably, the blades may be mounted so they are at an angle of about 45
25 degrees.

According to the present invention, the process may be set up so that the mechanical work is applied to the suspension in multiple stages. For example, the mechanical work may be applied to the suspension utilizing a first stage
30 under conditions to generate hydraulic pressure and mechanical shear stress sufficient to wet the pieces of bonded fibrous materials and separate at least some portions of fibers and fiber-like components from the bonded materials. Then additional mechanical work may be applied

utilizing a second stage under conditions to generate hydraulic pressure and mechanical shear stress conditions sufficient to rupture the bonded fibrous materials, fibers and fiber-like components into substantially individual
5 fibers and fiber like components.

In an aspect of the invention, the clearance between the rotating blades and the fixed blades at the closest point during the first stage is between about 20 millimeters and about 100 millimeters. The clearance is between about 1
10 millimeter (or as close as possible without metal to metal contact) and about 20 millimeters during the second stage. Desirably, the clearance between the rotating blades and the fixed blades at the closest point during the first stage is between about 20 millimeters and about 50 millimeters and
15 between about 1 millimeter and about 10 millimeters during the second stage.

The consistency of the suspension, speed of rotation of the rotating roll and blades, dimensions of the blades, weight and/or pressure load against the rotating roll are
20 variables that may be adjusted in order to control the clearance.

According to the invention, the approximate amount of mechanical work applied to the liquid suspension may be greater than about 3 Horsepower - day (24 hours) per dry ton
25 of bonded fibrous material - as determined by measuring the electric current drawn by the motor providing movement to the components generating hydraulic pressure and shear stress conditions. This number may be greater than 4 Horsepower - day per ton and may be even greater than 6 or more. It is
30 contemplated that, in some situations or under some conditions, the approximate amount of mechanical work may be less than 3 Horsepower - day per dry ton of bonded fibrous material.

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30 contemplated that, in some situations or under some conditions, the approximate amount of mechanical work may be less than 3 Horsepower - day per dry ton of bonded fibrous material.

The process of the present invention is practiced using bonded fibrous materials are selected from woven fabrics, knitted fabrics, nonwoven webs and combinations thereof. Generally speaking, these nonwoven webs are webs that are
5 thermally bonded, adhesively bonded, mechanically entangled, solvent bonded, hydraulically entangled and combinations thereof.

The bonded fibrous materials can be composed of synthetic fibrous materials, natural fibrous materials and combinations
10 thereof. The synthetic fibrous material may include thermoplastic fibers and filaments.

According to an aspect of the invention, the bonded fibrous materials may be recycled into substantially individual fibers and fiber-like components having a
15 relatively uniform length distribution. For example, the fiber and fiber-like material may have a length distribution that spans approximately 7 millimeters. Desirably, the fiber and fiber-like material may have a length distribution that spans approximately 5 millimeters. It is contemplated that
20 the fiber and fiber-like material may have a length distribution that spans less than 5 millimeters, for example, from 2 to 4 millimeters.

The present invention encompasses recycled synthetic fibers and fiber-like materials having at least one thread
25 element composed of synthetic material having at least one irregular distortion generated by hydraulic fracture of the thread element to separate it from a bonded fibrous material while the bonded fibrous material is suspended in a liquid.

The thread element may have a length ranging from about 1
30 millimeter to about 15 millimeters. For example, the thread element may have a length ranging from about 1.5 to about 10 millimeters. As another example, the thread element may have a length ranging from about 2 to about 5 millimeters. The thread element may have a diameter of less than 100

micrometers. For example, the thread element may have a diameter of less than 30 micrometers.

According to an aspect of the invention, the irregular distortions may be in the form of bends in the thread element, flattened segments of thread element, expanded segments of thread element and combinations thereof.

Generally speaking, the irregular distortions cause the thread elements of the recycled materials to have greater surface area than thread elements in the bonded fibrous material prior to hydraulic fracture of the thread element to separate it from the bonded fibrous material. For example, the surface areas of the recycled thread elements are at least about 5 percent greater.

In an embodiment of the invention, the recycled synthetic fibers and fiber-like materials may be a synthetic material that is a synthetic thermoplastic material. For example, the synthetic thermoplastic material may be a polyolefin such as polypropylene, polyethylene and combinations of the same. The synthetic thermoplastic material may be in the form of a multicomponent fibers, filaments, strands or the like and may include fiber and/or filaments having various cross-sectional shapes, lobes or other configurations.

The present invention encompasses a nonwoven fibrous web comprising the recycled synthetic fibers and fiber-like material described above. The web may be formed utilizing various web forming processes such as wet forming or wet laying, dry forming, air-laying, foam forming and combinations thereof.

The nonwoven fibrous web may further include non-recycled natural fibrous materials, non-recycled natural synthetic materials, recycled natural fibrous materials, particulate materials and combinations thereof.

DEFINITIONS

The term "machine direction" as used herein refers to the direction of travel of the forming surface onto which fibers are deposited during formation of a nonwoven web including, but not limited to spunbond webs, meltblown fiber webs, and paper.

The term "cross-machine direction" as used herein refers to the direction that is perpendicular to the machine direction defined above.

10 The term "pulp" as used herein refers to fibers from natural sources such as woody and non-woody plants. Woody plants include, for example, deciduous and coniferous trees. Non-woody plants include, for example, cotton, flax, esparto grass, milkweed, straw, jute hemp, and bagasse.

15 The term "average fiber length" as used herein refers to an average length of fibers, fiber bundles and/or fiber-like materials determined by measurement utilizing microscopic techniques. A sample of at least 20 randomly selected fibers is separated from a liquid suspension of fibers. The fibers are set up on a microscope slide prepared to suspend the fibers in water. A tinting dye is added to the suspended fibers to color cellulose-containing fibers so they may be distinguished or separated from synthetic fibers. The slide is placed under a Fisher Stereomaster II Microscope S19642/S19643 Series. Measurements of 20 fibers in the sample are made at 20X linear magnification utilizing a 0-20 mils scale and an average length, minimum and maximum length, and a deviation or coefficient of variation are calculated. In some cases, the average fiber length will be weighted average length of fibers (e.g., fibers, fiber bundles, fiber-like materials) determined by equipment such as, for example, a Kajaani fiber analyzer model No. FS-200 available from Kajaani Oy Electronics, Kajaani, Finland. According to a standard test procedure, a sample is treated with a macerating liquid to ensure that no

fiber bundles or shives are present. Each sample is disintegrated into hot water and diluted to an approximately 0.001% solution. Individual test samples are drawn in approximately 50 to 100 ml portions from the dilute solution when tested using the standard Kajaani fiber analysis test procedure. The weighted average fiber length be an arithmetic average, a length weighted average or a weight weighted average and may be expressed by the following equation:

$$\sum_{x_i=0}^k (x_i * n_i) / n$$

where k = maximum fiber length

x_i = fiber length

n_i = number of fibers having length x_i

n = total number of fibers measured.

One characteristic of the average fiber length data measured by the Kajaani fiber analyzer is that it does not discriminate between different types of fibers. Thus, the average length represents an average based on lengths of all different types, if any, of fibers in the sample.

As used herein, the term "spunbonded filaments" refers to small diameter continuous filaments which are formed by extruding a molten thermoplastic material as filaments from a plurality of fine, usually circular, capillaries of a spinneret with the diameter of the extruded filaments then being rapidly reduced as by, for example, eductive drawing and/or other well-known spun-bonding mechanisms. The production of spun-bonded nonwoven webs is illustrated in patents such as, for example, in U.S. Patent No. 4,340,563 to Appel et al., and U.S. Patent No. 3,692,618 to Dorschner et al. The disclosures of these patents are hereby incorporated by reference.

As used herein, the term "meltblown fibers" means fibers formed by extruding a molten thermoplastic material through a

plurality of fine, usually circular, die capillaries as molten threads or filaments into a high velocity gas (e.g. air) stream which attenuates the filaments of molten thermoplastic material to reduce their diameter, which may be to microfiber diameter. Thereafter, the meltblown fibers are carried by the high velocity gas stream and are deposited on a collecting surface to form a web of randomly disbursed meltblown fibers.

Such a process is disclosed, for example, in U.S. Patent No. 3,849,241 to Butin, the disclosure of which is hereby incorporated by reference.

As used herein, the term "microfibers" means small diameter fibers having an average diameter not greater than about 100 microns, for example, having a diameter of from about 0.5 microns to about 50 microns, more particularly, microfibers may have an average diameter of from about 4 microns to about 40 microns.

1. As used herein, the term "thermoplastic material" refers to a high polymer that softens when exposed to heat and returns to generally its un-softened state when cooled to room temperature. Natural substances which exhibit this behavior are crude rubber and a number of waxes. Other exemplary thermoplastic materials include, without limitation, polyvinyl chlorides, some polyesters, polyamides, polyfluorocarbons, polyolefins, some polyurethanes, polystyrenes, polyvinyl alcohols, caprolactams, copolymers of ethylene and at least one vinyl monomer (e.g., poly(ethylene vinyl acetates), copolymers of ethylene and n-butyl acrylate (e.g., ethylene n-butyl acrylates), and acrylic resins.

As used herein, the term "non-thermoplastic material" refers to any material which does not fall within the definition of "thermoplastic material," above.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic representation of an exemplary
5 process for shredding a bonded fibrous material.

FIG. 2 is a schematic representation of an exemplary
process for hydraulically fragmenting shredded pieces of a
bonded fibrous material.

FIG. 2A is a detail of the exemplary process shown in
10 FIG. 2.

FIG. 3 is a photomicrograph of a detail of an exemplary
recycled synthetic fiber.

FIG. 4 is a photomicrograph of a detail of an exemplary
virgin synthetic staple fiber.

FIG. 5 is a photomicrograph of a detail of an exemplary
15 recycled synthetic fiber.

FIG. 6 is a photomicrograph of a detail of an exemplary
recycled synthetic fiber.

FIG. 7 is a photomicrograph of a detail of an exemplary
20 recycled synthetic fiber.

FIG. 8 is a photomicrograph of a detail of an exemplary
recycled synthetic fiber.

FIG. 9 is a photomicrograph of a detail of an exemplary
virgin synthetic staple fiber.

FIG. 10 is a photomicrograph of a detail of multiple
25 exemplary recycled synthetic fibers.

FIG. 11 is a photomicrograph of a detail of an exemplary
recycled synthetic fiber.

FIG. 12 is a photomicrograph showing details of exemplary
30 recycled synthetic fibers.

FIG. 13 is a photomicrograph showing details of exemplary
recycled synthetic fibers.

FIG. 14 is a photomicrograph showing details of exemplary
recycled synthetic fibers.

DESCRIPTION OF THE INVENTION

5 The present invention is directed to a method of recycling bonded fibrous materials into substantially individual fibers and fiber-like materials. The method of the present invention may be practiced utilizing bonded fibrous materials that include synthetic fibers. The process of the
10 present invention may be practiced using bonded fibrous materials such as, for example, woven fabrics, knitted fabrics, nonwoven webs and combinations thereof. Generally speaking, bonded fibrous materials in the form of nonwoven webs are webs that are thermally bonded, adhesively bonded,
15 mechanically entangled, solvent bonded, hydraulically entangled and/or combinations of such techniques.

 The bonded fibrous materials can be composed of synthetic fibrous materials, natural fibrous materials and combinations thereof. The synthetic fibrous material may include
20 thermoplastic fibers and filaments.

 The method includes the steps of: (a) providing pieces of bonded fibrous materials, the pieces having sizes that are adapted for suspension in a liquid; (b) suspending the discrete pieces of bonded fibrous materials in a liquid; (c)
25 applying mechanical work to the liquid suspension of discrete pieces to generate hydraulic pressure and mechanical shear stress conditions sufficient to hydraulically fragment the bonded fibrous materials into fibers and fiber-like components; and (4) separating substantially individual
30 fibers and fiber-like components from the liquid.

 According to the invention, the step of providing discrete pieces of bonded fibrous materials may be in the form of a conventional operation such as, for example, mechanical shredding, mechanical cutting, mechanical tearing,
35 mechanical grinding, water jet cutting, laser cutting,

garnetting and combinations thereof.

Referring now to FIG. 1, there is shown an exemplary mechanical shredding operation 10. The shredding machine includes a knife roll 12 having a series of knife blades 14. The roll 12 rotates generally in the direction of the arrow associated therewith. The knife blades 14 are desirably mounted at an angle or inclination to the centerline of the roll so create a "scissors-cut" action as the knife blades 14 come in contact with a fixed knife 16. A press roll 18 may be used in combination with a belt conveyor 20 to feed material. The speeds of the conveyor 20 and the knife roll 12 may be set independently to control the size of the pieces produced by the operation. Of course, other types of shredding equipment may be used. For example, "bear-claw" type shredders that utilize teeth or bits that rip and tear the bonded fibrous material are satisfactory.

Generally speaking, the pieces of bonded fibrous material may have a length ranging from about 10 to about 350 millimeters and a width ranging from about 3 to about 70 millimeters. Importantly, the pieces should be sized so they can be suspended in a liquid such as water. It is contemplated that the liquid may, in some cases, be an aqueous solution, may include additives such as surfactants, treatments, dyes, caustics, solvents, emulsions and the like.

According to the invention, mechanical work is applied to the liquid suspension at levels that generate conditions of hydraulic pressure and shear stress sufficient to fragment, rupture, rupture, burst or disintegrate pieces of bonded fibrous materials into useful free fibers and fiber bundles or fiber-like materials. Generally speaking, process conditions used to convert the shredded material to recycled fibers are more aggressive and stringent than those found in conventional pulping operations. These conditions include passing the shredded pieces through a zone of increasing high

hydraulic pressure and high mechanical shear stress.

As an example, normal pulping operations typically use less than about 3 horsepower-day (24 hours) per dry ton of material. Embodiments of the present invention may utilize
5 much larger inputs of energy. For example, the method of the invention may be practiced utilizing 35% more energy; 50% percent more energy, or even more to separate useful free fibers and fiber bundles from the bonded fibrous material.

Although the inventors should not be held to a particular
10 theory of operation, it is believed that the combination of hydraulic pressure and shear stress breaks up the material into free fibers and fiber bundles. It is also thought that the content of free fibers and the average size of the bundles can be controlled by varying the pressure and
15 mechanical stress. It is generally thought that this high level of mechanical action or work is possible without causing significant degradation of the synthetic components of the bonded fibrous materials (e.g., without melting synthetic thermoplastic material) because the water/liquid in
20 the process absorbs the heat generated as free fibers and fiber-like materials are separated from the bonded fibrous material.

Generally speaking, conventional beating and/or refining equipment is used to modify cellulose fibers to develop
25 papermaking properties of hydration and fibrillation. According to the present invention, conventional beaters and/or refiners may be configured or operated in an unconventional manner to provide the hydraulic pressure and shear stress conditions sufficient to fragment and fracture
30 the bonded fibrous material into free fibers, fiber bundles and fiber-like materials.

Exemplary beater devices are available from manufacturers such as Beloit Jones, E. D. Jones, Valley, and Noble & Wood. Referring now to FIGS. 2 and 2A of the drawings, there is

shown an exemplary Hollander-type beater device 30 that may be used in the practice of the present invention. The beater includes an oval vat 32 with a central wall 34 and a cylinder roll 36 equipped with blades or vanes 38 that moved past a second set of blades 40 mounted on a platen or fixed plate 42. The blades 40 may be mounted on the fixed plate so that they can be aligned at an angle in at least one dimension with respect to the direction or plane of rotation "R" of the rotating blades 38. For example, the fixed blades 40 may be mounted so they are at an angle of between about 5 degrees and 70 degrees to the direction or plane of rotation "R" of the rotating blades 38. As another example, the fixed blades may be mounted so they are at an angle of between about 15 and 55 degrees, between about 40 and 50 degrees, or even about 45 degrees.

A liquid suspension of bonded fibrous material pieces is introduced into the beater device. Alternatively and/or additionally, bonded fibrous material pieces may be introduced directly into liquid in the beater vat. Various proportions of bonded fibrous materials and water may be used and appropriate proportions may be determined by one of skill in the art.

During operation, the cylinder roll 36 is rotated so that sufficient hydraulic pressure and shear stress is produced between the blades or vanes 38 and the blades 40 mounted on the fixed plate. One exemplary cylinder roll had a diameter of 72 inches, a width of 72 inches, 192 blades each having a length of 72 inches and spaced one-half inch apart. Such a roll weighed approximately 16 tons. Generally speaking, the speed of rotation is constant and the variable that is modified is the pressure or load on the roll. The roll is mounted such that a gauge pressure reading of 0 psi corresponds to very little or no portion of the weight of the

roll (~0 tons) counteracting the pressure generated by fibers and pieces of bonded fibrous material as they are squeezed through the gap existing between the blades at the bottom of the rotating roll and the fixed blades mounted underneath the roll. A gauge pressure reading of 50 psi corresponds to approximately one-half of the weight of the roll (~8 tons) counteracting the pressure generated by fibers and pieces of bonded fibrous material as they squeeze through the gap between the blades at the bottom of the rotating roll and the fixed blades mounted underneath the roll. A gauge pressure reading of 100 psi corresponds to approximately the full weight of the roll (~16 tons) counteracting the pressure generated by fibers and pieces of bonded fibrous material as they squeeze through the gap existing between the blades at the bottom of the rotating roll and the fixed blades mounted underneath the roll.

Rotation speed, consistency of the suspension in the vat and clearance between the rotating blades or vanes 38 and the fixed blades 40 is also adjusted to conditions that enhance "metal to fiber" interaction that cuts or controls the length of free fibers, fiber bundles and fiber-like particles. The term "metal to fiber" interaction is used to describe the contact between the bonded fibrous material and the fixed and/or rotating blades that may occur under conditions of hydraulic pressure and mechanical shear stress sufficient to sever, cut or break long fibers. According to the invention, this interaction should be controlled to cut long fibers without materially affecting or lowering the length and/or freeness of pulp or short fibers that may be present in the suspension. For example, operating equipment utilizing lower than conventional consistencies, larger blade dimensions, closer tolerances between rotating blades and fixed blades, and/or higher rotational speeds may enhance "metal to fiber" interaction. Generally speaking, the present invention

utilize operating conditions and/or equipment that provide large numbers of working edges to act on the suspended fiber instead of utilizing primarily "fiber to fiber" interaction.

The method of the present invention provides a technique
5 to recycled bonded fibrous materials into substantially individual fibers and fiber-like components having a relatively low average length and a relatively uniform average length distribution.

While the method of the present invention may be operated
10 to provide fibers, fiber bundles and fiber-like materials having wide range of lengths, it may also be used to generate fiber and fiber-like material having an average length distribution that spans approximately 7 millimeters or less.

In addition to controlling length, some "metal to fiber"
15 interaction may generate deformations and distortions of synthetic components of the bonded fibrous material. While some deformations and distortions may be generated by hydraulic fragmentation of the bonded fibrous material others may be generated by tearing, slicing and breaking of fiber
20 and/or filaments.

Referring now to FIGS. 3, 5-8, and 10-14, there is shown various exemplary recycled synthetic fibers, fiber bundles and/or fiber-like materials having at least one thread
25 element composed of synthetic material having at least one irregular distortion generated by hydraulic fracture of the thread element to separate it from a bonded fibrous material while the bonded fibrous material is suspended in a liquid.

The thread element may have a length ranging from about 1 millimeter to about 15 millimeters. For example, the thread
30 element may have a length ranging from about 1.5 to about 10 millimeters. As another example, the thread element may have a length ranging from about 2 to about 5 millimeters. The thread element may have a diameter of less than 100 micrometers. For example, the thread element may have a

diameter of less than 30 micrometers. Generally speaking, these dimensions are similar to certain varieties of commercially available pulps and may be readily blended with commercial pulps. In some embodiments of the invention, the
5 thread elements may have a diameter of less than 10 microns and may even be less than 1 micron.

According to an aspect of the invention, the irregular distortions may be in the form of bends in the thread element, flattened segments of thread element, expanded
10 segments of thread element and combinations thereof.

Generally speaking, the irregular distortions cause the thread elements of the recycled materials to have greater surface area than thread elements in the bonded fibrous material prior to hydraulic fracture of the thread element to
15 separate it from the bonded fibrous material. For example, the surface areas of the recycled thread elements may be at least about 5 percent greater.

FIG. 3 is a photomicrograph (approximately 500X linear magnification) showing a detail of an exemplary recycled
20 synthetic fiber. The recycled fiber was recovered from a composite structure containing a thermally point bonded continuous polypropylene filament web and pulp fibers hydraulically entangled with the continuous filament web. The fiber visible in the center of the photomicrograph is a
25 polypropylene thread element having bends in the filaments and a relatively flattened segment. At least a portion of these distortions are generated or exposed by hydraulic fracture of the thread element from the bonded fibrous material (i.e., the composite structure). The material
30 surrounding the thread element is cellulose pulp.

FIG. 4 is a photomicrograph (approximately 500X linear magnification) showing conventional polypropylene staple fibers appearing in a conventional bonded carded web structure. In contrast to the thread elements of FIG. 3,

these fibers appear relatively free of irregular distortions. The fibers have relatively smooth surfaces, even or uniform diameters, and lack the twists, bends and other irregular distortions that are evident in the thread element shown in FIG. 3.

FIG. 5 is a photomicrograph (approximately 120X linear magnification) showing a detail of an exemplary recycled synthetic fiber recovered from the same type of composite structure as the thread element shown in FIG. 3. The fiber visible across the central region of the photomicrograph is a polypropylene thread element that exhibits a loop and bends as well as relatively flattened segments. At least a portion of these distortions are generated or exposed by hydraulic fracture of the thread element from the bonded fibrous material (i.e., the composite structure). The material surrounding the thread element is cellulose pulp.

FIG. 6 is a photomicrograph (approximately 120X linear magnification) showing a detail of an exemplary recycled synthetic fiber recovered from the same type of composite structure as the thread element shown in FIG. 3. The fiber visible in the center of the photomicrograph is a polypropylene thread element. The arrow in the photomicrograph points to a sharp bend in the thread element.

FIG. 7 is a photomicrograph (approximately 500X linear magnification) showing a detail of an exemplary recycled synthetic fiber recovered from the same type of composite structure as the thread element shown in FIG. 3. The fiber visible in the center of the photomicrograph is a polypropylene thread element that exhibits bends as well as a roughened segment.

FIG. 8 is a photomicrograph (approximately 500X linear magnification) showing a detail of an exemplary recycled synthetic fiber recovered from the same type of composite structure as the thread element shown in FIG. 3. The fiber

visible across the center of the photomicrograph is a polypropylene thread element showing a cut end of the fiber that is flattened and expanded.

FIG. 9 is a photomicrograph (approximately 500X linear magnification) showing a detail of a conventional polypropylene staple fiber. In contrast to the thread element of FIG. 8, the fiber appears relatively free of irregular distortions and has an end that appears to be cut cleanly without evidence of expansion or other distortion.

FIG. 10 is a photomicrograph (approximately 250X linear magnification) showing a detail of two exemplary recycled synthetic fibers recovered from the same type of composite structure as the thread element shown in FIG. 3. The fibers visible across the center and near the lower portion of the photomicrograph are polypropylene thread elements that exhibit bends as well as roughened segments.

FIG. 11 is a photomicrograph (approximately 500X linear magnification) showing a detail of exemplary recycled synthetic fibers. The recycled fibers were recovered from Kimtex® brand wiper containing thermally point-bonded web of polypropylene meltblown fibers. The relatively fine meltblown fibers visible in the center of the photomicrograph are polypropylene thread elements having bends, twists, tangles and relatively flattened segments. At least a portion of these distortions are generated or exposed by hydraulic fracture of the thread elements from the bonded fibrous material (i.e., the Kimtex® wiper). The material surrounding the thread elements is cellulose pulp.

FIG. 12 is a photomicrograph (approximately 100X linear magnification) showing a detail of exemplary recycled synthetic fibers recovered from the same type of material as the thread elements shown in FIG. 11. A bond point approximately 500 micrometers in length is visible in the center of the photomicrograph. Fibers radiate outward from

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the edges of the bond point in the form of polypropylene thread elements having bends, twists, tangles and relatively flattened segments. At least a portion of these distortions are generated or exposed by hydraulic fracture of the thread elements from the bonded fibrous material. Some of the material in the background of the thread elements is cellulose pulp.

FIG. 13 is a photomicrograph (approximately 500X linear magnification) showing a detail of exemplary recycled synthetic fibers recovered from the same type of material as the thread elements shown in FIG. 11. A larger fiber-like material or fiber bundle is approximately 40 micrometers in width is visible in the center of the photomicrograph. Fibers surround and radiate outward from the edges of the fiber-like material or fiber bundle in the form of polypropylene thread elements having bends, twists, tangles and relatively flattened segments. At least a portion of these distortions are generated or exposed by hydraulic fracture of the thread elements from the bonded fibrous material. The larger fibrous materials near the thread elements are cellulose pulp fibers.

FIG. 14 is a photomicrograph (approximately 500X linear magnification) showing a detail of exemplary recycled synthetic fibers recovered from the same type of material as the thread elements shown in FIG. 11. A mix of cellulose pulp and recycled fibers in the form of polypropylene thread elements having bends, twists, tangles and relatively flattened segments is shown.

In an embodiment of the method of the present invention, mechanical work may be applied to a suspension of cut or shredded pieces of bonded fibrous material in multiple stages. As an example, mechanical work may be applied to a suspension of pieces of bonded fibrous material utilizing a Hollander-type beater or similar device under conditions to wet the pieces of bonded fibrous materials and separate at

least some portions of fibers and fiber-like components from the bonded materials. In some situations, bonded fibrous materials containing a mix of natural and synthetic fibers and/or very short and very long fibers (e.g., pulp fibers and
5 continuous synthetic filaments) may be partially or substantially separated in one or more initial treatment stages.

After such treatment, the short and longer fiber/filament streams may be separated. If a Hollander-type beater is used
10 to carry out the first stages or stages of treatment, the gap or clearance between the rotating blades and the fixed blades may be sufficiently large to enhance "fiber to fiber" or "fibrous material to fibrous material" interaction rather than "metal to fiber" interaction. As an example, under
15 conventional conditions the clearance between the rotating blades and fixed blades may be between about 20 millimeters and about 100 millimeters. It is contemplated that other variables such as consistency of the suspension, speed of beater roll rotation and/or pressure load applied to the
20 beater roll may also be adjusted to enhance treatment in the first stage (or stages).

In a second stage, additional mechanical work may be applied under conditions to generate hydraulic pressure and mechanical shear stress conditions sufficient to rupture the
25 bonded fibrous materials, fibers and fiber-like components into substantially individual fibers and fiber like components. If a Hollander-type beater is used to carry out the second stage (or second stages) of treatment, the gap or clearance between the rotating blades and the fixed blades
30 will desirably be sufficiently small to enhance "metal to fiber" or "metal to fibrous material" interaction that can occur under conditions of hydraulic pressure and mechanical shear stress to sever, cut or break long fibers (i.e., long synthetic fibers) without materially affecting or lowering

the length and/or freeness of pulp or short fibers that may be present in the suspension. As an example, the clearance may be between about 1 millimeter (or as close as possible without "metal to metal" contact) and about 20 millimeters.

- 5 It is contemplated that other variables such as consistency of the suspension, speed of beater roll rotation and/or pressure load applied to the beater roll may also be adjusted to enhance treatment in the second stage (or stages).

According to the invention, the amount of mechanical work
10 applied to the liquid suspension is greater than about 3 Horsepower - day (24 hours) per dry ton of bonded fibrous material. This number may desirably be greater than 6 Horsepower - day per ton and may be in the range of 10 to about 15 for many exemplary materials.

- 15 After the liquid suspension is treated and the bonded fibrous material is hydraulically fragmented into free fibers, fiber bundles and fiber-like materials, these materials may then be introduced into the furnish stream of a wet forming process, or they can be wet lapped for later use,
20 or they can be dried for dry forming processes. It is contemplated that the fiber stream may be screened to removed large pieces, flock and the like.

Generally speaking, bonded scrap or waste materials containing synthetic fibers can be recycled into free fibers,
25 and fiber-like materials that can have increased surface area and may be processed to have a controlled fiber length. Fibers recycled according to the present invention are thought provide better retention in wet-forming processes and with sufficient quantity, can improve the mechanical and
30 absorbent properties when incorporated into fibrous webs. In addition recycled high surface area fibers offer a significant cost advantage over virgin synthetic staple fibers. Using materials that have been previously formed into fiber networks, then bursting them apart as described

above results in fibers and fiber-like materials that generally have increased surface area. This surface area results from the breaking the networks into small segments that still have bond points, bends, twists, curls, open
5 layers of fibers, and flat areas as shown in the various photomicrographs described above.

In addition, the fiber length is controlled by the same mechanical work created during the bursting process. Controlling the length of the fiber will allow them to be
10 used in a number of web forming processes such as wet forming, dry forming, foam forming. For example, by controlling the synthetic fiber length to that of wood pulp fibers, recycled material can be reintroduced into virgin wood pulp furnishes without affecting the handling or
15 processing properties of the furnish.

EXAMPLE 1

This example relates to recycling a bonded and entangled
20 composite material containing natural fibers and synthetic filaments. A composite hydraulically entangled material containing virgin wood pulp and a continuous web of bonded synthetic polypropylene filaments (approximately 20 percent, by weight) (i.e., a spunbond continuous filament web) -
25 available from the Kimberly-Clark Corporation, Roswell, Georgia under the trademarks Workhorse® and Hydroknit® fast absorbing materials - was shredded into pieces ranging from about 10 - 350mm in length and 3 - 70mm in width. The composite contained approximately 80% by weight and about 20
30 percent, by weight, polypropylene filaments. The material was shredded utilizing a shredder available from the East Chicago Machine Tool Company of East Chicago, IN. The pieces were transferred to a conventional Hollander-type industrial beater manufactured by E.D. Jones & Sons, Pittsfield, MA.

20

The beater was a "Number 3 Jones Beating Unit" equipped with a 45 degree diagonal bed plate. The beater had a rotating roll with blades or vanes generally aligned on the roll as shown in FIG. 2A. The blades or vanes were approximately 1/4
5 inch (~6 mm) wide, approximately 1/2 inch (~12 to 13 mm) high. These were spaced approximately 1/2 inch (~12 to 13 mm) apart on the exterior of the roll perpendicular to the direction or plane of rotation. A fixed plate was mounted just below the rotating roll and was equipped with blades or
10 "knives" that were approximately 1/8 inch (~3mm) wide, 1/4 inch (~6 mm) high, spaced approximately 3/8 inches (~9 to 10 mm) apart. These were aligned at an angle of 45 degrees to the direction or plane of rotation generally as show in FIG 2A.

15 Water was added to the shredded material and hydraulic pressure and shear stress was applied to the material in the Hollander-type beater in two stages. Hydraulic pressure and shear stress was controlled by adjusting the load on the roll as it rotated. In this
20 particular arrangement, hydraulic pressure and shear stress is generated by a "paddle wheel" type pumping action produced when the beater roll rotates and its attached blades or vanes force liquid and wet material against a fixed plate with blades mounted diagonally to the direction or plane of
25 rotation. Generally speaking, a greater load applied to the rotating roll produces less clearance between the rotating roll and the fixed plate. This corresponds to greater levels of hydraulic pressure and shear stress.

During the first stage, the pressure or load against the
30 rotating roll was 0 pounds per square inch (psi) for 10 minutes. Essentially, no load was applied and the "paddle wheel" action of the rotating roll squeezed the pieces in the suspension through a gap of about 1 cm or more between blades of the rotating roll and blades mounted on the fixed plate.

Generally speaking, the first stage was used to wet the shredded material and separate the natural fibers from the synthetic fibers. The consistency was adjusted to be about 3.3 percent (the percentage by weight of air or oven dry fibrous material in the suspension).

During the second stage, conditions were adjusted to establish small zones of very high hydraulic pressure and shear stress between the moving blades on the rotating roll and fixed blades near or at their closest point of contact. These small zones are thought to generate a micro-bursting action on the shredded bonded fibrous material to hydraulically fragment and/or blow apart and reduce the resulting synthetic fiber length. In addition, the hydraulic fragmentation and "metal to fiber" or "metal to bonded fibrous material" contact alters the length of the longer synthetic filaments so they have the same length as the natural (i.e., pulp) fibers ranging from about 0.8 to about 3.5 mm without materially lowering the length or freeness of pulp fibers that may be present in the suspension.

In the second stage, pressure on the gauge for the rotating roll was increased to 50 psi and the clearance between the blades of the rotating roll and the fixed plates decreased to between 1 and 10 mm and the approximately one-half of the weight of the 16 ton roll (~8 tons) was available to counteract the pressure generated by pieces as they were squeezed through the gap between the roll and the fixed plate. These conditions were maintained for 50 minutes.

After treatment, free fiber, fiber bundles and fiber-like materials were separated from the suspension. Samples were examined microscopically and natural or pulp fibers were separated and measured separately from the synthetic fibers. In this example, average fiber length was determined as previously described - by manually separating a random sample of 20 synthetic fibers and 20 pulp fibers, measuring the

length of individual fibers utilizing a microscope, and then calculating an average length. The resulting recycled fibers and fiber-like materials had the following characteristics:

- 5 • The average length of the synthetic fiber was approximately the same length as the wood pulp fibers. Average length of the synthetic fibers was 3.78 mm. The length of individual fibers in the sample ranged from 1.65 to 5.33 mm. It should be noted that, prior to processing, the synthetic fibers initially were substantially continuous polypropylene filaments having indeterminate lengths or lengths at least far exceeding 5.33 mm. The average fiber length for the pulp component was 2.7 mm. The length of individual pulp fibers in the sample ranged from 1.35 to 3.81 mm. Measurements taken with a Kajanni FS-200 fiber analyzer indicated an arithmetic average length of 0.76 mm; a length weighted average length of 1.72 mm; and a weight weighted average length of 2.40 mm.
- 10
- 15
- 20 • The wood pulp fiber freeness shows a slight reduction (approximately 10 percent - from about 860 mL to about 760 mL) indicating that some additional surface area was developed on the wood pulp fiber component of the composite. However the fiber length was unaffected.
- 25
- The synthetic fibers have increased or higher surface area as a result of the remaining fiber bond areas, cross overs, and flat areas.

30

EXAMPLE 2

In this example, recycled fibers were prepared from the same composite hydraulically entangled material containing virgin

wood pulp and a continuous web of bonded synthetic polypropylene filaments (i.e., Workhorse® and Hydroknit® fast absorbing materials) utilizing the method set forth in Example 1. The fiber lengths were controlled to be between 1
5 and 5mm. A suspension of the recycled fibers was blended inline with a mixture of 60 percent, by weight, hardwood kraft pulp (eucalyptus) and 40 percent, by weight, softwood kraft pulp (radiata pine) at a level of 5% by dry weight.

The furnish was formed into a wet sheet having a basis
10 weight of 160 grams per square meter (gsm) using a conventional writing paper manufacturing process and then dried to a final product. The resulting product was compared to a control material prepared under the same conditions using the same virgin pulp materials but with no added
15 recycled materials. These results are shown in Table 1 below:

20

25

30

TABLE 1

PROPERTIES	Test Method	Product Without Recycled Material (CONTROL)	Product With 5% Recycled Material
Basis Wt	TAPPI - T410	163 gsm	161.8 gsm
Thickness	TAPPI - T411	8.3 mils	8.4 mils
Roughness FS	TAPPI - T538	198 Sheff.	164 Sheff.
Roughness WS	TAPPI - T538	150 Sheff.	145 Sheff.
Porosity	TAPPI - T489	94 Sheff.	71 Sheff.
Opacity	TAPPI - T425	98.3 %	84.4 %
Tensile MD	TAPPI - T494	12285 g/15mm	12155 g/15mm
Tensile CD	TAPPI - T494	9127 g/15mm	8237 g/15mm
Elongation MI	TAPPI - T404	1.0 %	1.0 %
Elongation CI	TAPPI - T404	1.4 %	2.1 %
Bursting strength	TAPPI - T403	51.2 psi	54.2 psi
Dry Tear MD	TAPPI - T414	140 g	144 g
Dry Tear CD	TAPPI - T414	156 g	148 g
Folding endurance MD	TAPPI - T511	73 cycles	115.5 cycles
Folding endurance CD	TAPPI - T511	59.5 cycles	61.5 cycles
Stiffness MD	TAPPI - T489	20.9 T.U.	21.0 T.U.
Stiffness CD	TAPPI - T489	12.6 T.U.	12.6 T.U.
Dennison FS	TAPPI - T459	18	18
Dennison WS	TAPPI - T459	18	18
PH	TAPPI - T509	8.7	8.7
Freeness	TAPPI - T227	670 mL	650 mL
F.L.I.	TAPPI - T232	5.7	3.2
Color L*	TAPPI - T527	92.54	92.71
Color a*	TAPPI - T527	-0.16	0.04
Color b*	TAPPI - T527	0.06	0.47
Brightness	TAPPI - T525	82.04 %	81.9 %

5 It is evident from these results that a paper sheet containing 5 percent, by weight, of the recycled material that includes synthetic fibers has physical properties essentially similar to the virgin pulp sheet. Importantly, the added recycled fibers did not detrimentally affect the

10 paper making process stability and efficiency.

EXAMPLE 3

In this example, the starting material was a bonded web
5 of meltblown polypropylene fibers available from Kimberly-
Clark Corporation under the trade designation Kimtex® wiper.
This material contained 100 percent meltblown polypropylene
fibers and was shredded into pieces ranging from 10 - 30 mm
in length and 5 - 20mm in width. These pieces were
10 transferred to a pulping process in a Hollander-type
laboratory beater (Ross Paper Machinery Company, Newark, NJ -
Model RPM 15). Hydraulic pressure and mechanical shear stress
were applied in two stages.

Hydraulic pressure and shear stress was produced by the
15 pumping action created by the rotor forcing the wet material
against the fixed blades. The rotor roll was approximately 7
5/8 inch (~19.4 cm) in diameter. The working face of the roll
was 6 inches (~15.4 cm) in width with thirty-two bars 3/16
inch (~4.8 mm) thick. The bedplate contained seven bars 1/8
20 inch (~3.2 mm) thick, spaced 3/32 inch (~2.4 mm) apart to
form a 5 degree "V" at the center of the bedplate.

In stage one the weight or load applied to the rotor was
set at 0 kg for 12 minutes, consistency was set to 1%, and a
defoaming agent was added to control foam generation. During
25 the first stage, the shredded material was wetted to achieve
free flow of the material through the rotating roll and
bedplate. During the second stage, the weight or load on the
rotating roll was increased first to 5.2 kg for 23 minutes
and then to 2.8 kg for 85 minutes. Conditions during the
30 second stage produced small zones of very high pressure
between the blades on the rotating roll and the bedplate to
create a micro-bursting action on the shredded synthetic
fiber bundles to blow apart and reduce the resulting
synthetic fiber length. With these process conditions the
35 resulting fibers have the following characteristics:

- 3
- The fibers obtained consist of a mixture of some individual fibers, fiber bundles, small segments that still have bond points, curls, open layers of fibers, and flat areas.
 - Average length of the synthetic fibers and fiber bundles was 2.84 mm. The lengths ranged from 0.6 to 6.1 mm.

The recycled meltblown fibers were blended with a mixture of 60 percent, by weight, hardwood kraft pulp (eucalyptus) and 40 percent, by weight, softwood kraft pulp (radiata pine) at a level of 5% by dry weight. This furnish was formed into a wet sheet having a basis weight of 90 gsm in a conventional laboratory handsheet former, then pressed in a laboratory press and finally dried. The resulting product was compared to a control material prepared under the same conditions using the same virgin pulp materials but with no added recycled materials. These results are shown in Table 2 below:

TABLE 2

PROPERTIES	Test Method	Handsheet Without Recycled Material (CONTROL)	Handsheet With 5% Recycled Material
Basis Wt	TAPPI - T410	90.4gsm	90.0 gsm
Size, Hercules Size Tester	TAPPI - T530	4 s	11 s
Tensile	TAPPI - T494	6082 g/15mm	4957 g/15mm
Elongation	TAPPI - T404	0.6 %	0.6 %
Bursting strength	TAPPI - T403	44 psi	31 psi
Dry Tear	TAPPI - T414	25 g	25 g
Folding endurance	TAPPI - T511	97 cycles	34 cycles

Even though the paper sheet incorporating recycled meltblown fibers exhibits lower levels of some mechanical properties in comparison to the control material, the paper sheet containing recycled fibers is still considered to have
5 generally good physical characteristics and is suitable for writing papers and other types of papers.

While the invention has been described in detail with respect to specific embodiments thereof, it will be appreciated that those skilled in the art, upon attaining an
10 understanding of the foregoing may readily conceive of alterations to, variations of and equivalents to these embodiments. Accordingly, the scope of the present invention should be assessed as that of the appended claims and any equivalents thereto.

We claim:

1. A method of recycling bonded fibrous materials, the
5 method comprising,
 providing pieces of bonded fibrous materials, the pieces
 having sizes that are adapted for suspension in a liquid;
 suspending the discrete pieces of bonded fibrous
 materials in a liquid;
10 applying mechanical work to the liquid suspension of
 discrete pieces to generate hydraulic pressure and mechanical
 shear stress conditions sufficient to hydraulically fragment
 the bonded fibrous materials into fibers and fiber-like
 components; and
15 separating substantially individual fibers and fiber-
 like components from the liquid.
2. The process of claim 1 wherein the step of providing
discrete pieces of bonded fibrous materials comprises an
20 operation to reduce the size of unitary bonded fibrous
materials into discrete pieces that are adapted for
suspension in a liquid, the operation being selected from
mechanical shredding, mechanical cutting, mechanical tearing,
mechanical grinding, water jet cutting, laser cutting,
25 garnetting and combinations thereof.
3. The process of claim 1 wherein the mechanical work
is applied to the liquid suspension utilizing a combination
of blades mounted on a rotating roll and blades mounted on a
30 fixed plate to generate areas of very high hydraulic pressure
and mechanical shear stress.
4. The process of claim 3 wherein the blades mounted on
the fixed plate are aligned at an angle in at least one

dimension with respect to the direction of rotation of the rotating blades.

5 5. The process of claim 4 wherein the angle is between 20 degrees and 70 degrees.

6. The process of claim 1 wherein the mechanical work is applied to the suspension in multiple stages.

10 7. The process of claim 6 wherein mechanical work is applied to the suspension utilizing a first stage under conditions to generate hydraulic pressure and mechanical shear stress sufficient to wet the pieces of bonded fibrous materials and separate at least some portions of fibers and
15 fiber-like components from the bonded materials and utilizing a second stage under conditions to generate hydraulic pressure and mechanical shear stress conditions sufficient to rupture the bonded fibrous materials, fibers and fiber-like components into substantially individual fibers and fiber
20 like components.

8. The process of claim 6 wherein the clearance between the rotating blades and the fixed blades at the closest point during the first stage is between about 20 millimeters and
25 about 100 millimeters and between about 1 millimeter and about 20 millimeters during the second stage.

9. The process of claim 1 wherein the amount of mechanical work applied to the liquid suspension is greater
30 than about 6 Horsepower - 24 hours per dry ton of bonded fibrous material.

10. The process of claim 1 wherein the bonded fibrous materials are selected from woven fabrics, knitted fabrics, nonwoven webs and combinations thereof.

5 11. The process of claim 10, wherein the nonwoven webs are webs that are thermally bonded, adhesively bonded, mechanically entangled, solvent bonded, hydraulically entangled and combinations thereof.

10 12. The process of claim 1 wherein the bonded fibrous materials are composed of synthetic fibrous materials, natural fibrous materials and combinations thereof

13. The process of claim 12 wherein the synthetic
15 fibrous material includes thermoplastic fibers and filaments.

14. The process of claim 1 wherein the substantially individual fibers and fiber-like components have a relatively uniform length distribution.

20

15. The process of claim 14, wherein the fiber and fiber-like material has a length distribution that spans approximately 7 millimeters.

25 16. Fiber and fiber-like materials produced according to the process of claim 1.

17. Recycled synthetic fibers and fiber-like materials comprising:

30

at least one thread element composed of synthetic material having at least one irregular distortion generated by hydraulic fracture of the thread element to separate it from a bonded fibrous material while the bonded fibrous material is suspended in a liquid.

18. The recycled synthetic fibers and fiber-like materials of claim 17, wherein the thread element has a length ranging from about 1 millimeter to about 15
5 millimeters.

19. The recycled synthetic fibers and fiber-like materials of claim 18, wherein the thread element has a length ranging from about 1.5 to about 10 millimeters.
10

20. The recycled synthetic fibers and fiber-like materials of claim 18, wherein the thread element has a length ranging from about 2 to about 5 millimeters.

15 21. The recycled synthetic fibers and fiber-like materials of claim 17, wherein the irregular distortions are in the form of bends in the thread element, flattened segments of thread element, expanded segments of thread element and combinations thereof.

20 22. The recycled synthetic fibers and fiber-like materials of claim 17, wherein the thread elements of the recycled materials have surface areas that are greater than comparable thread elements in the bonded fibrous material
25 prior to hydraulic fracture of the thread element to separate it from the bonded fibrous material.

23. The recycled synthetic fibers and fiber-like materials of claim 22, wherein the surface areas of the
30 recycled thread elements are at least about 5 percent greater.

24. The recycled synthetic fibers and fiber-like materials of claim 17, wherein the synthetic material is a

synthetic thermoplastic material.

25. A nonwoven fibrous web comprising the recycled synthetic fibers and fiber-like material of claim 17.

5

26. The nonwoven fibrous web of claim 25 wherein the web is formed utilizing a web forming process selected from wet forming, dry forming, foam forming and combinations thereof.

10

27. The nonwoven fibrous web of claim 25 wherein the web further includes non-recycled natural fibrous materials, non-recycled natural synthetic materials, recycled natural fibrous materials, particulates materials and combinations thereof.

15

2X

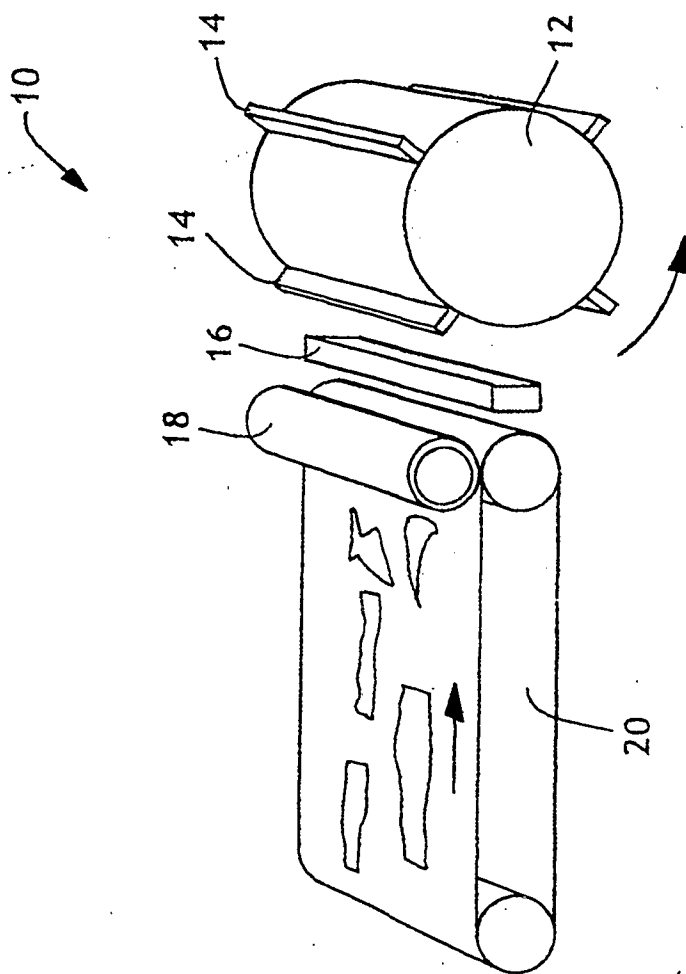


FIG. 1

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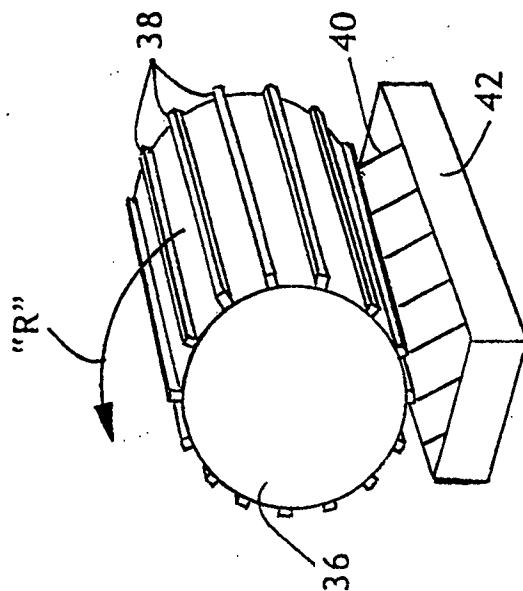


FIG. 2A

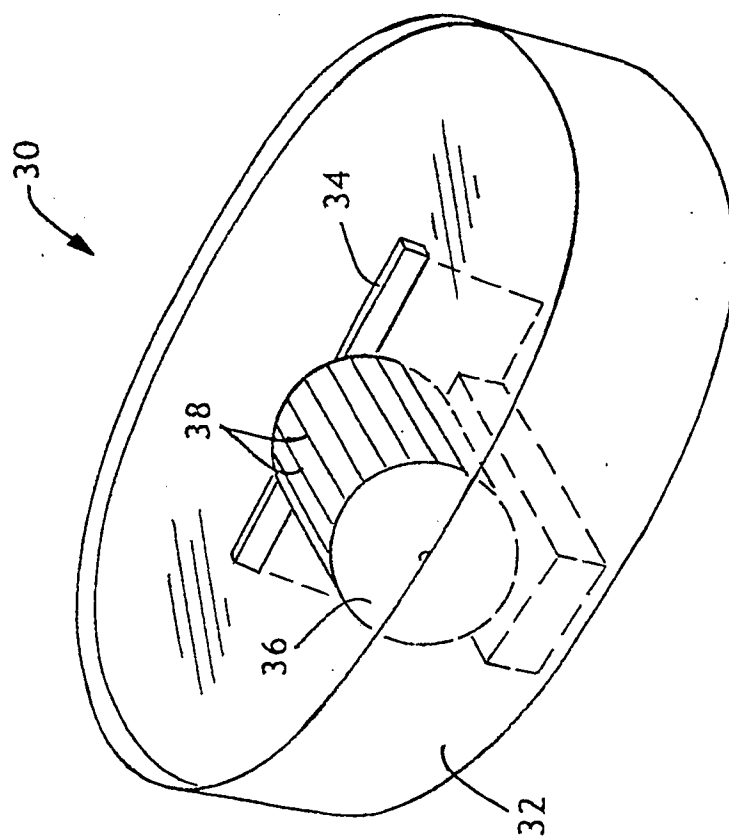


FIG. 2

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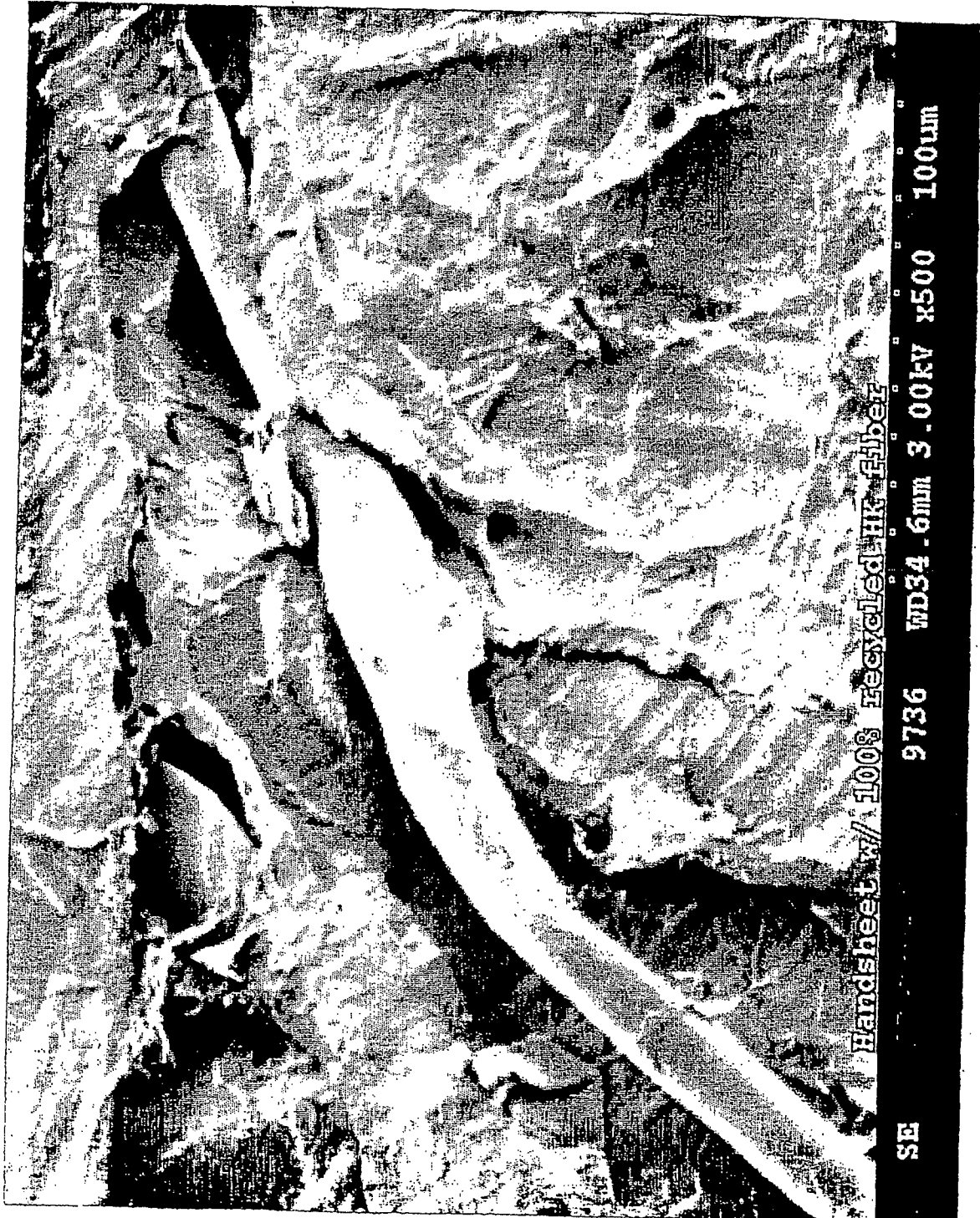


FIG. 3

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FIG. 4

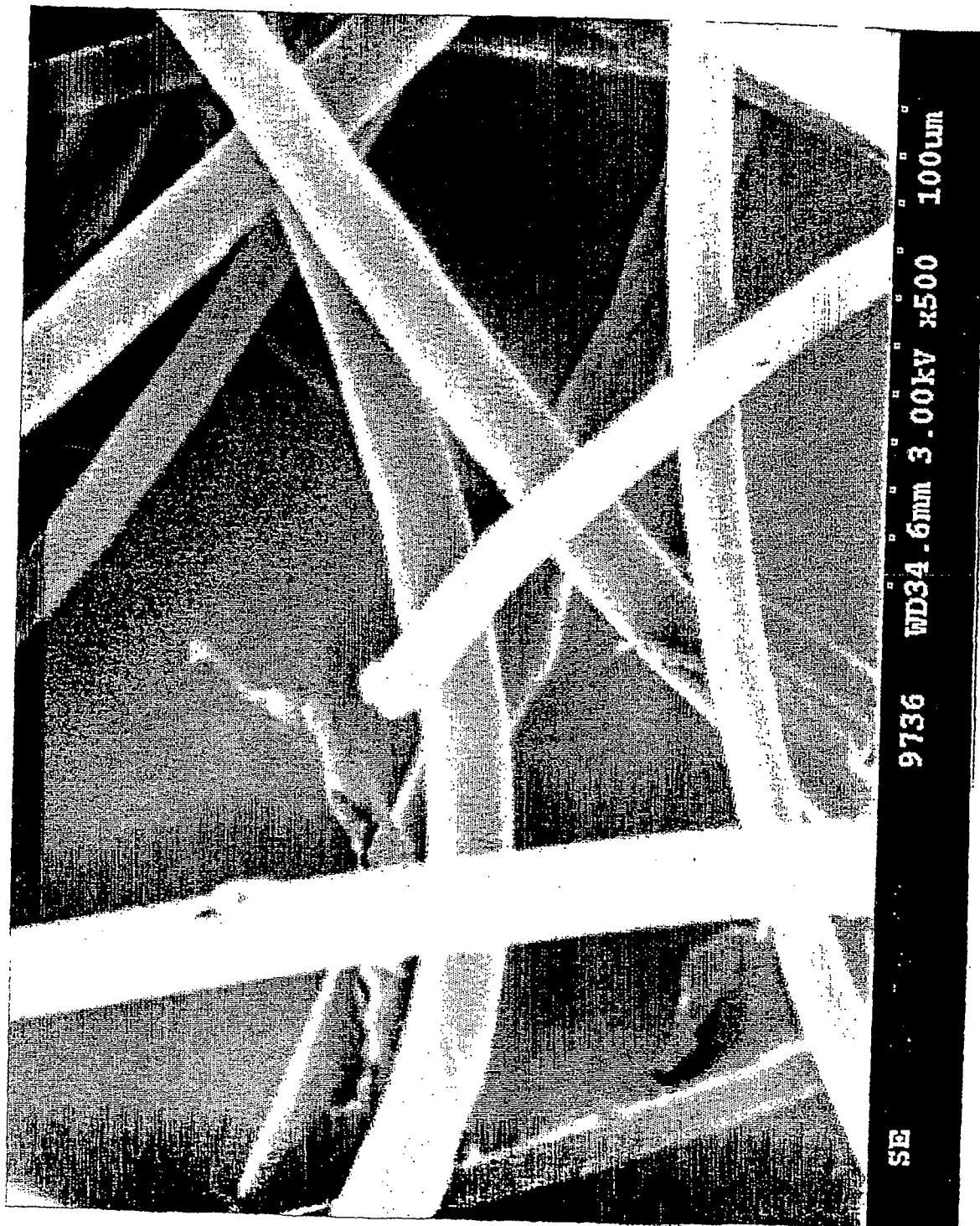


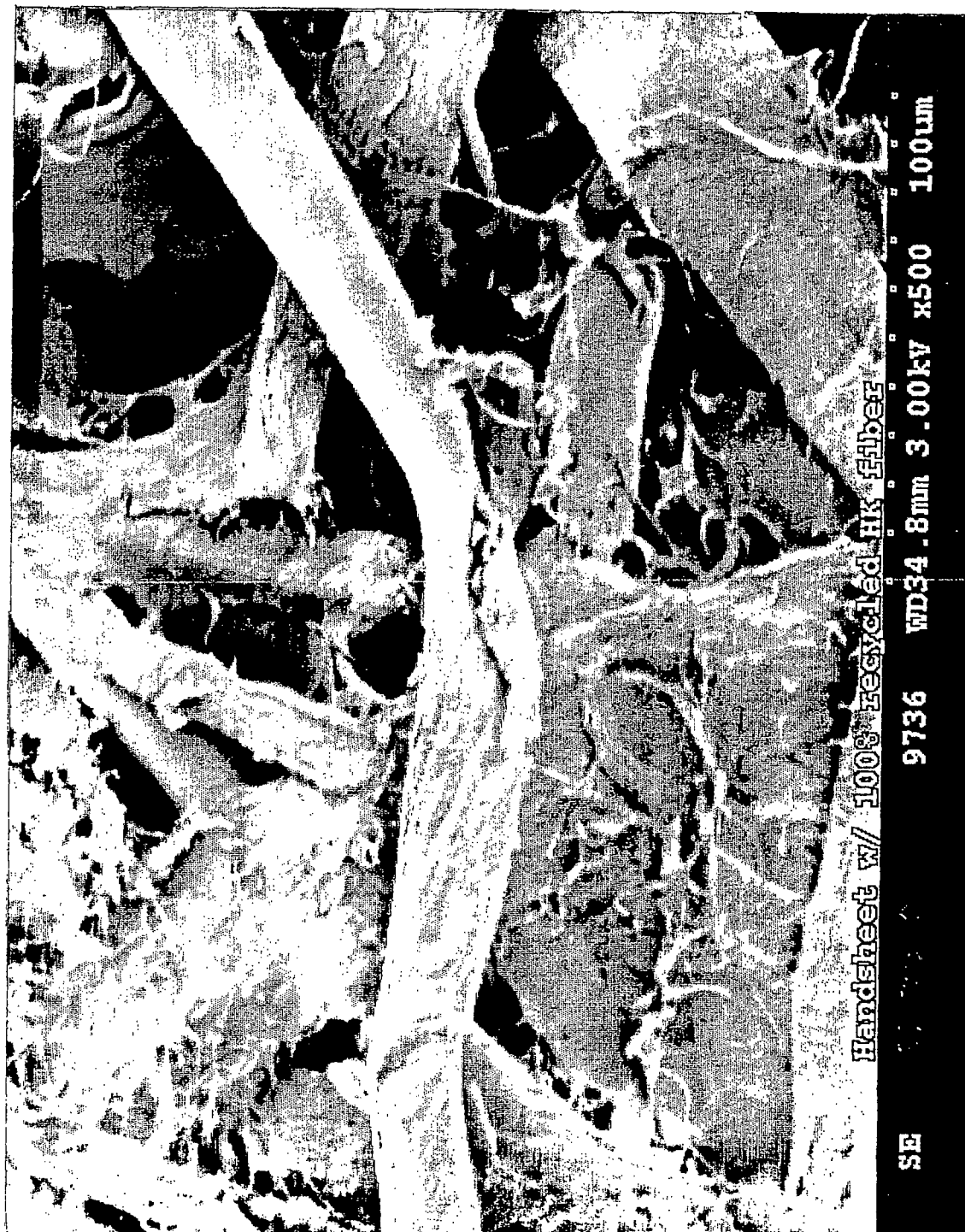
FIG. 5





FIG. 6

FIG. 7



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FIG. 8

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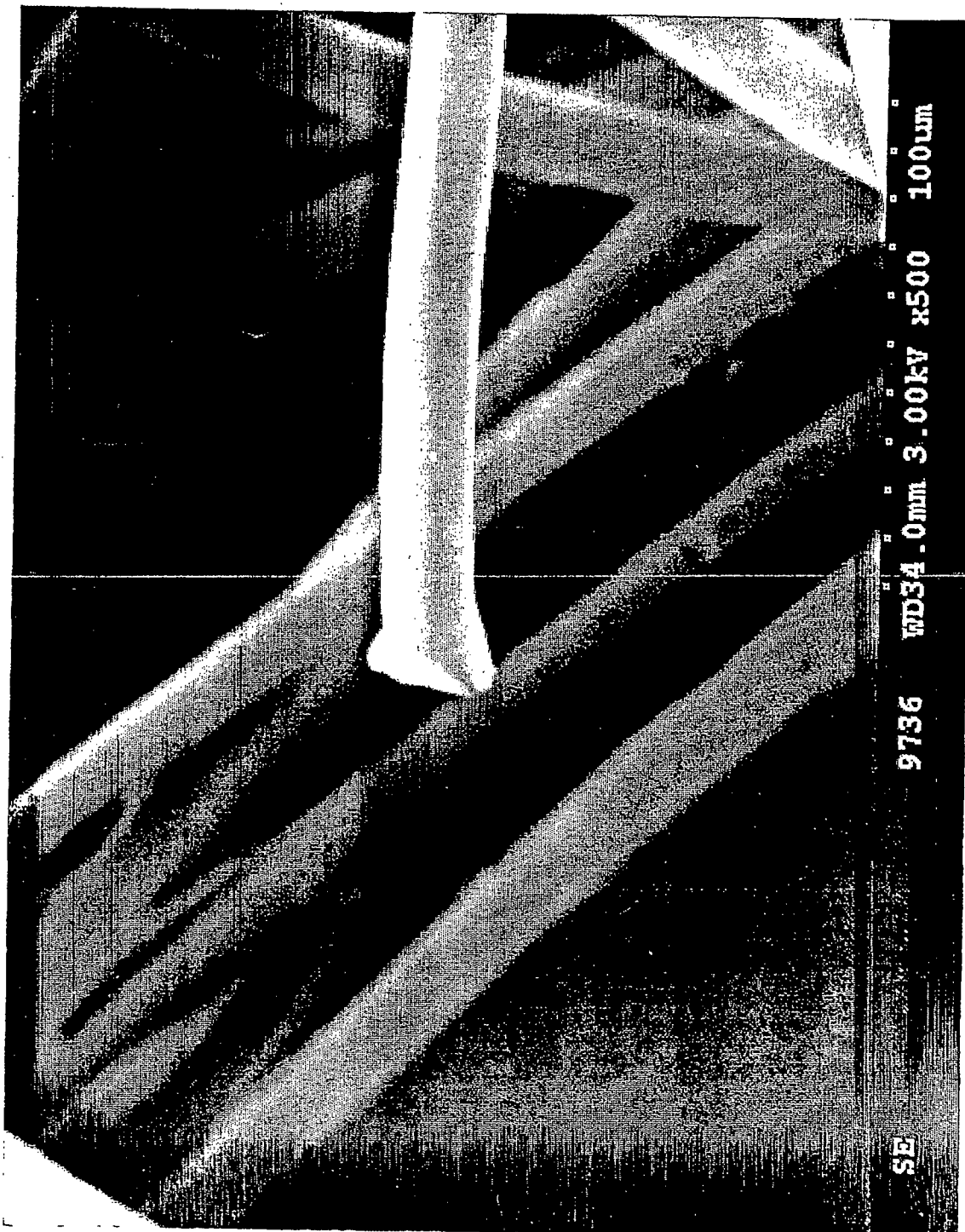


FIG. 9

FIG. 10



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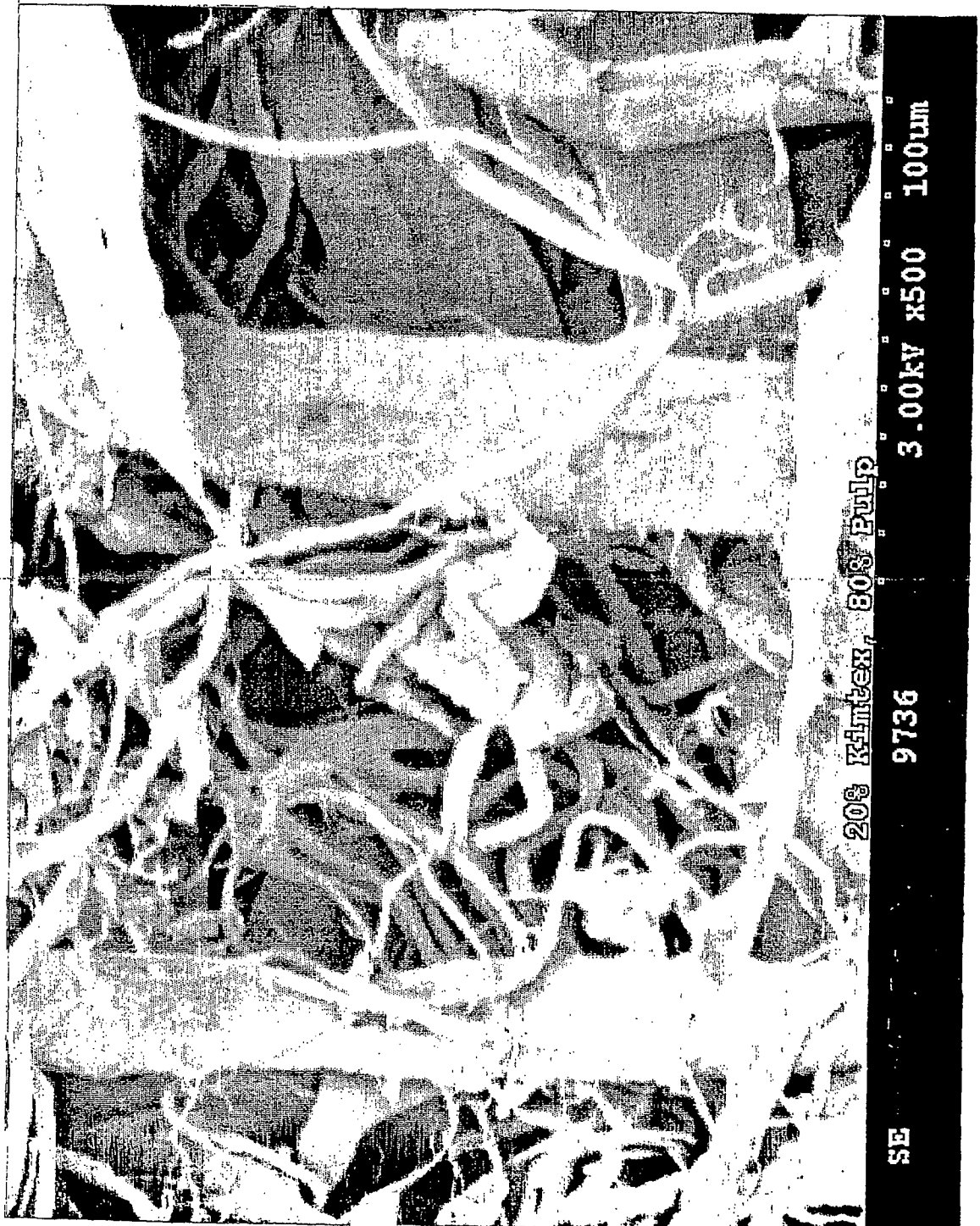


FIG. 11

FIG. 12





FIG. 13

FIG. 14



MÉTODO DE RECICLADO DE MATERIALES FIBROSOS UNIDOS Y FIBRAS SINTÉTICAS Y MATERIALES SIMILARES A FIBRAS PRODUCIDOS CON ELLOS

CAMPO DE LA INVENCION

La presente invención se relaciona con técnicas de reciclado y los materiales producidos utilizando dichas técnicas.

ANTECEDENTES

Los materiales de papel y textiles elaborados enteramente de fibras naturales (por ejemplo, fibras animales o vegetales) y/o fibras celulósicas (por ejemplo fibras de pulpa) se reciclan frecuentemente. Las técnicas para reciclar estos materiales se han desarrollado para romperlos en fibras o material similar a fibra y luego reformar los materiales para proporcionar productos de papel y similar a papel. Los textiles de fibras naturales y/o papel son dispersados en agua mediante una operación de formación de pulpa para crear un precipitado de fibras individuales. Las fibras pueden limpiarse y/o tratarse para retirar tinta, adhesivos u otros contaminantes. Las fibras tratadas pueden adicionalmente refinarse y/o fraccionarse antes de ser formadas en un sustrato entrapado en húmedo. En convencionales operaciones de reciclado, los materiales sintéticos son considerados contaminantes y típicamente son retirados. El material sintético puede estar presente en forma de fibras sintéticas o elaboradas y/o filamentos o en forma de adhesivos, enlazantes o similares.

Las telas tejidas y no tejidas compuestas parcial o completamente de fibras sintéticas o elaboradas han generado problemas para los

procesos convencionales focalizados para el reciclado de fibras naturales y/o celulósicas. Adicionalmente, las telas con base a fibras naturales y/o celulósicas de alta resistencia que utilizan adhesivos, enlazantes y/o enredado mecánico, tal como enredado hidráulico, también proporcionan problemas en los procesos de reciclado convencionales.

Estos tipos de telas son generalmente difíciles o imposibles de dispersar en fibras individuales en un proceso en húmedo tal como una operación de formación de pulpa. Esto es particularmente evidente si la tela se forma de fibras sintéticas unidas mediante unión térmica o adhesiva. En algunos casos, "cuerdas" de fibra o filamento pueden formarse. Si el material sintético es termoplástico, el trabajo mecánico a partir de procesos usados para romper o desmenuzar el material puede generar suficiente calor para causar que el material se funda en globos y grumos no usables.

Hablando en general, las telas compuestas de materiales sintéticos o compuestos que contienen materiales sintéticos y naturales son recicladas utilizando uno de dos métodos. En el primer método, las telas compuestas enteramente de material termoplástico sintético son limpiadas, fundidas y luego extruidas o formadas en fibras cortadas, filamentos continuos o películas. Si la tela es un compuesto que contiene materiales termoplásticos sintéticos y naturales (o material sintético no termoplástico), los materiales naturales (o sintético no termoplástico) deben separarse primero de los materiales termoplásticos antes de adicional procesamiento. Esto es a menudo no práctico debido a que la unión térmica, mecánica y/o adhesiva entre los componentes del compuesto hace difícil la separación. Aún si la separación es posible, el método requiere múltiples etapas de procesamiento y energía para fundir y

reformular el material. Aunque las fibras resultantes, filamentos o películas pueden contener materiales reciclados, las fibras, filamentos o películas pueden caracterizarse como "fabricados" o "extruidos" a partir de suministro de polímero reciclado.

El segundo método involucra romper mecánicamente una tela en piezas pequeñas tales como mazos de fibra, hilos y/o fibras individuales. Esto se cumple normalmente mediante desgarrado mecánico y torciendo material seco. Por ejemplo, la Solicitud Internacional PCT/SE95/00938 establece que es conocido desmenuzar mecánicamente no tejido seco y desperdicio textil y que puede usarse desperdicio mezclado seco que contiene fibras tanto sintéticas como naturales. De acuerdo con PCT/SE95/00938, una significativa característica de técnicas de desmenuzado y desgarrado es que la operación de desgarrado o desmenuzado es a menudo incompleta en forma tal que las fibras recicladas están presentes parcialmente en forma de pedazos individuales de la tela original que pueden caracterizarse como "flóculos" o mazos de fibra. Estos flóculos se describen como proporcionando no uniformidades que dan sustratos que contienen dichos flóculos de una apariencia similar a textil.

Los flóculos y pedazos de tela son difíciles de procesar en operaciones subsecuentes tales como, por ejemplo, un proceso de entrapado en húmedo, proceso de entrapado al aire, proceso de enredado hidráulico u otros procesos de formación de sustratos. La presencia de estas no uniformidades puede reducir el valor de las fibras recicladas así como degradar la apariencia, resistencia, uniformidad y otras propiedades deseables de un sustrato o tela elaborado con las fibras recicladas. Retirando las no uniformidades por tamizado u otras técnicas se reduce la

eficiencia de la recuperación de la fibra. Adicionales operaciones mecánicas en seco de corte, desmenuzado, desgarrado, granulado o picado operaciones para reducir los mazos o flóculos de fibra en fibras o material similar a fibra que tienen una longitud de menos de 5 milímetros pueden no ser prácticos. Adicionalmente, el trabajo mecánico adicional puede transferir demasiada energía en forma de calor que el material seco puede fundirse en grumos no usables y pueden disminuir o eliminar cualquier ventaja ambiental o económica inicialmente presente reciclando el material.

Aunque previas técnicas pueden ser de interés para aquellos que buscan reciclar material termoplástico en suministro de polímero para reprocesamiento así como para aquellos que buscan desgarrar o desmenuzar mecánicamente telas de desperdicio en pequeños pedazos, fallan en cumplir muchas necesidades existentes. Por ejemplo, las técnicas previas fallan en cumplir con la necesidad de un proceso en húmedo para sustancialmente aislar o individualizar fibras y/o filamentos a partir de un textil o tela no tejida. Como otro ejemplo, las técnicas previas fallan en cumplir con la necesidad de un proceso en húmedo para producir fibras usables y material similar a fibra a partir de telas unidas térmicamente, unidas adhesivamente y/o enredadas mecánicamente tales como textiles y sustratos no tejidos.

Las técnicas previas fallan en cumplir con la necesidad de un proceso en húmedo para convertir telas en fibras y/o filamentos individuales que tienen dimensiones similares a pulpas celulósicas y fibras cortas naturales tales como, por ejemplo, longitudes menores de cinco milímetros. Por ejemplo, las técnicas previas fallan en cumplir con la necesidad de un proceso para convertir telas en fibras y/o filamentos

individuales que tienen dimensiones similares a pulpas celulósicas convencionales y fibras cortas naturales tales como, por ejemplo, longitudes menores de cinco milímetros.

Existe aún una necesidad de una fibra reciclada no costosa o material similar a fibra que pueda procesarse fácilmente en una hoja o sustrato uniforme. Por ejemplo, existe una necesidad de una fibra no costosa reciclada o material similar a fibra que pueda procesarse en una forma de hoja o sustrato utilizando técnicas convencionales de formación en húmedo o formación en seco. Existe también una necesidad de una hoja o sustrato uniforme que puede incluir por lo menos una porción de una fibra no costosa reciclada o material similar a fibra.

Existe también una necesidad de una hoja de alta resistencia o más amplia que sea capaz de absorber rápidamente varias veces su peso en agua, líquido acuoso o aceite. Una necesidad existe de una hoja o paño limpiador que contenga una fibra no costosa reciclada o material similar a fibra y que sea capaz de absorber rápidamente varias veces su peso en agua, líquido acuoso o aceite. Una necesidad existe de una hoja o paño limpiador que contenga una fibra no costosa reciclada o material similar a fibra y que pueda usarse como un paño limpiador o como una capa de distribución de fluido y/o componente absorbente de un producto absorbente. Cumplir esta necesidad es importante puesto que es tanto económica como ambientalmente deseable sustituir fibra reciclada o materiales similares a fibra por pulpa de fibra de madera virgen de alta calidad y/o nuevas fibras o filamentos sintéticos y aún proporcionar un producto que pueda usarse como un paño limpiador o como una capa de distribución de fluido y/o componente absorbente de un producto absorbente.

RESUMEN DE LA INVENCION

Los problemas identificados arriba han sido solucionados por la presente invención la cual está dirigida a un método de reciclar materiales fibrosos unidos. El método incluye las etapas de: (a) proporcionar piezas de materiales fibrosos unidos, las piezas que tienen tamaños que están adaptados para suspensión en un líquido; (b) suspender las piezas separadas de materiales fibrosos unidos en un líquido; (c) aplicar trabajo mecánico a la suspensión líquida de piezas separadas para generar condiciones de presión hidráulica y tensión de corte mecánico suficientes para fragmentar hidráulicamente los materiales fibrosos unidos en fibras y componentes similares a fibra; y (4) separar sustancialmente las fibras individuales y componentes similares a fibra del líquido.

Hablando en general, las piezas de material fibroso unido pueden tener una longitud que varía dentro del rango de desde alrededor de 10 hasta alrededor de 350 milímetros y un ancho que varía dentro del rango de desde alrededor de 3 hasta alrededor de 70 milímetros. Más deseablemente, las piezas pueden tener una longitud que varía dentro del rango de desde alrededor de 10 hasta alrededor de 100 milímetros y un ancho que varía dentro del rango de desde alrededor de 3 hasta alrededor de 20 milímetros. En forma importante, las piezas pueden dimensionarse en forma tal que pueden suspenderse en un líquido tal como agua. Se contempla que las soluciones acuosas, solventes, emulsiones y similares pueden usarse también.

En un aspecto de la invención, la etapa de proporcionar piezas separadas de materiales fibrosos unidos incluye una operación de proceso para reducir el tamaño de los materiales fibrosos unidos unitarios tales

como telas grandes, textiles, sustratos y similares o grandes segmentos o trozos de dichas telas, textiles, sustratos, etc. en piezas individuales que están adaptadas para suspensión en líquido. La operación puede ser una operación convencional tal como, por ejemplo, desmenuzado mecánico, corte mecánico, desgarrado mecánico, molido mecánico, corte de chorro de agua, corte por láser, granulado y sus combinaciones.

En otro aspecto de la invención, el trabajo mecánico puede aplicarse a la suspensión líquida utilizando una combinación de aspas montadas en un rodillo de rotación y aspas montadas en un plato fijo para generar áreas de muy alta presión hidráulica y esfuerzo de corte mecánico. Una combinación tal puede encontrarse en equipo para procesamiento de precipitados de fibra tales como, por ejemplo, golpeadores y refinadores que pueden suministrar suficiente energía a la suspensión para controlar la longitud de fibra bajo condiciones que proporcionan un alto nivel de fibra para interacción de metal.

Las aspas pueden moverse en la placa fija que puede estar alineada a un ángulo en por lo menos una dimensión con respecto a la dirección o plano de rotación de las aspas rotativas. Por ejemplo, las aspas fijas pueden montarse en forma tal que están a un ángulo de entre alrededor de 5 grados y 70 grados en la dirección o plano de rotación de las aspas rotativas.

Deseablemente, las aspas fijas pueden montarse en forma tal que están a un ángulo de entre alrededor de 15 y 55 grados. Más deseablemente, las aspas fijas pueden montarse en forma tal que están a un ángulo de entre alrededor de 40 y 50 grados. Aún más deseablemente,

las aspas pueden montarse en forma tal que están a un ángulo de alrededor de 45 grados.

De acuerdo con la presente invención, el proceso puede establecerse en forma tal que el trabajo mecánico se aplica a la suspensión en múltiples etapas. Por ejemplo, el trabajo mecánico puede aplicarse a la suspensión utilizando una primera etapa bajo condiciones para generar presión hidráulica y tensión de corte mecánico suficiente para humedecer las piezas de material fibroso unido y separar por lo menos algunas porciones de fibras y componentes similares a fibra de los materiales unidos. Entonces adicional trabajo mecánico puede aplicarse utilizando una segunda etapa bajo condiciones para generar condiciones de presión hidráulica y tensión de corte mecánico suficientes para romper los materiales fibrosos unidos, fibras y componentes similares a fibras en fibras sustancialmente individuales y componentes similares a fibras.

En un aspecto de la invención, la separación entre las aspas rotativas y las aspas fijas en el punto más cercano durante la primera etapa está entre alrededor de 20 milímetros y alrededor de 100 milímetros. La separación es de entre alrededor de 1 milímetro (o tan cercana como sea posible sin contacto de metal con metal) y alrededor de 20 milímetros durante la segunda etapa. Deseablemente, la separación entre las aspas rotativas y las aspas fijas en el punto más cercano durante la primera etapa es entre alrededor de 20 milímetros y alrededor de 50 milímetros y entre alrededor de 1 milímetro y alrededor de 10 milímetros durante la segunda etapa.

La consistencia de la suspensión, la velocidad de rotación del rodillo y aspas rotativos, las dimensiones de las aspas, el peso y/o carga

de presión contra el rodillo rotativo son variables que pueden ajustarse con el fin de controlar la separación.

De acuerdo con la invención, la cantidad aproximada de trabajo mecánico aplicador a la suspensión líquida puede ser mayor de alrededor de 3 caballos de fuerza – día (24 horas) por tonelada seca de material fibroso unido – como se determina midiendo la corriente eléctrica dirigida por el motor que proporciona movimiento a los componentes que generan condiciones de presión hidráulica y tensión de corte. Este número puede ser mayor de 4 caballos de fuerza – día por tonelada y puede ser aún mayor de 6 o más. Se contempla que, en algunas situaciones o bajo algunas condiciones, la cantidad aproximada de trabajo mecánico puede ser menor de 3 caballos de fuerza - día por tonelada seca de material fibroso unido.

El proceso de la presente invención se practica usando materiales fibrosos unidos seleccionados a partir de telas tejidas, telas anudadas, sustratos no tejidos y sus combinaciones. Hablando en general, estos sustratos no tejidos son sustratos que son unidos térmicamente, unidos adhesivamente, enredados mecánicamente, unidos por solvente, enredados hidráulicamente y sus combinaciones.

Los materiales fibrosos unidos pueden estar compuestos de materiales fibrosos sintéticos, materiales fibrosos naturales y sus combinaciones. El material fibroso sintético puede incluir fibras y filamentos termoplásticos.

De acuerdo con un aspecto de la invención, los materiales fibrosos unidos pueden reciclarse en fibras sustancialmente individuales y

componentes similares a fibras que tienen una distribución de longitud relativamente uniforme. Por ejemplo, la fibra y material similar a fibra pueden tener una distribución de longitud que se expande aproximadamente 7 milímetros. Deseablemente, la fibra y material similar a fibra pueden tener una distribución de longitud que se expande aproximadamente 5 milímetros. Se contempla que la fibra y el material similar a fibra pueden tener una distribución de longitud que se expande menos de 5 milímetros, por ejemplo, de 2 a 4 milímetros.

La presente invención involucra fibras recicladas sintéticas y material similar a fibra que tienen por lo menos un elemento de hebras delgadas compuesto de material sintético que tiene por lo menos una distorsión irregular generada por la fractura hidráulica del elemento de hebras delgadas para separarlo de un material fibroso unido mientras el material fibroso unido es suspendido en un líquido.

El elemento de hebras delgadas puede tener una longitud que varía dentro del rango de desde alrededor de 1 milímetro hasta alrededor de 15 milímetros. Por ejemplo, el elemento de hebras delgadas puede tener una longitud que varía dentro del rango desde alrededor de 1,5 hasta alrededor de 10 milímetros. Como otro ejemplo, el elemento de hebras delgadas puede tener una longitud que varía dentro del rango de desde alrededor de 2 hasta alrededor de 5 milímetros. El elemento de hebras delgadas puede tener un diámetro de menos de 100 micrómetros. Por ejemplo, el elemento de hebras delgadas puede tener un diámetro de menos de 30 micrómetros.

De acuerdo con un aspecto de la invención, las distorsiones irregulares pueden estar en forma de combas en el elemento de hebras delgadas, segmentos aplanados de elemento de hebras delgadas,

segmentos expandidos de elemento de hebras delgadas y sus combinaciones.

Hablando en general, las distorsiones irregulares causan que los elementos de hebras delgadas de los materiales reciclados tengan mayor área superficial que los elementos de hebras delgadas en el material fibroso unido antes de la fractura hidráulica del elemento de hebras delgadas para separarlo del material fibroso unido. Por ejemplo, las áreas superficiales de los elementos de hebras delgadas son por lo menos alrededor de 5 por ciento mayores.

En una modalidad de la invención, las fibras sintéticas recicladas y el material similar a fibras puede ser un material sintético que es un material termoplástico sintético. Por ejemplo, el material termoplástico sintético puede ser una poliolefina tal como polipropileno, polietileno y sus combinaciones. El material termoplástico sintético puede estar en forma de fibras, filamentos, bandas o similares de múltiples componentes y pueden incluir fibras y/o filamentos que tienen varias formas lóbulos en sección transversal u otras configuraciones.

La presente invención involucra un sustrato fibroso no tejido que comprende las fibras sintéticas recicladas y material similar a fibra como se describe arriba. El sustrato puede formarse utilizando varios procesos de formación de sustratos tales como formación en húmedo o entrapado en húmedo, formación en seco, entrapado al aire, formación de espuma, y sus combinaciones.

El sustrato fibroso no tejido puede incluir adicionalmente materiales fibrosos naturales no reciclados, materiales sintéticos naturales no

recicladados, materiales fibrosos naturales reciclados, material particulado y sus combinaciones.

DEFINICIONES

El término "dirección de la máquina" tal como se usa aquí se refiere a la dirección de viaje de la superficie de formación dentro de la cual las fibras son depositadas durante la formación de un sustrato no tejido que incluye, pero no está limitado a sustratos esponjados pegados, sustratos de fibra fundidos soplados, y papel.

El término "dirección transversal a la máquina" tal como se usa aquí se refiere a la dirección que es perpendicular a la dirección de la máquina definida arriba.

El término "pulpa" tal como se usa aquí se refiere a fibras a partir de fuentes naturales tales como plantas maderosas y no maderosas. Las plantas maderosas incluyen, por ejemplo, árboles deciduos y coníferos.

Las plantas no maderosas incluyen, por ejemplo, algodón, cera, pasto de esparto, semilla de leche, paja, yute, y bagazo. El término "longitud promedio de fibra" tal como se usa aquí se refiere a una longitud promedio de fibras, mazos de fibra y/o material similar a fibras determinada por medición utilizando técnicas microscópicas. Una muestra de por lo menos 20 fibras seleccionadas al azar se separa de una suspensión líquida de fibras. Las fibras son establecidas en una placa de microscopio preparada para suspender las fibras en agua. Una tinta de entintado se agrega a las fibras suspendidas para colorear las fibras que contienen celulosa en forma tal que pueden distinguirse o separarse de las

fibras sintéticas. La placa es colocada bajo un Microscopio Fisher Stereomaster II Serie S19642/S19643. Las mediciones de 20 fibras en la muestra se hacen a magnificación lineal 20X utilizando una escala 0-20 mils y una longitud promedio, longitud mínima y longitud máxima, y una desviación o coeficiente de variación se calculan. En algunos casos, la longitud de fibra promedio será la longitud pesada promedio de las fibras (por ejemplo, fibras, mazos de fibras, materiales similares a fibra) determinados por equipo tal como, por ejemplo, un analizador de fibras Kajaani modelo FS-200 disponible en Kajaani Oy Electronics, Kajaani, Finlandia. De acuerdo con un procedimiento de prueba estándar, una muestra es tratada con un líquido de maceración para asegurar que los mazos o cedazos de fibra están presentes. Cada muestra es desintegrada en agua caliente y diluida a una solución de aproximadamente 0,001%. Muestras de prueba individuales son dirigidas en porciones de aproximadamente 50 a 100 ml de la solución diluida cuando se prueba, usando el procedimiento de prueba de análisis de fibra estándar Kajaani. La longitud promedio de la fibra pesada es un promedio aritmético, una longitud pesada promedio o un peso promedio pesado y se puede expresar mediante la siguiente ecuación:

$$\sum_{x_i=0}^k (x_i * n_i) / n$$

donde k = longitud de fibra máxima

x_i = longitud de fibra

n_i = número de fibras que tienen longitud x_i

n = número total de fibras medidas.

Una característica de los datos de longitud promedio de la fibra medidos por el analizador de fibras Kajaani es que no discrimina

entre los diferentes tipos de fibras. Consecuentemente, la longitud promedio representa un promedio basado en las longitudes de todos los diferentes tipos, si algunos, de fibras en la muestra.

Tal como se usa aquí, el término "filamentos esponjados pegados" se refiere a filamentos continuos de pequeño diámetro que se forman extruyendo un material termoplástico fundido como filamentos a partir de una pluralidad de finas, usualmente circulares, capilaridades de una hilandería con el diámetro de los filamentos extruidos que se reducen entonces rápidamente como, por ejemplo, dirección eductiva y/o otros mecanismos de esponjado pegado bien conocidos. La producción de sustratos no tejidos esponjados pegados se ilustra en patentes tales como, por ejemplo, en la Patente U.S. No. 4, 340,563 de Appel y otros, y la Patente U.S. No. 3, 692,618 de Dorschner y otros. Las divulgaciones de estas patentes se incorporan aquí a modo de referencia.

Tal como se usa aquí, el término "fibras fundidas sopladas" significa fibras formadas extruyendo un material termoplástico fundido a través de una pluralidad de finas, usualmente circulares, capilaridades de cubo como hilos o filamentos dentro de una corriente de gas a alta velocidad (por ejemplo, aire) que atenúa los filamentos de material termoplástico fundido para reducir su diámetro, el cual puede ser a un diámetro de micro fibra. Posteriormente, las fibras fundidas sopladas son llevadas por la corriente de gas a alta velocidad y son depositadas en una superficie de recolección para formar un sustrato de fibras fundidas sopladas entregadas al azar. Un proceso tal se divulga, por ejemplo, en la Patente U.S. No. 3, 849,241 de Butin, cuya divulgación se incorpora aquí a modo de referencia.

Tal como se usa aquí, el término "micro fibras" significa fibras de pequeño diámetro que tienen un diámetro promedio no mayor de alrededor de 100 micrones, por ejemplo, que tienen un diámetro de desde alrededor de 0,5 micrones hasta alrededor de 50 micrones, más particularmente, las micro fibras pueden tener un diámetro promedio de desde alrededor de 4 micrones hasta alrededor de 40 micrones.

1. Tal como se usa aquí, el término "material termoplástico" se refiere a un polímero superior que se ablanda cuando se expone a calor y retorna a su estado no ablandado generalmente cuando se enfría a temperatura ambiente. Las sustancias naturales que exhiben este comportamiento son el caucho crudo y un número de ceras. Otros materiales termoplásticos de ejemplo incluyen, sin limitación, cloruros de polivinilo, algunos poliésteres, poliamidas, polifluorocarburos, poliolefinas, algunos poliuretanos, poliestirenos, alcoholes de polivinilo, caprolactamas, copolímeros de etileno y por lo menos un monómero de vinilo (por ejemplo, poli(acetatos de vinil etileno), copolímeros de etileno y acrilato n-butil (por ejemplo, acrilatos de etileno n-butil), y resinas acrílicas.

Tal como se usa aquí, el término "material no termoplástico", se refiere a cualquier material que no caiga dentro de la definición de "material termoplástico," de arriba.

BREVE DESCRIPCIÓN DE LOS DIBUJOS



La Figura 1 es una representación esquemática de un proceso de ejemplo para desmenuzar un material fibroso unido.

La Figura 2 es una representación esquemática de un proceso de ejemplo para fragmentar hidráulicamente piezas desmenuzadas de un material fibroso unido.

La Figura 2A es un detalle de un proceso de ejemplo mostrado en la Figura 2.

La Figura 3 es una microfotografía de un detalle de una fibra sintética reciclada de ejemplo.

La Figura 4 es una microfotografía de un detalle de una fibra cortada sintética virgen de ejemplo.

La Figura 5 es una microfotografía de un detalle de una fibra sintética reciclada de ejemplo.

La Figura 6 es una microfotografía de un detalle de una fibra sintética reciclada de ejemplo.

La Figura 7 es una microfotografía de un detalle de una fibra sintética reciclada de ejemplo.

La Figura 8 es una microfotografía de un detalle de una fibra sintética reciclada de ejemplo.

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La Figura 9 es una microfotografía de un detalle de una fibra cortada sintética virgen de ejemplo.

La Figura 10 es una microfotografía de un detalle de múltiples fibras sintéticas recicladas de ejemplo.

La Figura 11 es una microfotografía de un detalle de una fibra sintética reciclada de ejemplo.

La Figura 12 es una microfotografía que muestra detalles de fibras sintéticas recicladas de ejemplo.

La Figura 13 es una microfotografía que muestra detalles de fibras sintéticas recicladas de ejemplo.

La Figura 14 es una microfotografía que muestra detalles de fibras sintéticas recicladas de ejemplo.

DESCRIPCIÓN DE LA INVENCION

La presente invención está dirigida a un método de reciclar materiales fibrosos unidos en fibras individuales sustancialmente y material similar a fibras. El método de la presente invención puede practicarse utilizando materiales fibrosos unidos que incluyen fibras sintéticas. El proceso de la presente invención puede practicarse usando materiales fibrosos unidos tales como, por ejemplo, telas no tejidas, telas anudadas, sustratos no tejidos y sus combinaciones. Hablando en general, los materiales fibrosos unidos en forma de sustratos no tejidos son sustratos que están unidos térmicamente, unidos adhesivamente,



enredados mecánicamente, unidos por solvente, hidráulicamente enredados y/o combinaciones de dichas técnicas.

Los materiales fibrosos unidos pueden estar compuestos de materiales fibrosos sintéticos, materiales fibrosos naturales y sus combinaciones. El material fibroso sintético puede incluir fibras y filamentos termoplásticos.

El método incluye las etapas de (a) proporcionar piezas de materiales fibrosos unidos, las piezas que tienen tamaños que están adaptados para suspensión en un líquido; (b) suspender las piezas individuales de materiales fibrosos unidos en un líquido; (c) aplicar trabajo mecánico a la suspensión líquida de piezas individuales para generar condiciones de presión hidráulica y tensión de corte mecánico suficientes para fragmentar hidráulicamente los materiales fibrosos unidos en fibras y componentes similares a fibra; y (4) separar sustancialmente las fibras individuales y los componentes similares a fibra del líquido.

De acuerdo con la invención, la etapa de proporcionar piezas individuales de materiales fibrosos unidos pueden estar en forma de una operación convencional tal como, por ejemplo, desmenuzado mecánico, corte mecánico, desprendimiento mecánico, molido mecánico, corte con chorro de agua, corte con láser, granulado y sus combinaciones.

Haciendo referencia ahora a la Figura 1, se muestra una operación 10 de ejemplo de desmenuzado mecánico, la máquina de desmenuzado incluye un rodillo de aspa 12 que tiene una serie de espas de cuchilla 14. El rodillo 12 rota generalmente en la dirección de la flecha asociada con él. Las espas de cuchilla 14 están montadas deseablemente a un ángulo o

inclinación con respecto a la línea central del rodillo en forma tal de crear una acción de “corte de tijeras” cuando las aspas de cuchilla 14 entran en contacto con un aspa fija 16. Un rodillo de prensado 18 puede usarse en combinación con un transportador de correa 20 para alimentar material. Las velocidades del transportador 20 y el rodillo de cuchillo 12 pueden establecerse independientemente para controlar el tamaño de las piezas producidas durante la operación. Por supuesto, otros tipos de equipo de desmenuzado pueden usarse. Por ejemplo, desmenuzadores del tipo que “llevan clavos” que utilizan dientes o puntas que cortan y desprenden el material fibroso unido son satisfactorios.

Hablando en general, las piezas de material fibroso unido pueden tener una longitud que varía dentro del rango desde alrededor de 10 hasta alrededor de 350 milímetros y un ancho que varía dentro del rango de desde alrededor de 3 hasta alrededor de 70 milímetros. En forma importante, las piezas pueden dimensionarse en forma tal que pueden suspenderse en un líquido tal como agua. Se contempla que el líquido puede, en algunos casos, ser una solución acuosa, puede incluir aditivos tales como tensioactivo, tratamientos, tintas, cáusticos, solventes, emulsiones y similares.

De acuerdo con la invención, el trabajo mecánico es aplicado a la suspensión líquida a niveles que generan condiciones de presión hidráulica y tensión de corte suficientes para fragmentar, romper, explotar o desintegrar piezas de materiales fibrosos unidos en útiles fibras libres y mazos de fibra 30 o material similar a fibras. Hablando en general, las condiciones de proceso usadas para convertir el material desmenuzado en fibras recicladas son más agresivas y severas que aquellas encontradas en las operaciones convencionales de formación de pulpa. Estas condiciones

incluyen pasar las piezas desmenuzadas a través de una zona de incrementada presión hidráulica y alta tensión de corte mecánico.

Como un ejemplo, las operaciones normales de formación de pulpa usan típicamente menos de alrededor de 3 caballos de fuerza-día (24 horas) por tonelada seca de material. Las modalidades de la presente invención pueden utilizar mucho mayores entradas de energía. Por ejemplo, el método de la invención puede practicarse utilizando 35% más de energía; 500 por ciento más de energía, o aún más para separar útiles fibras libres y mazos de fibra del material fibroso unido.

Aunque los inventores no están unidos a una teoría particular de operación, se considera que la combinación de presión hidráulica y tensión de corte rompe el material en fibras libres y mazos de fibra. También se considera que el contenido de fibras libres y el tamaño promedio de los mazos puede controlarse variando la presión y la tensión mecánica. Se considera generalmente que este alto nivel de acción mecánica o trabajo es posible sin causar significativa degradación de los componentes sintéticos de los materiales fibrosos unidos (por ejemplo, sin fundir el material termoplástico sintético) debido a que el agua/líquido en el proceso absorbe el calor generado como fibras libres y material similar a fibras son separados del material fibroso unido.

Hablando en general, el equipo de batido convencional y/o refinación se usa para modificar fibras de celulosa para desarrollar propiedades de elaboración de papel de hidratación y fibrilación. De acuerdo con la presente invención, golpeadores y/o refinadores convencionales pueden configurarse u operarse en una manera no convencional para proporcionar las condiciones de presión hidráulica y

tensión de corte, suficientes para fragmentar y fracturar el material fibroso unido en fibras libres, bandas de fibras y material similar a fibras.

Ejemplos de estos dispositivos de batido se encuentran disponibles en fabricantes tales como Beloit, Jones, Valley, y Noble & Wood. Haciendo referencia ahora a las Figuras 2 y 2A de los dibujos, se muestra un dispositivo de ejemplo golpeador 30 del tipo Hollander que puede usarse en la práctica de la presente invención. El golpeador incluye un tanque oval 32 con una pared central 34 y un rodillo de cilindro 26 equipado con aspas o vanos 38 que se mueven pasando una segunda serie de aspas 40 montadas en una platina o placa fija 42. Las cuchillas 40 pueden montarse en la placa fija en forma tal que pueden estar alineadas a un ángulo en por lo menos una dimensión con respecto a la dirección o plano de rotación "R" de las aspas rotativas 38. Por ejemplo, las aspas fijas 40 pueden montarse en forma tal que están a un ángulo de entre alrededor de 5 grados y 70 grados con respecto a la dirección o plano de rotación "R" de las aspas rotativas 38. Como otro ejemplo, las aspas fijas pueden montarse en forma tal que están a un ángulo de entre alrededor de 15 y 55 grados, entre alrededor de 40 y 50 grados, o aún alrededor de 45 grados.

Una suspensión líquida de piezas de material fibroso unido es introducida dentro de un dispositivo golpeador. Alternativa y/o adicionalmente, piezas de material fibroso unido pueden introducirse directamente dentro de líquido en el tanque. Varias proporciones de materiales fibrosos unidos y agua pueden usarse y apropiadas proporciones pueden ser determinadas por un experto en el arte.

Durante la operación, el rodillo de cilindro 36 es rotado en forma tal que suficiente presión hidráulica y tensión de corte es producida entre las aspas o vanos 38 y las aspas 40 montadas sobre la placa fija. Un rodillo de cilindro de ejemplo tiene un diámetro de 72 pulgadas, un ancho de 72 pulgadas, 192 aspas que tienen una longitud de 72 pulgadas cada una y espaciadas aparte media pulgada. Un rodillo tal pesó aproximadamente 16 toneladas. Hablando en general, la velocidad de rotación es constante y la variable que es modificada es la presión o carga en el rodillo. El rodillo está montado en forma tal que una lectura de presión en calibre de 0 psi corresponde a muy poco o ninguna porción del peso del rodillo (± 0 toneladas) contrarresta la presión generada por las fibras y piezas de material fibroso unido cuando son torcidas a través del intersticio existente entre las aspas en el fondo del rodillo rotativo y las aspas fijas montadas debajo del rodillo. Una lectura de presión en calibre de 50 psi corresponde a aproximadamente la mitad del peso del rodillo (± 8 toneladas) que contrarresta la presión generada por las fibras y piezas de material fibroso unido a medida que se tuerce a través del intersticio entre las aspas en el fondo del rodillo rotativo y las aspas fijas montadas debajo del rodillo. Una lectura de presión en calibre de 100 psi corresponde a aproximadamente todo el peso del rodillo (± 16 toneladas) contrarresta la presión generada por las fibras y piezas de material fibroso unido a medida que se tuercen a través del intersticio existente entre las aspas en el fondo del rodillo rotativo y las aspas fijas montadas debajo del rodillo.

La velocidad de rotación, consistencia de la suspensión en el tanque y tolerancia entre las aspas rotativas o vanos 38 y las aspas fijas 40 también se ajusta a condiciones que mejoran la interacción "metal a fibra" que corta o controla la longitud de las fibras libres, mazos de fibras y partículas similares a fibra. El término interacción "metal a fibra" se usa

para describir el contacto entre el material fibroso unido y las aspas fijas y/o rotativas que puede ocurrir bajo condiciones de presión hidráulica y tensión de corte mecánico suficientes para separarse, cortarse o romperse a lo largo de las fibras. De acuerdo con la invención, esta interacción debe controlarse para cortar fibras largas sin afectar o disminuir materialmente la longitud y/o libertad de la pulpa o fibras cortas que pueden estar presentes en la suspensión. Por ejemplo, el equipo de operación que utiliza menos que las consistencias convencionales, mayores dimensiones de aspas, tolerancias más cercanas entre las aspas rotativas y aspas fijas, y/o mayores velocidades de rotación puede mejorar la interacción “metal a fibra”. Hablando en general, la presente invención utiliza condiciones de operación y/o equipo que proporcionan mayores números de bordes de trabajo para actuar en las fibras suspendidas en vez de primordialmente utilizar la interacción “fibra a fibra”.

El método de la presente invención proporciona una técnica para reciclar materiales fibrosos unidos en fibras sustancialmente individuales y componentes similares a fibra que tienen una longitud promedio relativamente baja y una distribución de longitud promedio relativamente uniforme.

Aunque el método de la presente invención puede operarse para proporcionar fibras, mazos de fibras y materiales similares a fibra que tienen amplios rangos de longitudes, también puede usarse para generar fibra y material similar a fibra que tiene una distribución de longitud promedio que se expande a aproximadamente 7 milímetros o menos.

En adición al control de la longitud, alguna interacción “metal a fibra” puede generar deformaciones y distorsiones de los componentes

sintéticos del material fibroso unido. Aunque algunas deformaciones y distorsiones pueden generarse por la fragmentación hidráulica del material fibroso unido otras pueden generarse por desgarramiento, rebanado y rotura de la fibra y/o filamentos.

Haciendo referencia ahora a las Figuras 3, 5 a 8, y 10 a 14, se muestra allí varias fibras sintéticas recicladas de ejemplo, mazos de fibras, y/o material similar a fibras que tienen por lo menos un elemento de hebras delgadas compuesto de material sintético que tiene por lo menos una distorsión irregular generada por la fractura hidráulica del elemento de hebras delgadas para separarlo de un material fibroso unido mientras el material fibroso unido está suspendido en un líquido.

El elemento de hebras delgadas puede tener una longitud que varía dentro del rango de desde alrededor de 1 milímetro hasta alrededor de 15 milímetros. Por ejemplo, el elemento de hebras delgadas puede tener una longitud que varía dentro del rango de desde alrededor de 1,5 hasta alrededor de 10 milímetros. Como otro ejemplo, el elemento de hebras delgadas puede tener una longitud que varía dentro del rango de desde alrededor de 2 hasta alrededor de 5 milímetros. El elemento de hebras delgadas puede tener un diámetro de menos de 100 micrómetros. Por ejemplo, el elemento de hebras delgadas puede tener un diámetro de menos de 30 micrómetros. Generalmente hablando, estas dimensiones son similares a algunas variedades de pulpas comercialmente disponibles y pueden mezclarse fácilmente con pulpas comerciales. En algunas modalidades de la invención, los elementos de hebras delgadas pueden tener un diámetro de menos de 10 micrones y pueden aún ser de menos de 1 micrón.

De acuerdo con un aspecto de la invención, las distorsiones irregulares pueden estar en forma de combas en el elemento de hebras delgadas, segmentos aplanados de elemento de hebras delgadas, segmentos expandidos de elementos de hebras delgadas y sus combinaciones.

Hablando en general, las distorsiones irregulares causan que los elementos de hebras delgadas de los materiales reciclados tengan mayor área superficial que los elementos de hebras delgadas en el material fibroso unido antes de la fractura hidráulica del elemento de hebras delgadas para separarlo del material fibroso unido. Por ejemplo, las áreas superficiales de los elementos de hebras delgadas reciclados pueden ser por lo menos alrededor de 5 por ciento mayores.

La Figura 3 es una microfotografía (aproximadamente una magnificación lineal 500X) que muestra un detalle de una fibra de ejemplo sintética reciclada. La fibra reciclada se recuperó a partir de una estructura compuesta que contiene un sustrato de filamentos de polipropileno continuos unidos por puntos térmicamente y fibras de pulpa enredadas hidráulicamente con el sustrato de filamentos continuos. La fibra visible en el centro de la microfotografía es un elemento de hebras delgadas de polipropileno que tiene combas en el filamento y un segmento relativamente aplanado. Por lo menos una porción de estas distorsiones son generadas o expuestas mediante fractura hidráulica del elemento de hebras delgadas a partir del material fibroso unido (es decir, la estructura compuesta). El material que circunda el elemento de hebras delgadas es pulpa de celulosa.

La Figura 4 es una microfotografía (magnificación lineal de aproximadamente 500X) que muestra fibras cortadas de polipropileno convencionales que aparece en una estructura de sustrato cardado unido convencional. En contraste con los elementos de hebras delgadas de la Figura 3, estas fibras aparecen relativamente libres de distorsiones irregulares. Las fibras tienen superficies relativamente lisas, aún de diámetros uniformes, y sin torcimientos, combas y otras distorsiones irregulares que son evidentes en el elemento de hebras delgadas mostrado en la Figura 3.

La Figura 5 es una microfotografía (magnificación lineal de aproximadamente 120X) que muestra un detalle de una fibra de ejemplo sintética reciclada recuperada del mismo tipo de estructura compuesta del elemento de hebras delgadas mostrado en la Figura 3. La fibra visible a través de la región central de la microfotografía es un elemento de hebras delgadas de polipropileno que exhibe una presilla y combas así como segmentos relativamente aplanados. Por lo menos una porción de estas distorsiones son generadas o expuestas mediante la fractura hidráulica del elemento de hebras delgadas a partir del material fibroso unido (es decir, la estructura compuesta). El material que circunda el elemento de hebras delgadas es pulpa de celulosa.

La Figura 6 es una microfotografía (magnificación lineal de aproximadamente 120X) que muestra un detalle de una fibra sintética reciclada de ejemplo recuperada a partir del mismo tipo de estructura compuesta del elemento de hebras delgadas mostrado en la Figura 3. La fibra visible en el centro de la microfotografía es un elemento de hebras delgadas de polipropileno. La flecha en la microfotografía apunta a una comba aguda en el elemento de hebras delgadas.

La Figura 7 es una microfotografía (magnificación lineal de aproximadamente 500X) que muestra un detalle de una fibra de ejemplo sintética reciclada recuperada a partir del mismo tipo de estructura compuesta como el elemento de hebras delgadas mostrado en la Figura 3. La fibra visible en el centro de la microfotografía es un elemento de hebras delgadas de polipropileno que exhibe combas así como un segmento basto.

La Figura 8 es una microfotografía (magnificación lineal de aproximadamente 500X) que muestra un detalle de una fibra de ejemplo sintética reciclada recuperada a partir del mismo tipo estructura compuesta del elemento de hebras delgadas mostrado en la Figura 3. La fibra visible a través del centro de la microfotografía es un elemento de hebras delgadas de polipropileno que muestra un extremo cortado de la fibra que está aplanada y expandida.

La Figura 9 es una microfotografía (magnificación lineal de aproximadamente 500X) que muestra un detalle de una fibra cortada convencional de polipropileno. En contraste con el elemento de hebras delgadas de Figura 8, la fibra aparece relativamente libre de distorsiones irregulares y tiene un extremo que aparece estar cortado limpiamente sin evidencia de expansión u otra distorsión.

La Figura 10 es una microfotografía (magnificación lineal de aproximadamente 250X) que muestra un detalle de dos fibras de ejemplo sintéticas recicladas recuperadas a partir del mismo tipo de estructura compuesta del elemento de hebras delgadas mostrado en la Figura 3. Las fibras visibles a través del centro y cerna a la porción inferior de la

microfotografía son elementos de hebras delgadas de polipropileno que exhiben combas así como segmentos bastos.

La Figura 11 es a microfotografía (magnificación lineal de aproximadamente 500X) que muestra un detalle de fibras de ejemplo sintéticas recicladas. Las fibras recicladas se recuperaron a través de un paño limpiador de marca Kintex® que contiene un sustrato unido por puntos térmicamente de fibras fundidas sopladas de polipropileno. Las fibras fundidas sopladas relativamente finas visibles en el centro de la microfotografía son elementos de hebras delgadas de polipropileno que tienen combas, torcimientos, enredos y segmentos relativamente aplanados. Por lo menos una porción de estas distorsiones son generadas o expuestas mediante fractura hidráulica de los elementos de hebras delgadas del material fibroso unido (es decir, el paño limpiador Kintex®). El material que circunda los elementos de hebras delgadas es pulpa de celulosa.

La Figura 12 es una microfotografía (magnificación lineal de aproximadamente 100X) que muestra un detalle de fibras sintéticas recicladas de ejemplo recuperadas a partir del mismo tipo de material de los elementos de hebras delgadas mostrados en la Figura 11. Un punto de unión de aproximadamente 500 micrómetros de longitud es visible en el centro de la microfotografía las fibras radian hacia fuera desde los bordes del punto de unión en forma de elementos de hebras delgadas de polipropileno que tienen combas, torcimientos enredos y segmentos relativamente aplanados. Por lo menos una porción de estas distorsiones son generadas o expuestas mediante fractura hidráulica de los elementos de hebras delgadas a partir del material fibroso unido. Algo del material en el antecedente de los elementos de hebras delgadas es pulpa de celulosa.

La Figura 13 es una microfotografía (magnificación lineal de aproximadamente 500X) que muestra un detalle de las fibras sintéticas recicladas de ejemplo recuperadas a partir del mismo tipo de material de los elementos de hebras delgadas mostrados en la Figura 11. Un más largo material similar a fibra o mazo de fibras es de aproximadamente 40 micrómetros de ancho es visible en el centro de la microfotografía. Las fibras circundan y radian hacia fuera desde los bordes del material similar a fibra o mazos de fibras en forma de elementos de hebras delgadas de polipropileno que tienen combas, torcimientos, enredos y segmentos relativamente aplanados. Por lo menos una porción de estas distorsiones son generadas o expuestas a fractura hidráulica de los elementos de hebras delgadas del material fibroso unido. Los más largos materiales fibrosos cercanos a los elementos de hebras delgadas son fibras de pulpa de celulosa.

La Figura 14 es una microfotografía (magnificación lineal de aproximadamente 500X) que muestra un detalle de fibras de ejemplo sintéticas recicladas recuperadas a partir del mismo tipo de material de los elementos de hebras delgadas mostrados en la Figura 11. Una mezcla de pulpa de celulosa y fibras recicladas en forma de elementos de hebras delgadas de polipropileno que tienen combas, torcimientos, enredos y segmentos relativamente aplanados se muestra.

En una modalidad del método de la presente invención, el trabajo mecánico puede aplicarse a una suspensión de piezas cortadas o desmenuzadas de material fibroso unido en múltiples etapas. Como un ejemplo, el trabajo mecánico puede aplicarse a una suspensión de piezas de material fibroso unido utilizando un golpeador tipo Hollander o dispositivo similar bajo condiciones para humedecer las piezas de

materiales fibrosos unidos y separar por lo menos algunas porciones de fibras y componentes similares a fibras de los materiales unidos. En algunas situaciones, los materiales fibrosos unidos que contienen una mezcla de fibras naturales y sintéticas y/o fibras muy cortas y muy largas (por ejemplo fibras de pulpa y filamentos sintéticos continuos) pueden separarse parcial o sustancialmente en una o más iniciales etapas de tratamiento.

Después de dicho tratamiento, las corrientes de fibra/filamento cortos y largos pueden separarse. Si se usa un golpeador del tipo Hollander para llevar a cabo las primeras etapas o etapas de tratamiento, el intersticio o tolerancia entre las aspas rotativas y las aspas fijas puede ser suficientemente grande para mejorar la interacción “fibra a fibra” o “material fibroso a material fibroso” más que la interacción “metal a fibra”. Como un ejemplo, bajo condiciones convencionales la tolerancia entre las aspas rotativas y las aspas fijas puede estar entre alrededor de 20 milímetros y alrededor de 100 milímetros. Se contempla que otras variables tales como la consistencia de la suspensión, la velocidad de rotación del rodillo golpeador y/o la carga de presión aplicada al rodillo golpeador puede ajustarse también para mejorar el tratamiento en la primera etapa (o etapas).

En una segunda etapa, adicional trabajo mecánico puede aplicarse bajo condiciones para generar condiciones suficientes de presión hidráulica y tensión de corte mecánico para romper los materiales fibrosos unidos, fibras y componentes similares a fibra en fibras sustancialmente individuales y componentes similares a fibra. Si se usa un golpeador del tipo Hollander para llevar a cabo la segunda etapa (o segundas etapas) de tratamiento, el intersticio o tolerancia entre las aspas rotativas y las aspas

fijas será deseablemente pequeñas suficientemente para mejorar la interacción “metal a fibra” o “metal a material fibroso” que puede ocurrir bajo condiciones de presión hidráulica y tensión de corte mecánico para separar, cortar o romper fibras largas (es decir, fibras sintéticas largas) sin afectar materialmente o disminuir la longitud y/o libertad de la pulpa o fibras cortas que pueden estar presentes en la suspensión. Como un ejemplo, la tolerancia puede estar entre alrededor de 1 milímetro (o tan cercano como sea posible sin contacto de “metal a metal”) y alrededor de 20 milímetros. Se contempla que otras variables tal como consistencia de la suspensión, velocidad de rotación del rodillo golpeador y/o carga de presión aplicada al rodillo golpeador pueden ajustarse también para mejorar el tratamiento en la segunda etapa (o etapas).

De acuerdo con la invención, la cantidad de trabajo mecánico aplicado a la suspensión líquida es mayor de alrededor de 3 caballos de fuerza por día (24 horas) por tonelada seca de material fibroso unido. Este número puede ser deseablemente mayor de 6 caballos de fuerza – día por tonelada y puede variar en el rango de 10 hasta alrededor de 15 para varios materiales de ejemplo.

Después de que la suspensión líquida es creada y el material fibroso unido es fragmentado hidráulicamente en fibras libres, mazos de fibras y materiales similares a fibra, estos materiales pueden entonces introducirse en la corriente de suministro de un proceso de formación en húmedo, o pueden traslaparse en húmedo para uso posterior, o pueden secarse para procesos de formación en seco. Se contempla que la corriente de fibras puede tamizarse para retirar piezas largas, flóculos, y similares.

Hablando en general, trozos unidos o materiales de desperdicio que contienen fibras sintéticas pueden reciclarse en fibras libres, y materiales similares a fibra que tienen incrementada área superficial y pueden procesarse para tener una controlada longitud de fibra. Se considera que las fibras recicladas de acuerdo con la presente invención proporcionan mejor retención en procesos de formación en húmedo y con suficiente cantidad, pueden mejorar las propiedades mecánicas y absorbentes cuando se incorporan en los sustratos fibrosos. En adición las fibras recicladas de alta área superficial ofrecen una ventaja significativa en costos sobre las fibras cortadas sintéticas vírgenes. Mediante el uso de materiales que se han formado previamente en redes de fibras, luego rompiéndolas aparte como se describe arriba resulta en fibras y material similar a fibra que tiene generalmente incrementada área superficial. Esta área superficial resulta del estallido de las redes en pequeños segmentos que tienen aún puntos de unión, combas, torcimientos, bucles, capas abiertas de fibras, y áreas planas como se muestra en las varias microfotografías descritas arriba.

En adición, la longitud de fibra se controla mediante el mismo trabajo mecánico creado durante el proceso de estallido. Controlando la longitud de las fibras le permitirá ser usadas en un número de procesos de formación de sustratos tales como formación en húmedo, formación en seco, formación de espuma. Por ejemplo, controlando la longitud de la fibra sintética con respecto a la de las fibras de pulpa de Madera, el material reciclado puede reintroducirse en suministros de pulpa de madera virgen sin afectar las propiedades de manejo o procesamiento del suministro.

EJEMPLO 1

Este ejemplo se relaciona con el reciclado de un material compuesto unido y enredado que contiene fibras naturales y filamentos sintéticos. Un material compuesto enredado hidráulicamente que contiene pulpa de madera virgen y un sustrato continuo de filamentos de polipropileno unidos sintéticos (aproximadamente 20 por ciento, en peso) (es decir, un sustrato de filamentos continuos esponjado pegado) disponible en Kimberly-Clark Corporation, Roswell, Georgia bajo las marcas comerciales Workhorse® e Hydroknit® materiales de rápida absorción se desmenuzó en piezas que varían dentro del rango de desde alrededor de 10 a 350 mm en longitud y 70 mm en ancho. El compuesto contenía aproximadamente 80% en peso y alrededor de 20 por ciento, en peso, de filamentos de polipropileno. El material fue desmenuzado utilizando un desmenuzador disponible en East Chicago Machine Tool Company de East Chicago, IN. Las piezas fueron transferidas a un golpeador convencional industrial del tipo Hollander fabricado por E.D. Jones & Sons, Pittsfield, MA.

El golpeador era una “Unidad Golpeadora Jones Número 3” equipada con una placa de lecho diagonal a 45 grados. El golpeador tenía un rodillo rotativo con aspas o vanos generalmente alineados sobre el rodillo como se muestra en la Figura 2A. Las aspas o vanos eran de aproximadamente 1/4 de pulgada (± 12 mm) de ancho, aproximadamente 1/2 pulgada (± 12 a 13 mm) de alto. Estos estaban espaciados aproximadamente 1/2 pulgada (± 12 a 13 mm) aparte sobre el exterior del rodillo perpendicular a la dirección o plano de rotación. Una placa fija estaba montada justo debajo del rodillo rotativo y estaba equipada con aspas o “cuchillas” que eran de aproximadamente 1/8 de pulgada (± 3 mm) de ancho, 1/4 de pulgada (± 6 mm) de alto, espaciadas aproximadamente 3/8 de pulgada (± 9 a 10 mm) aparte. Estas estaban alineadas a un ángulo

de 45 grados con respecto a la dirección o plano de rotación generalmente como se muestra en la Figura 2A.

Se agregó agua al material desmenuzado y se aplicó presión hidráulica y tensión de corte al material en el golpeador tipo Hollander en dos etapas. La presión hidráulica y la tensión de corte se controló ajustando la carga sobre el rodillo a medida que el rodillo rota. En esta disposición particular, la presión hidráulica y tensión de corte son generados por una acción de bombeo del tipo de "rueda de paletas" producida cuando el rodillo golpeador y sus aspas o vanos unidos fuerzan líquido y material húmedo contra una placa fija con aspas montadas diagonalmente a la dirección o plano de rotación. Hablando en general, una mayor carga aplicada al rodillo rotativo produce menos tolerancia entre el rodillo rotativo y la placa fija. Esto corresponde a mayores niveles de presión hidráulica y tensión de corte.

Durante la primera etapa, la presión o carga contra el rodillo rotativo era de 0 libras por pulgada cuadrada (psi) durante 10 minutos. Esencialmente, no se aplicó carga y la acción de "rueda de paletas" del rodillo rotativo torció las piezas en la suspensión a través de un intersticio de alrededor de 1 cm o más entre las aspas o el rodillo rotativo y las aspas montadas sobre la placa fija.

Hablando en general, la primera etapa se usó para humedecer el material desmenuzado y separar las fibras naturales de las fibras sintéticas. La consistencia se ajustó para ser alrededor de 3,3 por ciento (el porcentaje en peso de aire o material fibroso seco en horno en la suspensión).

Durante la segunda etapa, las condiciones fueron ajustadas para establecer pequeñas zonas de muy alta presión hidráulica y tensión de corte entre las aspas que se mueven sobre el rodillo rotativo y las aspas fijas cercanas o en su punto más cercano de contacto. Se considera que estas pequeñas zonas generan una acción de micro-explosión sobre el material fibroso unido desmenuzado para fragmentar hidráulicamente y/o soplar aparte y reducir la longitud de la fibra sintética resultante. En adición, la fragmentación hidráulica y el contacto de “metal a fibra” o “metal a material fibroso unido” altera la longitud de los filamentos sintéticos más largos en forma tal que tienen la misma longitud de las fibras naturales (es decir, pulpa) que varían dentro del rango de desde alrededor de 0,8 hasta alrededor de 3,5 mm sin disminuir materialmente la longitud o libertad de las fibras de pulpa que pueden estar presentes en la suspensión.

En la segunda etapa, presión sobre el calibre para el rodillo rotativo se incrementó a 50 psi y la tolerancia entre las aspas del rodillo rotativo y las placas fijas disminuyó a entre 1 y 10 mm y aproximadamente una mitad del peso del rodillo de 16 toneladas (± 8 toneladas) fue disponible para contrarrestar la presión generada por las piezas a medida que se tuercen a través del intersticio entre el rodillo y la placa fija. Estas condiciones se mantuvieron durante 50 minutos.

Después del tratamiento, la fibra libre, los mazos de fibra y el material similar a fibras se separaron de la suspensión. Las muestras se examinaron microscópicamente y las fibras naturales o fibras de pulpa se separaron y midieron separadamente a partir de las fibras sintéticas. En este ejemplo, la longitud de fibra promedio se determinó como se describió previamente separando manualmente una muestra al azar de

fibras sintéticas y 20 fibras de pulpa, midiendo la longitud de las fibras individuales utilizando un microscopio, y luego calculando una longitud promedio. Las fibras recicladas resultantes y los materiales similares a fibra tuvieron las siguientes características:

- La longitud promedio de la fibra sintética era aproximadamente la misma longitud de las fibras de pulpa de madera. La longitud promedio de las fibras sintéticas fue de 3 a 78 mm. La longitud de las fibras individuales en la muestra estaban dentro del rango de desde 1,65 a 5,33 mm. Debe notarse que, antes del procesamiento, las fibras sintéticas inicialmente eran sustancialmente filamentos continuos de polipropileno que tienen longitudes indeterminadas que exceden de lejos 5,33 mm. La longitud de fibra promedio para el componente de pulpa fue de 2,7 mm. La longitud de las fibras de pulpa individuales en la muestra estaban dentro del rango de desde 1,35 a 3,81 mm. Las mediciones tomadas con un analizador de fibras Kajanni FS-200 indicaron una longitud aritmética promedio de 0,76 mm; una longitud promedio pesada de longitud de 1,72 mm; y una longitud promedio pesada de peso de 2,40 mm.
- La libertad de la fibra de pulpa de madera muestra una ligera reducción (aproximadamente 10 por ciento de desde alrededor de 860 mL hasta alrededor de 760 mL) indicando que alguna área superficial adicional se desarrolló sobre el componente de fibra de pulpa de madera del compuesto. Sin embargo no se afectó la longitud de la fibra.

- Las fibras sintéticas tienen incrementada o mayor área superficial como resultado de las áreas de unión de las fibras remanentes, cruces y áreas planas.

EJEMPLO 2

En este ejemplo, las fibras recicladas se prepararon a partir del mismo material compuesto enredado hidráulicamente que contiene pulpa de madera y un sustrato continuo de filamentos de polipropileno sintéticos unidos (por ejemplo, Workhorse® e Hydroknit® materiales de rápida absorbencia) que utilizan el método establecido en el Ejemplo 1. Las longitudes de fibra se controlaron como entre 1 y 5 mm. Una suspensión de las fibras recicladas se mezcló en línea con una mezcla de 60 por ciento, en peso, de pulpa kraft de madera dura (eucalipto) y 40 por ciento, en peso, de pulpa kraft de madera blanda (radiata pine) a un nivel de 5% en peso seco.

El suministro se formó en una hoja húmeda que tiene un peso base de 160 gramos por metro cuadrado (g/m²) usando un proceso de fabricación de papel de escribir convencional y luego secando al producto final. El producto resultante se comparó a un material de control preparado bajo las mismas condiciones usando los mismos materiales de pulpa virgen sin adición de materiales reciclados. Estos resultados se muestran en la Tabla 1 abajo:

TABLA 1

PROPIEDADES	Método de Prueba	Producto sin Material Reciclado (CONTROL)	Producto con 5% Material Reciclado
Peso base	TAPPI – T410	163 g/m ²	161,8 g/m ²
Espesor	TAPPI – T411	8,3 mils	8,4 mils
Rugosidad FS	TAPPI – T538	198 Sheff.	164 Sheff.
Rugosidad WS	TAPPI – T538	150 Sheff.	145 Sheff.

Porosidad	TAPPI – T489	94 Sheff.	71 Sheff.
Opacidad	TAPPI – T425	98,3 %	84,4 %
Tensión MD	TAPPI – T494	12 285 g/15mm	12 155 g/15mm
Tensión CD	TAPPI – T494	9 127 g/15mm	8 237 g/15mm
Elongación MD	TAPPI – T404	1,0 %	1,0 %
Elongación CD	TAPPI – T404	1,4 %	2,1 %
Resistencia a la Explosión	TAPPI – T403	51,2 psi	54,2 psi
Desgarre en seco MD	TAPPI – T414	140 g	144 g
Desgarre en seco CD	TAPPI – T414	156 g	148 g
Endurancia de plegado MD	TAPPI – T511	73 ciclos	115,5 ciclos
Endurancia de plegado CD	TAPPI – T511	59,5 ciclos	61,5 ciclos
Rigidez MD	TAPPI – T489	20,9 T.U.	21,0 T.U.
Rigidez CD	TAPPI – T489	12,6 T.U.	12,6 T.U.
Dennison FS	TAPPI – T459	18	18
Dennison WS	TAPPI – T459	18	18
PH	TAPPI – T509	8,7	8,7
Libertad	TAPPI – T227	670 mL	650 mL
F.L.T.	TAPPI – T232	5,7	3,2
Color L*	TAPPI – T527	52,54	92,71
Color a*	TAPPI – T527	-0,16	0,04
Color b*	TAPPI – T527	0,06	0,047
Brillantez	TAPPI – T525	82,04 %	81,9 %

Es evidente a partir de estos resultados que una hoja de papel que contiene 5 por ciento, en peso, del material reciclado que incluye fibras sintéticas tiene propiedades físicas esencialmente similares a la hoja de pupa virgen. En forma importante las fibras recicladas agregadas no afectan en detrimento la estabilidad y la eficiencia del proceso de elaboración de papel.

EJEMPLO 3

En este ejemplo, el material de partida era un sustrato unido de fibras de polipropileno fundidas sopladas disponibles en Kimberly-Clark Corporation bajo la designación comercial limpiador Kintex®. Este material contenía 100 por ciento de fibras de polipropileno fundidas sopladas y se desmenuzó en piezas que varían dentro del rango de desde 10 a 30 mm en longitud y 5 a 20 mm en ancho. Estas piezas se transfirieron a un proceso de formación de pulpa en un golpeador de

laboratorio del tipo Hollander (Ross Paper Machinery Company, Newark, NJ, Modelo RPM 15). La presión hidráulica y la tensión de corte mecánico se aplicaron en dos etapas.

La presión hidráulica y la tensión de corte se produjeron por la acción de bombeo creada por el rotor que fuerza el material húmedo contra las aspas fijas. El rodillo rotor era de aproximadamente $7 \frac{5}{8}$ de pulgada ($\pm 19,4$ cm) de diámetro. La cara de trabajo del rodillo era de 6 pulgadas ($\pm 15,4$ cm) de ancho con treinta y dos bar $\frac{3}{16}$ de pulgada ($\pm 4,8$ mm) de espesor. La placa de lecho contenía siete bar $\frac{1}{8}$ de pulgada ($\pm 3,2$ mm) de espesor, espaciado $\frac{3}{32}$ de pulgada ($\pm 2,4$ mm) aparte para formar una "V" a 5 grados en el centro de la placa de lecho.

En la etapa uno el peso, o carga aplicada al rotor se estableció a 0 kg durante 12 minutos, la consistencia se estableció a 1%, y se agregó un agente de des-espumado para controlar la generación de espuma. Durante la primera etapa, el material desmenuzado se humedeció para obtener flujo libre del material a través del rodillo rotativo y la placa de lecho. Durante la segunda etapa, el peso o carga en el rodillo rotativo se incrementó a 5,2 kg durante 23 minutos y luego a 2, 8 kg durante 85 minutos. Las condiciones durante la segunda etapa produjeron pequeñas zonas de muy alta presión entre las cuchillas en el rodillo rotativo y la placa de lecho para crear acción de micro-estallido en los mazos de fibra sintética desmenuzada para fluir aparte y reducir la longitud resultante de la fibra sintética. Con estas condiciones del proceso las fibras resultantes tienen las siguientes características:

- Las fibras obtenidas consisten de una mezcla de algunas fibras individuales, mazos de fibras, pequeños segmentos que tienen aún puntos de unión, rizos, capas abiertas de fibras, y áreas planas.
- La longitud promedio de las fibras sintéticas y los mazos de fibras fue de 2,84 mm. Las longitudes variaron dentro del rango de desde 0,6 a 6,1 mm.

Las fibras fundidas sopladas recicladas se mezclaron con una mezcla de 60 por ciento, en peso, de pulpa kraft de madera dura (eucalipto) y 40 por ciento, en peso, de pulpa kraft de madera blanda (radiata pine) a un nivel de 5% en peso seco. Este suministro se formó en una hoja húmeda que tiene un peso base de 90 g/m², en un formador de hojas manuales de laboratorio convencional, luego se prensó en una prensa de laboratorio y finalmente se secó. El producto resultante se comparó con un material de control preparado bajo las mismas condiciones usando los mismos materiales de pulpa virgen pero sin agregar materiales reciclados. Estos resultados se muestran la Tabla 2 abajo:

TABLA 2

PROPIEDADES	Método de Prueba	Hoja manual sin material reciclado	Hoja manual con 5% de material reciclado
Peso base	TAPPI – T410	90,4 g/m ²	90,0 g/m ²
Tamaño, Probador de Tamaño Hercules	TAPPI – T530	4 s	11 s
Tensión	TAPPI – T494	6 082 g/15mm	4 957 g/15mm
Elongación	TAPPI – T404	0,6 %	0,6 %
Resistencia a explosión	TAPPI – T403	44 psi	31 psi
Desprendido en seco	TAPPI – T414	25 g	25 g
Endurancia plegado	TAPPI – T511	97 ciclos	34 ciclos

Aún si la hoja de papel que incorpora las fibras fundidas sopladas recicladas exhibe menores niveles de algunas propiedades mecánicas en comparación con el material de control, la hoja de papel que contiene las

fibras recicladas se considera aún que tiene generalmente buenas características físicas y es adecuada para papeles de escritura y otros tipos de papeles.

Aunque la invención se ha descrito en detalle con respecto a sus específicas modalidades, se apreciará que aquellos expertos en el arte, al lograr un entendimiento de lo anterior pueden concebir fácilmente alteraciones, variaciones y equivalentes a estas modalidades. De acuerdo con lo anterior, el alcance de la presente invención debe tomarse de las reivindicaciones del apéndice y cualquiera de sus equivalentes.

REIVINDICACIONES

Reivindicamos:

1. Un método de reciclar materiales fibrosos unidos, el método que comprende:

proporcionar piezas de materiales fibrosos unidos, las piezas que tienen tamaños que están adaptados para suspensión en un líquido;

suspender las piezas individuales de materiales fibrosos unidos en un líquido;

aplicar trabajo mecánico a la suspensión líquida de piezas individuales para generar condiciones de presión hidráulica y tensión de corte mecánica suficientes para fragmentar hidráulicamente el material fibroso unido en fibras y componentes similares a fibras; y

separar sustancialmente fibras individuales y componentes similares a fibras del líquido.

2. El proceso de la reivindicación 1 donde la etapa de proporcionar piezas individuales de materiales fibrosos unidos comprende una operación para reducir el tamaño de los materiales fibrosos unidos unitarios en piezas individuales que están adaptadas para suspensión en un líquido, la operación que se selecciona a partir de desmenuzado mecánico, corte mecánico, desgarrado mecánico, molido mecánico, corte por chorro de agua, corte por láser, granulado y sus combinaciones.

3. El proceso de la reivindicación 1 donde el trabajo mecánico es aplicado a la suspensión líquida utilizando una combinación de aspas montadas en un rodillo rotativo y aspas montadas en una placa fija para generar áreas de muy alta presión hidráulica y tensión de corte mecánico.

4. El proceso de la reivindicación 3 donde las aspas montadas en la placa fija están alineadas a un ángulo en por lo menos una dimensión con respecto a la dirección de rotación de las aspas rotativas.

5. El proceso de la reivindicación 4 donde el ángulo está entre 20 grados y 70 grados.

6. El proceso de la reivindicación 1 donde el trabajo mecánico se aplica a la suspensión en múltiples etapas.

7. El proceso de la reivindicación 6 donde el trabajo mecánico se aplica a la suspensión utilizando una primera etapa bajo condiciones para generar presión hidráulica y tensión de corte mecánico suficientes para humedecer las piezas de materiales fibrosos unidos y separar por lo menos algunas porciones de fibras y componentes similares de los materiales unidos y utilizar una segunda etapa bajo condiciones para generar condiciones de presión hidráulica y tensión de corte mecánico suficientes para romper los materiales fibrosos unidos, fibras y componentes similares a fibras en fibras sustancialmente individuales y componentes similares a fibras.

8. El proceso de la reivindicación 6 donde la tolerancia entre las aspas rotativas y las aspas fijas en el punto más cercano durante la primera etapa está entre alrededor de 20 milímetros y alrededor de 100 milímetros y entre alrededor de 1 milímetro y alrededor de 20 milímetros durante la segunda etapa.

9. El proceso de la reivindicación 1 donde la cantidad de trabajo mecánico aplicado a la suspensión líquida es mayor de alrededor de 6

HP → NO SIC / 44 4

caballos de fuerza - 24 horas por día por tonelada seca de material fibroso
unido.

10. El proceso de la reivindicación 1 donde los materiales fibrosos unidos se seleccionan a partir de telas no tejidas, telas anudadas, sustratos no tejidos y sus combinaciones.

11. El proceso de la reivindicación 10, donde los sustratos no tejidos son sustratos que están térmicamente unidos, adhesivamente unidos, enredados mecánicamente, unidos por solvente, enredados hidráulicamente y sus combinaciones.

12. El proceso de la reivindicación 1 donde los materiales fibrosos unidos están compuestos de materiales fibrosos sintéticos, materiales fibrosos naturales, y sus combinaciones.

13. El proceso de la reivindicación 12 donde el material fibroso sintético incluye fibras y filamentos termoplásticos.

14. El proceso de la reivindicación 1 donde las fibras sustancialmente individuales y los componentes similares a fibras tienen una distribución de longitud relativamente uniforme.

15. El proceso de la reivindicación 14, donde la fibra y el material similar a fibra tiene una distribución de longitud que se expande aproximadamente 7 milímetros.

16. La fibra y el material similar a fibra producidos de acuerdo con el proceso de la reivindicación 1.

17. Las fibras sintéticas recicladas y el material similar a fibras que comprende:

por lo menos un elemento de hebras delgadas compuesto de material sintético que tiene por lo menos una distorsión irregular generada por la fractura hidráulica del elemento de hebras delgadas para separarlo de un material fibroso pegado con el material fibroso pegado suspendido en un líquido.

18. Las fibras sintéticas recicladas y el material similar a fibras de la reivindicación 17, donde el elemento de hebras delgadas tiene una longitud que varía dentro del rango desde alrededor de 1 milímetro hasta alrededor de 15 milímetros.

19. Las fibras sintéticas recicladas y material similar a fibras de la reivindicación 18, donde el elemento de hebras delgadas tiene una longitud que varía dentro del rango desde alrededor de 1,5 a alrededor de 10 milímetros.

20. Las fibras sintéticas recicladas y el material similar a fibras de la reivindicación 18, donde el elemento de hebras delgadas tiene una longitud que varía dentro del rango de desde alrededor de 2 hasta alrededor de 5 milímetros.

21. Las fibras sintéticas recicladas y el material similar a fibras de la reivindicación 17, donde las distorsiones irregulares son de forma de combas en el elemento de hebras delgadas, segmentos aplanados de elemento de hebras delgadas, segmentos expandidos de elemento de hebras delgadas y sus combinaciones.

22. Las fibras sintéticas recicladas y el material similar a fibras de la reivindicación 17, donde los elementos de hebras delgadas de los materiales reciclados tienen áreas superficiales que son mayores que los elementos de hebras delgadas en el material fibroso unido comparable antes de la fractura hidráulica del elemento de hebras delgadas para separarlo del material fibroso unido.

23. Las fibras sintéticas recicladas y material similar a fibra de la reivindicación 22, donde las áreas superficiales de los elementos de hebras delgadas reciclados son por lo menos alrededor de 5 por ciento mayores.

24. Las fibras sintéticas recicladas y el material similar a fibras de la reivindicación 23, donde el material sintético es un material termoplástico sintético.

25. Un sustrato fibroso no tejido que comprende las fibras sintéticas recicladas y material similar a fibra de la reivindicación 17.

26. El sustrato fibroso no tejido de la reivindicación 25 donde el sustrato se forma utilizando un proceso de formación de sustrato seleccionado a partir de formación en húmedo, formación en seco, formación de espuma y sus combinaciones.

27. El sustrato fibroso no tejido de la reivindicación 25 donde el sustrato incluye adicionalmente materiales fibrosos naturales no reciclados, materiales sintéticos naturales no reciclados, materiales fibrosos naturales reciclados, material particulado y sus combinaciones.

PATENT COOPERATION TREATY

27

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

RECIBIDO

PCT

To:

BRIGARD & CASTRO
Carrera 7 No.16 - 56
piso 9
P.O. Box 3692
Bogotá
COLOMBIE

13 ENE 2003

BRIGARD & CASTRO
NOTIFICATION OF TRANSMITTAL OF
INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing
(day/month/year)

18/12/2002

Applicant's or agent's file reference

./.

IMPORTANT NOTIFICATION

International application No.

PCT/IB 01/02770

International filing date (day/month/year)

06/11/2001

Priority date (day/month/year)

10/11/2000

Applicant

COLOMBIANA KIMBERLY COLPAPEL S.A.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the IPEA/



European Patent Office
D-80298 Munich
Tel. (+49-89) 2399-0, Tx: 523656 epmu d
Fax: (+49-89) 2399-4465

Authorized officer

MARRA E

Tel. (+49-89) 2399 2828



PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

(Rationalised Report according to the Notice of the President of the EPO published in the OJ11/2001)

Applicant's or agent's file reference ./.	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/IB 01/ 02770	International filing date (day/month/year) 06/11/2001	Priority date (day/month/year) 10/11/2000
International Patent Classification (IPC) or national classification and IPC D21B1/32		
Applicant COLOMBIANA KIMBERLY COLPAPEL S.A.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This **REPORT** consists of a total of 2 sheets, including this cover sheet.
- ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

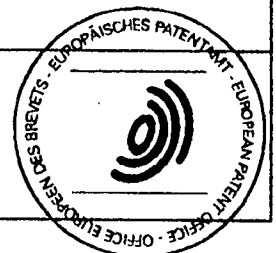
These annexes consists of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 03/06/2002	Date of completion of this report 13/12/2002
Name and mailing address of the IPEA/  European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465	Authorized officer LEFEBVRE L J F Tel. (+49-89) 2399 2828

Form PCT/IPEA/409 (cover sheet) P20476 (October 2002)



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I. Basis of the report

The basis of this international preliminary examination is the application as originally filed.

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability

In light of the documents cited in the international search report, it is considered that the invention as defined in the claims meets the criteria mentioned in Article 33 (1) PCT, i.e. it appears to be novel, to involve an inventive step and to be industrially applicable.

PATENT COOPERATION TREATY

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From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

CASTRO DUQUE, Ramiro
Carrera 7 No.16
56 piso 9
3692 Bogotá
COLOMBIE

NOTIFICATION OF RECEIPT OF DEMAND BY COMPETENT INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

(PCT Rules 59.3(c) and 61.1(b), first sentence
and Administrative Instructions, Section 601(a))

Date of mailing
(day/month/year)

1 0. 07. 02

Applicant's or agent's file reference

./.

IMPORTANT NOTIFICATION

International application No.

PCT/IB 01/02770

International filing date (day/month/year)

06/11/2001

Priority date (day/month/year)

10/11/2000

Applicant

COLOMBIANA KIMBERLY COLPAPEL S.A.

1. The applicant is hereby notified that this International Preliminary Examining Authority considers the following date as the date of receipt of the demand for international preliminary examination of the international application:

+ 1st page of IPEA 401: correction on appl.
03/06/2002

2. This date of receipt is:

- ☒ the actual date of receipt of the demand by this Authority (Rule 61.1(b)).
☐ the actual date of receipt of the demand on behalf of this Authority (Rule 59.3(e)).
☐ the date on which this Authority has, in response to the invitation to correct defects in the demand (Form PCT/IPEA/404), received the required corrections.

3. ☐ **ATTENTION:** That date of receipt is **AFTER** the expiration of 19 months from the priority date. Consequently, the election(s) made in the demand does (do) not have the effect of postponing the entry into the national phase until 30 months from the priority date (or later in some Offices) (Article 39(1)). Therefore, the acts for entry into the national phase must be performed within 20 months from the priority date (or later in some Offices) (Article 22). For details, see the *PCT Applicant's Guide*, Volume II.

- ☐ (If applicable) This notification confirms the information given by telephone, facsimile transmission or in person on:

4. Only where paragraph 3 applies, a copy of this notification has been sent to the International Bureau.

Name and mailing address of the IPEA/



European Patent Office
D-80298 Munich
Tel. (+49-89) 2399-0, Tx: 523656 epmu d
Fax: (+49-89) 2399-4465

Authorized officer

DUPONT-HUEPER M

Tel. (+49-89) 2399-7952



The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ EP

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only		
Identification of IPI:A		Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference
International application No. PCT/IB01/02770	International filing date (day/month/year) 06.11.2001	(Earliest) Priority date (day/month/year) 10.11.2000
Title of invention METHOD OF RECYCLING BONDED FIBROUS MATERIALS AND SYNTHETIC FIBERS AND FIBER-LIKE MATERIALS PRODUCED THEREOF		
Box No. II APPLICANT(S)		
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) COLOMBIANA KIMBERLY COLPAPEL S.A.		Telephone No. (074) 3210930
		Facsimile No. 3211477
		Teleprinter No.
		Applicant's registration No. with the Office
State (that is, country) of nationality: CO		State (that is, country) of residence: CO
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) COLOMBIANA KIMBERLY COLPAPEL S.A. Carrera 43A 1A sur - 143, Torre sur, Oficina 413 Medellin Colombia		
State (that is, country) of nationality: CO		State (that is, country) of residence: CO
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)		
State (that is, country) of nationality:		State (that is, country) of residence:
☐ Further applicants are indicated on a continuation sheet.		

Sheet No. . . .

International application No. **Continuation of Box No. II APPLICANT(S)***If none of the following sub-boxes is used, this sheet should not be included in the demand.*Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*State *(that is, country)* of nationality:State *(that is, country)* of residence:Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*State *(that is, country)* of nationality:State *(that is, country)* of residence:Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*State *(that is, country)* of nationality:State *(that is, country)* of residence:Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*State *(that is, country)* of nationality:State *(that is, country)* of residence:☐ Further applicants are indicated on another continuation sheet.

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Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: *(Family name followed by given name; for a legal entity, full official designation.
The address must include postal code and name of country.)*CASTRO DUQUE, RAMIRO
Carrera 7 No. 16-56 Piso 9
3692 Bogotá D.C.
Colombia

Telephone No.

3802200

Facsimile No.

3802700

Teleprinter No.

Agent's registration No. with the Office

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filedthe description ☒ as originally filed
☐ as amended under Article 34the claims ☒ as originally filed
☐ as amended under Article 19 (together with any accompanying statement)
☐ as amended under Article 34the drawings ☒ as originally filed
☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: ENGLISH☒ which is the language in which the international application was filed.☐ which is the language of a translation furnished for the purposes of international search.☐ which is the language of publication of the international application.☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.**Box No. V ELECTION OF STATES**

The applicant hereby elects all eligible States (that is, all States which have been designated and which are bound by Chapter II of the PCT)

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (specify) | : | sheets |

For International Preliminary
Examining Authority use only

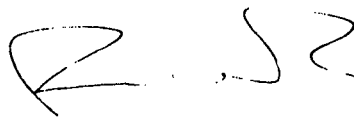
received	not received
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐

The demand is also accompanied by the item(s) marked below:

- | | |
|--|--|
| 1. ☐ fee calculation sheet | 5. ☐ statement explaining lack of signature |
| 2. ☐ original separate power of attorney | 6. ☐ sequence listing in computer readable form |
| 3. ☐ original general power of attorney | 7. ☐ other (specify): |
| 4. ☐ copy of general power of attorney; reference number, if any: | |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).



RAMIRO CASTRO DUQUE

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

NOTES TO THE DEMAND FORM (PCT/IPEA/401)

These Notes are intended to facilitate the filling in of the demand form and to give some information concerning international preliminary examination under Chapter II of the Patent Cooperation Treaty (PCT). For more detailed information, see the *PCT Applicant's Guide*, a WIPO publication, which is available, together with other PCT related documents, at WIPO's Website: www.wipo.int/pct/en/index.html. The Notes are based on the requirements of the PCT, the Regulations and the Administrative Instructions under the PCT. In case of any discrepancy between these Notes and those requirements, the latter are applicable.

In the demand form and these Notes, "Article", "Rule" and "Section" refer to the provisions of the PCT, the PCT Regulations and the Administrative Instructions, respectively.

Please use a typewriter; check-boxes may be marked by hand with dark ink (Rules 11.9(a) and (b) and 11.14).

The demand form and these Notes may be downloaded from WIPO's Website at the address given above.

IMPORTANT GENERAL INFORMATION

Who May File a Demand? (Article 31(2)(a) and Rule 54): A demand (for international preliminary examination) may only be filed by an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II of the PCT; furthermore, the international application must have been filed with a receiving Office of, or acting for, a State bound by Chapter II. Where there are two or more applicants (for the same or different elected States) at least one of them must qualify.

Where Must the Demand Be Filed? (Article 31(6)(a)): The demand must be filed with a competent International Preliminary Examining Authority (IPEA). The receiving Office with which the international application was filed will, upon request, give information about the competent IPEA (or see the *PCT Applicant's Guide*, Volume I/B, Annex C). If several IPEAs are competent, the applicant has the choice and the demand must be filed with (and the fees must be paid to) the IPEA chosen by the applicant. The IPEA chosen by the applicant may be identified, preferably by an indication of the name or two-letter code of the IPEA, at the top of the first sheet of the demand in the space provided for that purpose.

When Must the Demand Be Filed? (Article 39(1)): The demand must be filed before the expiration of 19 months from the priority date in order to extend the time limit for entering the national phase of the PCT procedure from 20 to 30 months from the priority date. *Warning:* if the demand is filed later, the national phase will not be delayed in respect of the elected States and the applicant must enter the national phase before the expiration of the time limit applicable under Article 22 (which is usually 20 months from the priority date).

In Which Language Must the Demand Be Filed? (Rule 55.1): The demand must be filed in the language in which international preliminary examination will be carried out (see Notes to Box No. IV).

What is the Language of Correspondence? (Rules 66.9 and 92.2 and Section 104): Any letter from the applicant to the IPEA must be in the same language as the international application to which it relates. However, where the international preliminary examination will be carried out on the basis of a translation (see Notes to Box No. IV), any letter from the applicant to the IPEA must be in the language of the translation. The IPEA may authorize the use of other languages for letters which do not contain or relate to amendments of the international application. Any letter from the applicant to the International Bureau must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

Which Fees Must Be Paid and When? (Rules 57 and 58):

Two fees are due in respect of the international preliminary examination: the preliminary examination fee and the handling fee. Both fees must be paid to the IPEA within one month from the date on which the demand is submitted. The Fee Calculation Sheet should be used for that purpose. For details concerning the payment of the fees, see the Notes to that Sheet.

BOX No. I

Applicant's or Agent's File Reference: A file reference may be indicated, if desired. It should not exceed 12 characters. Characters in excess of 12 may be disregarded (Section 109).

Identification of the International Application (Rule 53.6): The international application number must be indicated in Box No. I. Where the demand is filed at a time when the international application number has not yet been notified by the receiving Office, the name of that Office must be indicated instead of the international application number.

International Filing Date and (Earliest) Priority Date (Section 110): Dates must be indicated by the Arabic number of the day, the name of the month and the Arabic number of the year—in that order; after, below or above such indication, the date should be repeated in parentheses, using two-digit Arabic numerals for each of the number of the day, the number of the month and the last two digits of the year, in that order, and separated by periods, slants or hyphens, for example, "20 March 2001 (20.03.01)", "20 March 2001 (20/03/01)" or "20 March 2001 (20-03-01)". Where the international application claims the priority of several earlier applications, the filing date of the earliest application whose priority is claimed must be indicated as the priority date.

Title of the Invention: If a new title has been established by the International Searching Authority, that title must be indicated in Box No. I.

BOX No. II

Applicant(s) (Rule 53.4): All the applicants for the elected States must be indicated in the demand; an applicant named in the request (Form PCT/RO/101) for a State which is not elected need not be named in the demand. It should be noted that the persons named as "inventor only" in the request need not be named in the demand.

Make in Box No. II of the demand the required indications as appearing in Boxes Nos. II and III of the request. The Notes to the request apply *mutatis mutandis*. If there are two or more applicants for the States elected in the demand, give the required indications for each of them; if there are more than

three applicants, make the required indications on the "Continuation Sheet".

If different applicants are indicated in the request for different designated States, indicate in Box No. II of the demand only the applicants for the States elected in Box No. V (no indication of the States for which a person is applicant need be made, because those indications have been made in the request).

Applicant's registration number with the Office (Rule 53.4): Where the applicant is registered with the national or regional Office that is acting as International Preliminary Examining Authority, the demand may indicate the number or other indication under which the applicant is so registered.

BOX No. III

Agent or Common Representative (Rules 53.5, 90.1 and 90.2): Mark the applicable check-boxes to indicate *first* whether the person named in this Box is agent or common representative, *then* whether that person *has been appointed earlier* (i.e., during the procedure under Chapter I), or *is appointed in the demand* and any earlier appointment of another person is revoked, or *is appointed specifically for the procedure before the IPEA* (without revocation of any earlier appointment), in addition to the person(s) appointed earlier.

Where an additional person is appointed specifically for the procedure before the IPEA, all notifications issued by the IPEA will be addressed only to that additional person.

A separate power of attorney must be filed with the IPEA, the International Bureau or the receiving Office, if the person appointed at the time the demand is filed (i.e., was not appointed earlier) signs the demand on behalf of the applicant (Rule 90.4).

Agent's registration number with the Office (Rule 53.5): Where the agent is registered with the national or regional Office that is acting as International Preliminary Examining Authority, the demand may indicate the number or other indication under which the agent is so registered.

Address for Correspondence (Rule 4.4(d) and Section 108): Where an agent is appointed, any correspondence intended for the applicant will be sent to the address indicated for that agent (or for the first-mentioned agent, if more than one is appointed). Where one of two or more applicants is appointed as common representative, the address indicated for that applicant in Box No. III will be used.

Where no agent or common representative is appointed, any correspondence will be sent to the address, indicated in Box No. II, of the applicant (if only one person is named as applicant) or of the applicant who is considered to be common representative (if there are two or more persons named as applicants). However, if the applicant wishes correspondence to be sent to a different address in such a case, that address may be indicated in Box No. III instead of the designation of an agent or common representative. In this case, and only in this case, the last check-box of Box No. III must be marked (that is, the last check-box must not be marked if either of the check-boxes "agent" or "common representative" in Box No. III has been marked).

BOX No. IV

Statement Concerning Amendments (Rules 53.2(a)(v), 53.9, 62, 66.1 and 69.1): The international preliminary examination will start on the basis of the international application

as filed or, if amendments have been filed, as amended. Mark the appropriate check-box(es) to enable the IPEA to determine when and on what basis it can start international preliminary examination.

Mark the corresponding check-box(es) under No. 1 where the international preliminary examination should start on the basis of the international application as originally filed or where amendments are to be taken into account, as the case may be. Where amendments are to be taken into account, the applicant must submit *with the demand* a copy of amendments to the claims under Article 19 (Rule 53.9(a)(i)) and/or the amendments of the international application under Article 34 (Rule 53.9(c)), as the case may be. If a check-box is marked but the demand is not accompanied by the documents referred to, the start of international preliminary examination will be delayed until the IPEA receives them.

Mark check-box No. 2 if amendments of the claims under Article 19 have been filed with the International Bureau during the Chapter I procedure, but the applicant does not want these amendments to be taken into account for the purpose of international preliminary examination when the latter starts (Rule 53.9(a)(ii)).

Mark check-box No. 3 where the time limit for filing amendments of the claims under Article 19 has not expired at the time the demand is filed and the applicant wants to keep the option for the filing of such amendments open; the IPEA is thus requested to postpone the start of international preliminary examination (Rules 53.9(b) and 69.1(d)). It should be noted that the examination will start in any event after the expiration of 20 months from the priority date even where the time limit for filing amendments has not yet expired or no amendments have been received by the IPEA.

If no check-box is marked, refer to the footnote at the bottom of the Box.

Language for the Purposes of International Preliminary Examination (Rule 55.2): Where neither the language in which the international application is filed nor the language in which the international application is published is accepted by the IPEA that is to carry out the international preliminary examination, the applicant must furnish with the demand a translation of the international application into a language which is both a language accepted by that Authority and a language of publication.

Where such translation has already been furnished to the International Searching Authority for the purposes of carrying out international search and the IPEA is part of the same Office or intergovernmental organization as the International Searching Authority, the applicant need not furnish another translation. In such a case the international preliminary examination is carried out on the basis of the translation furnished for the purposes of international search.

The language for the purposes of international preliminary examination should be indicated in Box No. IV, on the dotted line, and the corresponding check-box should be marked.

Language of Amendments (Rules 55.3 and 66.9): Amendments and letters relating thereto must be in the same language as that in which the international preliminary examination is carried out, as explained in the preceding paragraphs.

Time Limit for Furnishing Translation of the International Application (Rule 55.2): Any required translation of the international application should be furnished (by the applicant) together with the demand. If it is not so furnished, the IPEA will invite the applicant to furnish it within a time limit which shall not be less than one month from the date of the invitation. That time limit may be extended by the IPEA.

BOX No. V

Election of States (Rule 53.7): Only States which are bound by Chapter II of the PCT and which have been designated in the international application (that is, States whose designations have been made under Rule 4.9(a), confirmed under Rule 4.9(c) or considered as having been made under Rule 32.2(a)(i)) can be elected. They are the "eligible States".

For the convenience and protection of applicants, Box No. V contains a statement to the effect that all eligible States are elected. It is only where the applicant does not wish to elect certain eligible States that the name(s) or two-letter code(s) of those States must be indicated after the words "wishes not to elect:".

The indication in the demand of the kind of protection or treatment desired for any elected State is not required since it follows the indication made when designating that State in the international application.

BOX No. VI

Check List: It is recommended that this Box be filled in carefully in order for the IPEA to determine as soon as possible whether it is in possession of the documents on the basis of which the applicant wishes international preliminary examination to start.

Where the international application contains disclosure of one or more nucleotide and/or amino acid sequences, and a copy of the sequence listing in computer readable form complying with the standard provided for in the Administrative Instructions is required by the IPEA, the applicant may furnish the listing in computer readable form to the IPEA with the demand. If this is the case, check-box No. 5 must be marked.

BOX No. VII

Signature (Rules 53.8, 90.3(a) and 90.4(a)): The demand must be signed by the applicant or by his agent; if there are two or more applicants, the common representative may sign the demand. If the demand is not signed by (all) the persons who are applicants for the elected States (a person who is applicant only for a State which is not elected need not sign the demand), a power of attorney signed by that (all those) applicant(s) must be filed with the IPEA, with the International Bureau or with the receiving Office unless the agent has previously been appointed.

A

**NOTES TO THE FEE CALCULATION SHEET
(ANNEX TO FORM PCT/IPEA/401)**

The purpose of the fee calculation sheet is to help the applicant to identify the prescribed fees and to calculate the amounts to be paid. It is strongly recommended that the applicant complete, by entering the appropriate amounts in the boxes provided, and submit the fee calculation sheet at the time of filing of the demand. This will help the International Preliminary Examining Authority (IPEA) to verify the calculations and to identify any error in them.

CALCULATION OF PRESCRIBED FEES

Two fees must be paid for international preliminary examination:

- (i) the preliminary examination fee for the benefit of the IPEA (Rule 58.1);
- (ii) the handling fee for the benefit of the International Bureau (Rule 57).

Both fees must be paid to the IPEA within one month from the date on which the demand is submitted. The amount payable is the amount applicable on the date of submittal (Rules 57.3 and 58.1(b)). The fees must be paid in a currency acceptable to the IPEA.

Information about the amount of those fees or about equivalent amounts in other currencies can be obtained from the IPEA or the receiving Office. This information is also published in the *PCT Applicant's Guide*, Volume I/B, Annex E, and from time to time in Section IV of the *PCT Gazette*.

Box P: The amount of the preliminary examination fee must be entered in Box P.

Box H: The amount of the handling fee must be entered in Box H.

Reduction of the Handling Fee for Applicants from Certain States: An applicant who is a natural person and who is a national of and resides in a State whose per capita national income is below 3,000 US dollars (according to the average per capita national income figures used by the United Nations for determining its scale of assessments for the contributions payable for the years 1995, 1996 and 1997) is entitled, in accordance with the Schedule of Fees, to a reduction of 75% of certain PCT fees including the handling fee. If there are several applicants, each must satisfy the above-mentioned criteria. The reduction of the handling fee will be automatically available to any applicant (or applicants) who is (or are) so entitled on the basis of the indications of name, nationality and residence given in Box No. II of the demand.

The fee reduction will be available even if one or more of the applicants are not from PCT Contracting States, provided that each of them is a national and resident of a State that meets the above-mentioned requirements and that at least one of the applicants is a national or resident of a PCT Contracting State and thus is entitled to file an international application.

Natural persons who are nationals of and reside in the following PCT Contracting States are eligible: AL Albania, AM Armenia, AZ Azerbaijan, BA Bosnia and Herzegovina, BF Burkina Faso, BG Bulgaria, BJ Benin, BR Brazil, BY Belarus, BZ Belize, CF Central African Republic,

CG Congo, CI Côte d'Ivoire, CM Cameroon, CN China, CO Colombia, CR Costa Rica, CU Cuba, CZ Czech Republic, DM Dominica, DZ Algeria, EC Ecuador, EE Estonia, GA Gabon, GD Grenada, GE Georgia, GH Ghana, GM Gambia, GN Guinea, GQ Equatorial Guinea, GW Guinea-Bissau, HR Croatia, HU Hungary, ID Indonesia, IN India, KE Kenya, KG Kyrgyzstan, KP Democratic People's Republic of Korea, KZ Kazakhstan, LC Saint Lucia, LK Sri Lanka, LR Liberia, LS Lesotho, LT Lithuania, LV Latvia, MA Morocco, MD Republic of Moldova, MG Madagascar, MK The former Yugoslav Republic of Macedonia, ML Mali, MN Mongolia, MR Mauritania, MW Malawi, MX Mexico, MZ Mozambique, NE Niger, PH Philippines, PL Poland, RO Romania, RU Russian Federation, SD Sudan, SK Slovakia, SL Sierra Leone, SN Senegal, SZ Swaziland, TD Chad, TG Togo, TJ Tajikistan, TM Turkmenistan, TN Tunisia, TR Turkey, TZ United Republic of Tanzania, UA Ukraine, UG Uganda, UZ Uzbekistan, VN Viet Nam, YU Yugoslavia, ZA South Africa, ZM Zambia and ZW Zimbabwe. As far as other States are concerned, inquiries should be addressed to the International Bureau.

Calculation of the Handling Fee in Case of Fee Reduction: Where the applicant is (or all applicants are) entitled to a reduction of the handling fee, the total to be entered at Box H is 25% of the handling fee.

Total Box: The total of the amounts inserted in Boxes P and H is the amount which must be paid to the IPEA.

MODE OF PAYMENT

In order to help the IPEA identify the mode of payment of the prescribed fees, it is recommended to mark the applicable check-box(es).

**AUTHORIZATION TO CHARGE
(OR CREDIT) DEPOSIT ACCOUNT**

The applicant should check whether the IPEA allows the use of deposit accounts for payment of PCT fees. In addition, it is recommended that the applicant check what are the specific conditions applicable to the use of deposit accounts with the IPEA since not all IPEAs provide the same services.

Finally, if the IPEA is not the same national Office or intergovernmental organization as that with which the international application was filed, the deposit account with the receiving Office cannot be charged for the purpose of paying the preliminary examination and handling fees due to the IPEA.

The IPEA will not charge fees to deposit accounts unless the deposit account authorization is signed and indicates the deposit account number.

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ EP

EPO - Munich
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03. Juni 2002

CHAPTER II

PCT

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only		
Identification of IPEA EP		Date of receipt of DEMAND 03-06-2002
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference
International application No. PCT/IB01/02770	International filing date (day/month/year) 06.11.2001	(Earliest) Priority date (day/month/year) 10.11.2000
Title of invention METHOD OF RECYCLING BONDED FIBROUS MATERIALS AND SYNTHETIC FIBERS AND FIBER-LIKE MATERIALS PRODUCED THEREOF		
Box No. II APPLICANT(S)		
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) COLOMBIANA KIMBERLY COLPAPEL S.A.		Telephone No. (074) 3210930
		Facsimile No. 3211477
		Teleprinter No.
		Applicant's registration No. with the Office
State (that is, country) of nationality: CO		State (that is, country) of residence: CO
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) [COLOMBIANA KIMBERLY COLPAPEL S.A.] [Carrera 43A 1A sur - 143, Torre sur,] [Oficina 413] [Medellín] [Colombia]		
State (that is, country) of nationality: [CO]		State (that is, country) of residence: [CO]
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)		
State (that is, country) of nationality:		State (that is, country) of residence:
☐ Further applicants are indicated on a continuation sheet.		

PATENT COOPERATION TREATY

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From the INTERNATIONAL SEARCHING AUTHORITY

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT
OR THE DECLARATION

(PCT Rule 44.1)

To:

CASTRO DUQUE, Ramiro
Carrera 7 No.16
56 piso 9
3692 Bogotá
COLOMBIA

Date of mailing
(day/month/year)

23/09/2002

Applicant's or agent's file reference

85796

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/IB 01/02770

International filing date

(day/month/year)

09/11/2001

Applicant

COLOMBIANA KIMBERLY COLPAPEL S.A.

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the International application, or of the priority claim, must reach the International Bureau as provided in Rules 90*bis*.1 and 90*bis*.3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Amélie M[^]ller

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

NOTES TO FORM PCT/ISA/220 (continued)

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The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

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AFFIDAVIT

The undersigned deponents being duly sworn, deposes and says:

1. That Gustavo Palacio, Maria Clara Garcia, Pablo Ramirez, and Bernardo Vanegas assigned all right, title, and interest to Colombiana Kimberly Colpapel, S.A., as indicated in the Assignment. The assignment was executed by, Pablo Ramirez on November 15, 2001; Bernardo Vanegas on December 3, 2001; Gustavo Palacio on December 4, 2001; and Maria Clara Garcia on December 13, 2001; pertaining to US Application No. 60/247,321 filed November 10, 2000 of which a true and correct copy is attached hereto, as well as all applications filed outside of the US which claim priority to US Application No. 60/247,321 filed November 10, 2000.
2. That the application referenced above, (60/247,321), is the priority document associated with filing of the Argentina Patent Application No. 010105215; and
3. That Gustavo Palacio, Maria Clara Garcia, Pablo Ramirez, and Bernardo Vanegas have assigned all right, title and interest to said applicants prior to the filing of the Argentina Patent Application No. 010105215.

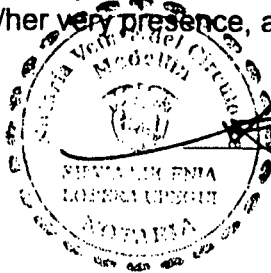
Dated:

Gustavo Palacio
Gustavo Palacio
Pablo Ramirez
Pablo Ramirez

Maria Clara Garcia
Maria Clara Garcia
Bernardo Vanegas
Bernardo Vanegas

On this 14 day of January, 2002, in Medellin, Colombia, personally appeared **Gustavo Palacio, Maria Clara Garcia, Pablo Ramirez, and Bernardo Vanegas** before me, a Notary Public in and for the city of Medellin, Colombia to me known, and known to be the persons who executed the foregoing document.

The undersigned Notary Public hereby certifies and ATTESTS THAT the deponents signed the foregoing Assignment in his/her very presence, and such signatures are therefore genuine.

 [Signature]
Notary Public

104

REPUBLICA DE COLOMBIA
APOSTILLE
(Convention de la Haye du 5 octobre 1961)

País: República de Colombia

El presente documento público

Ha sido firmado por: MILTON CONTRERAS AMELA

Actuando en calidad de: COORDINADOR ACTIVIDADES NOTARIALES

Lleva el sello / estampilla de: SUPERINTENDENCIA DE NOTARIADO Y REGISTRO

Certificado

En: Bogotá, D. C.

El: JUEVES, 17 DE ENERO DE 2002

Por: Legalizaciones del Ministerio de Relaciones Exteriores.

Bajo el No: 257612

NO. DE HOJAS: 1
CP 94522

Firma

Para mayor información consulte www.mitrext.gov.co/Apostilla
con el número que aparece al lado de la firma.

02238763

VERIFICADO

17 ENE 2002

17 ENE 2002

Silva & Lopez

10



17 ENE 2002

Silva & Lopez

10

BRIGARD & CASTRO
SANTAFE DE BOGOTA - COLOMBIA

DOCUMENT OF ASSIGNMENT OF PATENT
APPLICATION

ASSIGNMENT

The Undersigned: Maria Clara Garcia

Acting as: inventors

Of: Patent application PCT No. 01095027
Entitled: Method of Recycling Bonded Fibrous
Materials and Synthetic Fibers and Fiber-Like
Materials Produced Thereof.

With domicile in: Calle 38 64ª-39, Barrio
Conquistadores, Medellin, Colombia

Hereby declares that it assigns all rights of ownership
as well as all rights and privileges relating thereto
without exception over the following Colombian patent
application:

Patent application PCT No. 01095027
Entitled: Method of Recycling Bonded Fibrous
Materials and Synthetic Fibers and Fiber-Like
Materials Produced Thereof.

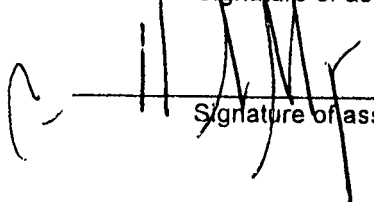
To: COLOMBIANA KIMBERLY COLPAPEL S.A.

Domiciled in: Carrera 43ª 1ª Sur - 143, Torre Sur,
Oficina 413, Medellin, COLOMBIA

The assignor and the assignee sign this document as
proof of their acceptance of the assignment.

Given and signed on the Dic 13 of 2001



Signature of assignor


Signature of assignee

CERTIFICADO NOTARIAL
PERSONA NATURAL

Hoy 13 de Diciembre 2001
compareció(eron) ante mí Maria Clara Garcia

a quien (es) conozco y me consta que es(son) la(s)
persona(s) firmante(s) del documento que precede y
quien(es) declara(n) que otorgan el mismo para los
fines y propósitos que en él se expresan.

Notario Público (sello)

LEGALIZACION POR APOSTILLA ES REQUERIDA

DOCUMENTO DE TRASPASO DE SOLICITUD DE
PATENTE

CESION

El(los) suscrito(s): Maria Clara Garcia

En calidad de: inventores

De: Solicitud de patente PCT No. 01095027
Titulada: Método de reciclado de materiales fibrosos
pegados y fibras sintéticas así producidas.

Con domicilio en: Calle 38 64ª-39, Barrio
Conquistadores, Medellin, Colombia

declara por el presente documento que cede todos los
derechos de propiedad que le correspondan, así como
las prerrogativas, sin excepción alguna, sobre la
siguiente solicitud de patente Colombiana:

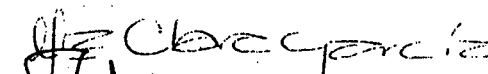
Solicitud de patente PCT No. 01095027
Titulada: Método de reciclado de materiales fibrosos
pegados y fibras sintéticas así producidas.

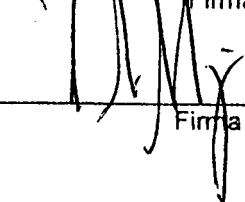
A: COLOMBIANA KIMBERLY COLPAPEL S.A.

Domiciliada en: Carrera 43ª 1ª Sur - 143, Torre Sur,
Oficina 413, Medellin, COLOMBIA

El cedente y el cesionario firman este documento como
prueba de su aceptación de la cesión.

Dado y firmado a los 13 Dic de 2001



Firma del cedente


Firma del cesionario

NOTARIAL CERTIFICATE
NATURAL PERSON

On this day Dic 13 2001
Personally appeared before me Maria Clara Garcia

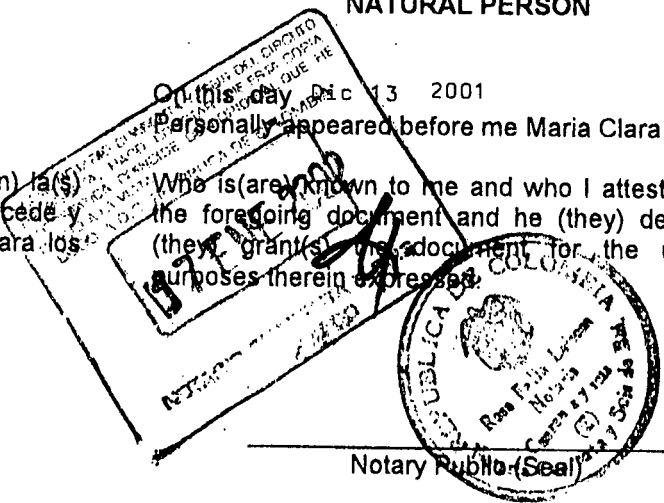
Who is(are) known to me and who I attest executed
the foregoing document and he (they) declared he
(they) grant(s) the document for the uses and
purposes therein expressed.

Notary Public (Seal)

LEGALIZATION BY APOSTILLE IS REQUIRED

15776
LA

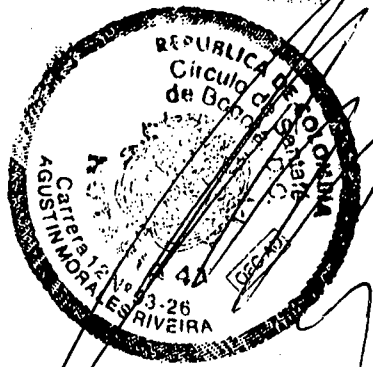
EL CONTENIDO SIN RESPONSABILIDAD
PARA EL NOTARIO



901

RECONOCIMIENTO DE DOCUMENTO PRIVADO
Ante mi Notario Cuarenta y Uno(41) de este
Círculo se presentó (compareció) personal-
mente: Mónica Clara Bustamante
quien exhibió la c.c. 93505817
MCA y declaró que el contenido
del presente documento es cierto y que la(s)
con(s)ignatario(s) en él es (son) suyo(s)
[Firma]
Firma del de Jure

EL CONTENIDO SIN RESPONSABILIDAD
PARA EL NOTARIO

En Bogotá D.C. a 19 DIC 2001
AUTORIZÓ ESTA DILIGENCIA EL SUSCRITO: [Firma]


SUPERINTENDENCIA DE NOTARIADO Y REGISTRO
Bogotá, D.C. a 28 DIC 2001
[Firma]
Mónica Clara Bustamante

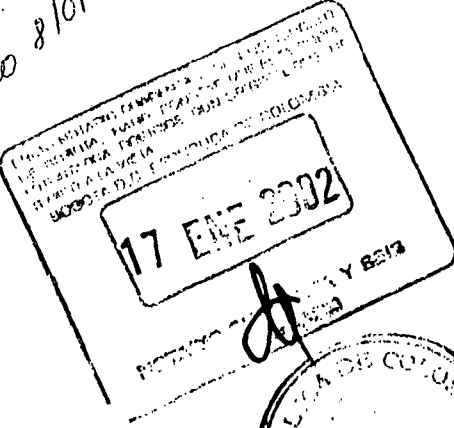
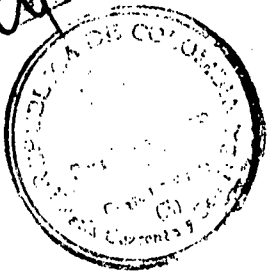

REPUBLICA DE COLOMBIA
MINISTERIO DE RELACIONES EXTERIORES
APOSTILLE
(Convention de la Haya du 6 octobre 1961)
País: República de Colombia
El presente documento público
Ha sido firmado por: MILTON CONTRERAS AMELL
Actuando en calidad de: COORDINADOR ACTIVIDADES NOTARIALES
Lleva el sello / estampilla de: SUPERINTENDENCIA DE NOTARIADO Y REGISTRO

Certificado
En: Bogotá, D. C.
El: VIERNES, 4 DE ENERO DE 2002
Por: Legalizaciones del Ministerio de Relaciones Exteriores.

Bajo el No: 250332 [Firma]
NO. DE HOJAS: 1
CP 91539

Para mayor información consulte www.minrext.gov.co/Apostilla
con el número que aparece al lado de la firma.


VERIFICADO
Diciembre 8/01

107

BRIGARD & CASTRO
SANTAFE DE BOGOTA - COLOMBIA

**DOCUMENT OF ASSIGNMENT OF PATENT
APPLICATION**

ASSIGNMENT

The Undersigned: Gustavo Palacio, ~~Maria Clara Garcia~~, Pablo Ramirez, Bernardo Vanegas

Acting as: inventors

Of: Patent application PCT No. 01095027
Entitled: Method of Recycling Bonded Fibrous Materials And Synthetic Fibers and Fiber-Like Materials Produced Thereof.

With domicile in: Carrera 38 No. 11-19, Edificio Casaclara, Apto 701, Medellin, Colombia; Calle 38 64ª-39, Barrio Conquistadores, Medellin, Colombia; Calle 9ª Sur 25-33, Bosques de Madeira, Apto. 208, Medellin, Colombia; Calle 20 19ª -27 Barbosa, Antioquia, Colombia; respectively

Hereby declares that it assigns all rights of ownership as well as all rights and privileges relating thereto without exception over the following Colombian patent application:

Patent application PCT No. 01095027
Entitled: Method of Recycling Bonded Fibrous Materials And Synthetic Fibers and Fiber-Like Materials Produced Thereof.

To: COLOMBIANA KIMBERLY COLPAPEL S.A.

Domiciled in: Carrera 43ª 1ª Sur – 143, Torre Sur, Oficina 413, Medellin, COLOMBIA

The assignor and the assignee sign this document as proof of their acceptance of the assignment.

Given and signed on the _____ day
of _____ of 2001 **03 DIC. 2001**

Gustavo Palacio
Signature of assignor **98541961 ENVI**

Bernardo Vanegas
Signature of assignor **98541961 ENVI**

Signature of assignor

Pablo Ramirez
Signature of assignor **98541961 ENVI**

[Signature]
Signature of assignee

LEGALIZATION BY APOSTILLE IS REQUIRED

**DOCUMENTO DE CESION DE SOLICITUD DE
PATENTE**

CESION

El(los) suscrito(s): Gustavo Palacio, ~~Maria Clara Garcia~~, Pablo Ramirez, Bernardo Vanegas

En calidad de: inventores

De: Solicitud de patente PCT No. 01095027
Titulada: Método de reciclado de materiales fibrosos pegados y fibras sintéticas así producidas.

Con domicilio en: Carrera 38 No. 11-19, Edificio Casaclara, Apto 701, Medellin, Colombia; Calle 38 64ª-39, Barrio Conquistadores, Medellin, Colombia; Calle 9ª Sur 25-33, Bosques de Madeira, Apto. 208, Medellin, Colombia; Calle 20 19ª -27 Barbosa, Antioquia, Colombia; respectivamente.

declara por el presente documento que cede todos los derechos de propiedad que le correspondan, así como las prerrogativas, sin excepción alguna, sobre la siguiente solicitud de patente Colombiana:

Solicitud de patente PCT No. 01095027
Titulada: Método de reciclado de materiales fibrosos pegados y fibras sintéticas así producidas.

A: COLOMBIANA KIMBERLY COLPAPEL S.A.

Domiciliada en: Carrera 43ª 1ª Sur – 143, Torre Sur, Oficina 413, Medellin, COLOMBIA

El cedente y el cesionario firman este documento como prueba de su aceptación de la cesión.

Dado y firmado a los _____ días del mes de
De 2001 **03 DIC 2001**

Gustavo Palacio
Firma del cedente **98541961 ENVI**

Bernardo Vanegas
Firma del cedente **98541961 ENVI**

[Signature]
Firma del cedente

Pablo Ramirez
Firma del cedente **98541961 ENVI**

[Signature]
Firma del cesionario

LEGALIZACION POR APOSTILLA ES REQUERIDA

CERTIFICADO NOTARIAL (SOCIEDAD)

NOTARIAL CERTIFICATE (CORPORATION)

Hoy 4 de Dic de 2001
Personalmente compareció ante mí

On this 4th day of Dec. of 2001
Personally appeared before me

Ricardo Mejia Cano

Ricardo Mejia Cano

a quien conozco, y de quien me consta que firmó el anterior documento, debidamente juramentado declaró y dijo que él es

to me known, and known to me to be the person who signed the foregoing instrument who being by me duly sworn did depose and say that he (she) is the

Director General Gerente General

Managing Director

de: COLOMBIANA KIMBERLY COLPAPEL S.A.

Of: COLOMBIANA KIMBERLY COLPAPEL S.A.

Sociedad legalmente constituida para un periodo de duración que aún no ha terminado; que el declarante está autorizado por dicha compañía para conferir esta cesión; que el sello estampado por él al pie de tal cesión, en nombre y representación de la expresada compañía, es el sello oficial de ella; y que el objeto para el cual se confiere este instrumento está comprendido dentro del de la sociedad.

Which is legally constituted for a term not yet expired, that deponent is authorized by said Company to confer this assignment: that the seal affixed hereunto by the deponent in the name and on behalf of said Corporation is the corporate seal thereof, and that the purpose for which this instrument is granted is included within the corporate purpose of company.

El suscrito Notario hace constar que tuvo a la vista las pruebas de la existencia de la sociedad.

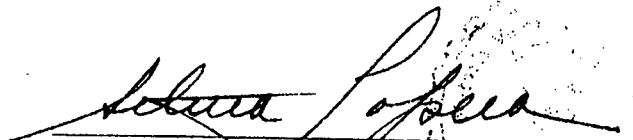
The undersigned Notary Public attests that he has seen the documents that prove the existence of the company.

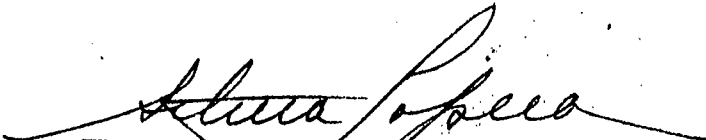
Estado de República de Colombia
Fecha 4 de Diciembre 2001

State of Country of Colombia
Under date of 4th of December 2001

que quien confiere la presente cesión es su representante.

And that he (she) who grants the present assignment is its Representative.


Notario Público (sello)


Notary Public (Seal)

CERTIFICADO NOTARIAL
PERSONA NATURAL

NOTARIAL CERTIFICATE
NATURAL PERSON

El 4 de Dic. de 2001
compareció(eron) ante mí

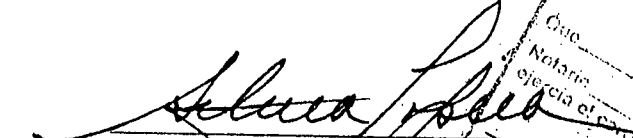
On this 4th day of Dec of 2001
Personally appeared before me

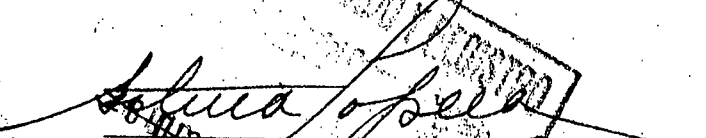
Gustavo Palacio, Maria Clara Garcia, Pablo Ramirez, Bernardo Vanegas

Gustavo Palacio, Maria Clara Garcia, Pablo Ramirez, Bernardo Vanegas

quien (es) conozco y me consta que es(son) la(s) persona(s) firmante(s) del documento que precede y quien(es) declara(n) que otorgan el mismo para los fines propósitos que en él se expresan.

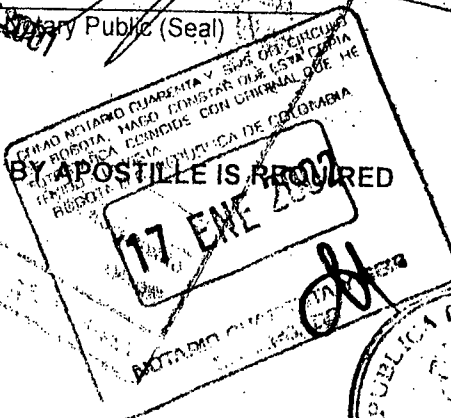
Who is(are) known to me and who I attest executed the foregoing document, and he (they) declared he (they) grant(s) the document for the uses and purposes therein expressed.


Notario Público (sello)


Notary Public (Seal)

LEGALIZACION POR APOSTILLA ES REQUERIDA

LEGALIZATION BY APOSTILLE IS REQUIRED





REPUBLICA DE COLOMBIA
MINISTERIO DE RELACIONES EXTERIORES
APOSTILLE

(Convention de la Haye du 5 octobre 1961)

País: República de Colombia

El presente documento público

Ha sido firmado por: MILTON CONTRERAS AMELL
Actuando en calidad de: COORDINADOR ACTIVIDADES
NOTARIALES
Lleva el sello / estampilla de: SUPERINTENDENCIA DE
NOTARIADO Y REGISTRO

Certificado

En: Bogotá, D. C.
El: VIERNES, 4 DE ENERO DE 2002
Por: Legalizaciones del Ministerio de Relaciones Exteriores.

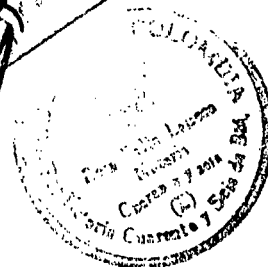
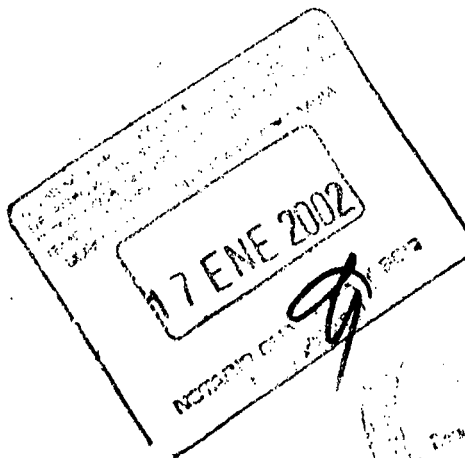
Bajo el No: 250331
NO. DE HOJAS: 1
CP 91539

Firma

Para mayor información consulte www.minrelext.gov.co/Apostilla
con el número que aparece al lado de la firma.



AP231607



Coy

PETITORIO PCT

Original (para PRESENTACION) - Impreso el 06.11.2001 02:40:50 PM

0	Para uso de la Oficina receptora únicamente	
0-1	Solicitud internacional No..	
0-2	Fecha de presentación internacional	
0-3	Nombre de la Oficina receptora y "Solicitud Internacional PCT"	
0-4	Formulario - PCT/RO/101 Petitorio PCT	
0-4-1	Preparado usando	PCT-EASY Version 2.92 (actualizado el 01.03.2001)
0-5	Petición El abajo firmante solicita que la presente solicitud internacional sea procesada de acuerdo con el Tratado de Cooperación en materia de Patentes	
0-6	Oficina receptora (indicada por el solicitante)	Superintendencia de Industria y Comercio de Colombia (RO/CO)
0-7	Referencia al expediente del solicitante o del mandatario	85796
I	Título de la invención	MÉTODO DE RECICLADO DE MATERIALES FIBROSOS PEGADOS Y FIBRAS SINTÉTICAS ASÍ PRODUCIDAS.
II	Solicitante	
II-1	Esta persona es:	solicitante únicamente
II-2	Solicitante para	todos los Estados designados
II-4	Nombre	COLOMBIANA KIMBERLY COLPAPEL S.A.
II-5	Dirección:	Carrera 43A 1A Sur - 143, Torre Sur, oficina 413 MEDELLIN Colombia
II-6	Estado de nacionalidad	CO
II-7	Estado de domicilio	CO
II-8	No. de teléfono	0943210930
II-9	No. de telefacsímil	0943211477
II-10	Correo electrónico	fordonez@kcc.com
III-1	Solicitante e/o inventor	
III-1-1	Esta persona es:	inventor únicamente
III-1-4	Nombre (APELLIDOS, Nombre)	PALACIO, Gustavo
III-1-5	Dirección:	Carrera 38 No.11 - 19, Edificio Casaclara, Apto 701 Medellin Colombia

PETITORIO PCT

85796

Original (para PRESENTACION) - impreso el 06.11.2001 02:40:50 PM

III-2	Solicitante e/o inventor	
III-2-1	Esta persona es:	inventor únicamente
III-2-4	Nombre (APELLIDOS, Nombre)	GARCIA, Maria, Clara
III-2-5	Dirección:	Calle 38 64A - 39, Barrio Conquistadores Medellin Colombia
III-3	Solicitante e/o inventor	
III-3-1	Esta persona es:	inventor únicamente
III-3-4	Nombre (APELLIDOS, Nombre)	RAMIREZ, Pablo
III-3-5	Dirección:	Calle 9A Sur 25 - 33, Bosques de Madeira, Apto 208 Medellin Colombia
III-4	Solicitante e/o inventor	
III-4-1	Esta persona es:	inventor únicamente
III-4-4	Nombre (APELLIDOS, Nombre)	VANEGAS, Bernardo
III-4-5	Dirección:	Calle 20 19A - 27 Barbosa, Antioquia Colombia
IV-1	Mandatario o representante común; o dirección para la correspondencia La persona identificada a continuación se designa/ha sido designada para actuar en nombre del/de los solicitante(s) ante las administraciones internacionales competentes como:	mandatario
IV-1-1	Nombre (APELLIDOS, Nombre)	CASTRO DUQUE, Ramiro
IV-1-2	Dirección:	Carrera 7 No.16 - 56 piso 9 3692 Bogotá D.C. Colombia
IV-1-3	No. de teléfono	3802200
IV-1-4	No. de telefacsímile	3802700
IV-1-5	Correo electrónico	bricas@brigardycastro.com.co

PETITORIO PCT

Original (para PRESENTACION) - impreso el 06.11.2001 02:40:50 PM

V	Designación de Estados	
V-1	Patente regional (otros tipos de protección o de tramitación, si es posible hacerlo, están indicados entre paréntesis a continuación de la(s) designación(es) correspondiente(s))	AP: GH GM KE LS MW MZ SD SL SZ TZ UG ZW y cualquier otro Estado contratante del Protocolo de Harare y del PCT EA: AM AZ BY KG KZ MD RU TJ TM y cualquier otro Estado contratante del Convenio sobre la Patente Euroasiática y del PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE TR y cualquier otro Estado contratante del Convenio sobre la Patente Europea y del PCT OA: BF BJ CF CG CI CM GA GN GQ GW ML MR NE SN TD TG y cualquier otro Estado que sea Estado miembro de la OAPI y que sea un Estado contratante del PCT
V-2	Patente nacional (otros tipos de protección o de tramitación, si es posible hacerlo, están indicados entre paréntesis a continuación de la(s) designación(es) correspondiente(s))	AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH&LI CN CO CR CU CZ DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PH PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG UZ VN YU ZA ZW
V-5	Declaración de designación precautoria Además de las designaciones efectuadas en los puntos V-1, V-2 y V-3 el solicitante efectuará también, en virtud de la Regla 4.9.b), todas las designaciones que estén permitidas con arreglo al PCT, salvo la(s) designación(es) del(de los) Estado(s) indicado(s) en el punto V-6 a continuación. El solicitante declara que esas designaciones adicionales están sujetas a confirmación y que cualquier designación que no se confirme antes de que expiren los 15 meses a partir de la fecha prioritaria se considerará retirada por el solicitante al expirar dicho plazo.	
V-6	Exclusión de las designaciones precautorias	NINGUNA
VI-1	Reivindicación de prioridad de una solicitud nacional anterior	
VI-1-1	Fecha de depósito	10 Noviembre 2000 (10.11.2000)
VI-1-2	Número	60/247,321
VI-1-3	País	US
VII-1	Administración encargada de la búsqueda internacional elegida	Oficina Europea de Patentes (OEP) (ISA/EP)

PETITORIO PCT

85796

Original (para PRESENTACION) - impreso el 06.11.2001 02:40:50 PM

VIII	Declaraciones	Número de declaraciones	
VIII-1	Declaración sobre la identidad del inventor	—	
VIII-2	Declaración sobre el derecho del solicitante, en la fecha de presentación internacional, para solicitar y que le sea concedida una patente	—	
VIII-3	Declaración sobre el derecho del solicitante, en la fecha de presentación internacional, a reivindicar la prioridad de la solicitud anterior	—	
VIII-4	Declaración sobre la calidad de inventor (sólo para la designación de los Estados Unidos de América)	—	
VIII-5	Declaración sobre las divulgaciones no perjudiciales o las excepciones a la falta de novedad	—	
IX	Lista de verificación	número de hojas	fichero(s) electrónico(s) adjunto(s)
IX-1	Petitorio (incluidas las hojas de declaración)	5	—
IX-2	Descripción	34	—
IX-3	Reivindicaciones	5	—
IX-4	Resumen	1	EZABST00.TXT
IX-5	Dibujos	14	—
IX-7	TOTAL	59	
	Elementos de acompañamiento	documento(s) en papel adjunto(s)	fichero(s) electrónico(s) adjunto(s)
IX-8	Hoja de cálculo de tasas	✓	—
IX-17	Disquete PCT-EASY	—	Disquete
IX-19	Figura de los dibujos que debe acompañar el resumen		
IX-20	Idioma de presentación de la solicitud internacional	español	
X-1	Firma del solicitante, del mandatario o del representante común		
X-1-1	Nombre (APELLIDOS, Nombre)	CASTRO DUQUE, Ramiro	

PARA USO DE LA OFICINA RECEPTORA UNICAMENTE

10-1	Fecha efectiva de recepción de la pretendida solicitud internacional	
10-2	Dibujos:	
10-2-1	Recibido	
10-2-2	No recibido	
10-3	Fecha efectiva de recepción, rectificada en razón de la recepción ulterior pero dentro del plazo, de documentos o de dibujos que completan la pretendida solicitud internacional	
10-4	Fecha de recepción, dentro del plazo, de las correcciones solicitadas según el Artículo 11(2) del PCT	

PETITORIO PCT

Original (para PRESENTACION) - impreso el 06.11.2001 02:40:50 PM

10-5	Administración encargada de la búsqueda internacional	ISA/EP
10-6	Transmisión de la copia para la búsqueda diferida hasta que se pague la tasa de búsqueda	

PARA USO DE LA OFICINA INTERNACIONAL UNICAMENTE

11-1	Fecha de recepción del ejemplar original por la Oficina Internacional	
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 85796	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, Item 5 below.	
International application No. PCT/IB 01/02770	International filing date (day/month/year) 09/11/2001	(Earliest) Priority Date (day/month/year) 10/11/2000
Applicant COLOMBIANA KIMBERLY COLPAPEL S.A.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

2☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 01/02770

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 D21B1/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 D21B D21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 44 25 237 A (PRUSS) 18 January 1996 (1996-01-18) the whole document ---	1, 2, 10, 12
A	US 4 735 682 A (DIDWANIA ET AL) 5 April 1988 (1988-04-05) the whole document ---	1, 7, 10-12
A	GB 615 169 A (JONES & SONS) 3 January 1949 (1949-01-03) the whole document ---	3-5
A	US 1 815 007 A (KNOLL) 14 July 1931 (1931-07-14) the whole document ---	3, 7
	--- -/--	

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

16 September 2002

Date of mailing of the international search report

23/09/2002

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

De Rijck, F

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 01/02770

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 1 980 253 A (BRYAN) 13 November 1934 (1934-11-13) the whole document ----	3,7
A	US 1 831 004 A (HOPE) 10 November 1931 (1931-11-10) the whole document ----	3,7
A	AT 314 961 B (SUMITOMO) 15 March 1974 (1974-03-15) ----	
A	DE 31 16 005 A (AMETEX) 28 October 1982 (1982-10-28) -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IB 01/02770

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 4425237	A	18-01-1996	DE 4425237 A1	18-01-1996
US 4735682	A	05-04-1988	NONE	
GB 615169	A	03-01-1949	NONE	
US 1815007	A	14-07-1931	NONE	
US 1980253	A	13-11-1934	NONE	
US 1831004	A	10-11-1931	NONE	
AT 314961	B	15-03-1974	NONE	
DE 3116005	A	28-10-1982	DE 3116005 A1	28-10-1982

DEUTSCHES
PATENTAMT

⑩ DE 44 25 237 A 1

⑲ Aktenzeichen: P 44 25 237.4
⑳ Anmeldetag: 16. 7. 94
㉑ Offenlegungstag: 18. 1. 96

D 21 C 5/00

D 21 C 3/00

D 21 C 3/02

D 21 C 9/18

B 09 B 3/00

D 21 B 1/08

DE 44 25 237 A 1

⑦① Anmelder:

Pruss, Günter, 25582 Hohenaspe, DE; Eggerstedt,
Alexandra, 25582 Hohenaspe, DE

⑦④ Vertreter:

Thomas, G., Dipl.-Ing., Pat.-Anw., 25524 Itzehoe

⑦② Erfinder:

Pruss, Günter, 25582 Hohenaspe, DE

⑥④ Verfahren zur Entsorgung ausgedienter Transportsäcke aus verwebten natürlichen Fasermaterialien

⑥⑤ Die Erfindung betrifft ein Verfahren zur Entsorgung ausgedienter Transportsäcke aus verwebten natürlichen Fasermaterialien, wie beispielsweise Sisal, Jute, Hanf, Baumwolle und dergleichen. Um eine Verwertung der bislang verbrannten oder deponierten Transportsäcke zu ermöglichen, sieht die Erfindung vor, die Transportsäcke zu einem Grund- oder Zuschlagstoff für die Zellstoffverarbeitende Industrie zu verarbeiten und sie insbesondere als Rohstoff für die Papierherstellung einzusetzen.

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Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

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Beschreibung

Die Erfindung betrifft ein Verfahren zur Entsorgung ausgedienter Transportsäcke aus verwebten natürlichen Fasermaterialien, wie beispielsweise Sisal, Jute, Hanf, Baumwolle und dergleichen.

Weltweit werden täglich Tausende von Tonnen von Gütern, wie Getreide, Kaffee, Kakao oder dergleichen in Säcken aus den genannten oder anderen natürlichen Fasermaterialien transportiert, insbesondere Güter aus Ländern der Dritten Welt, wo diese Säcke sehr preiswert hergestellt werden. Nach ihrer Anlandung in der Bundesrepublik oder anderen Industrieländern gibt es für die entleerten und ausgedienten Transportsäcke allerdings keine Verwendung mehr, so daß allein in der Bundesrepublik wöchentlich mehrere zehntausend dieser Transportsäcke als Abfall deponiert oder in Müllverbrennungsanlagen verbrannt werden. Beide Verfahren sind jedoch relativ teuer; das erstere wegen des relativ großen Volumens der leeren Säcke und das letztere wegen der anlage- und emissionsbedingt hohen Betriebskosten der Müllverbrennungsanlagen. Außerdem wird vom Gesetzgeber verlangt, zur Schonung natürlicher Ressourcen und der Umwelt Reststoffe zunehmend einer Wiederverwendung zuzuführen, zu nutzbaren Gütern zu verarbeiten oder in sonstiger Weise zu verwerten. Eine Verwertung dieser insbesondere in den Überseehäfen anfallenden Transportsäcke wurde bisher vermutlich deshalb nicht in Betracht gezogen, weil die Säcke einerseits mit Resten ihres vorherigen Inhalts verunreinigt sind und andererseits je nach Herkunft und Verwendungszweck aus unterschiedlichen Fasermaterialien bestehen.

Ausgehend hiervon liegt der Erfindung die Aufgabe zugrunde, ein Verfahren der eingangs genannten Art zu entwickeln, das eine Verwertung der ausgedienten Transportsäcke ermöglicht.

Diese Aufgabe wird erfindungsgemäß dadurch gelöst, daß die Transportsäcke zu einem Grund- oder Zuschlagstoff für die Zellstoffverarbeitende Industrie verarbeitet und insbesondere als Rohstoff bei der Papierherstellung eingesetzt werden. Der Erfindung liegt der Gedanke zugrunde, die in den Säcken enthaltenen Fasern dort zu nutzen, wo bisher überwiegend auf andere Art gewonnene natürliche Fasern, wie Holzfasern verwendet werden. Dadurch können einerseits die Kosten für die Entsorgung eingespart und andererseits die natürlichen Recourcen geschont werden.

Eine bevorzugte Ausgestaltung der Erfindung sieht dabei vor, daß Transportsäcke aus unterschiedlichen Fasermaterialien gemeinsam verarbeitet werden, ohne sie jedoch zuvor mit anderen Fasermaterialien zu vermischen. Dem ersteren liegt der Gedanke zugrunde, daß die Herkunft der Fasern bei der Zellstoffverarbeitung in den meisten Fällen gegenüber den Eigenschaften der Fasern, wie beispielsweise ihrer Länge, Biegsamkeit oder dergleichen zurücktritt, wobei die gewünschten Eigenschaften gerade bei den sehr haltbaren, für Transportsäcke verwendeten Fasern in sehr viel stärkerem Maße vorhanden sind, als beispielsweise bei Holzfasern. Gegen eine Vermischung mit anderen Fasermaterialien, auch mit anderen Textilfasern spricht, daß es sich bei den Fasermaterialien der Transportsäcke im Gegensatz zu Fasermaterialien aus Altkleidersammlungen oder dergleichen nahezu durchweg um ungebleichte und ungefärbte Fasern handelt, so daß eine vorangehende Entfärbung entbehrlich ist, während umgekehrt ein Bleichvorgang zur Entfernung der natürlichen Faserfarbe benötigt wird. Da außerdem fast ausschließlich Lebensmittel in den Transportsäcken verwendet werden, sind diese im Gegensatz zu vielen Textilien falls überhaupt dann nur mit lebensmittelverträglichen Chemikalien behandelt worden, so daß eine getrennte Verarbeitung auch einen Einsatz zur Herstellung von Zellstoffprodukten gestattet, die in der Lebensmittelindustrie Verwendung finden.

Bei der erfindungsgemäßen Verwertung der Transportsäcke werden diese bevorzugt nach einer faserschonenden mechanischen Zerkleinerung durch Zerreißen in einzelne Fetzen und/oder Faserbündel chemisch aufgeschlossen, um sie zu Zellstoff zu verarbeiten. Bei starker Verschmutzung der Säcke kann vor oder nach der Zerkleinerung ein zusätzlicher Reinigungsschritt vorgesehen sein.

Im folgenden wird die Erfindung anhand eines Ausführungsbeispiels näher erläutert:

Ausführungsbeispiel

Im Hamburger Hafen angefallene ausgediente Lebensmitteltransportsäcke unterschiedlichster Herkunft und Zusammensetzung, jedoch ausschließlich aus Naturfasern und größtenteils aus Jutefasern bestehend, wurden ohne vorherige Reinigung grob zerkleinert und in einem Behälter in wäßrigem Milieu durch Zugabe eines Oxidationsmittels, bevorzugt von Wasserstoffperoxid und einer Säure, beispielsweise Ascorbinsäure aufgeschlossen, wobei der Behälter extern erwärmt wurde, bis sich unter Aufschäumen und teilweiser Entfärbung der Fasern eine sichtbare Oxidationsreaktion zeigte. In diesem Stadium konnte der Bleichvorgang durch Zugabe von Ätznatron oder einem anderen stark alkalisch wirkenden Stoff oder einer Lauge verzögert werden.

Bevorzugt wurde dann nach einer vorgegebenen Verweilzeit der pH-Wert der Mischung auf etwa 2 abgesenkt und nach dem Aufschäumen beispielsweise durch Zugabe von Natriumbicarbonat auf einen schwach sauren Wert, vorzugsweise auf 6 angehoben. Bei der danach einsetzenden Nachbleichung wurde eine geringe Dosis eines Zuckers zugesetzt, wobei sich die Fasern zu einer flauschigen weißen Masse aus Zellstoff verdichteten.

Bei einer anschließenden Prüfung eines aus dem Zellstoff hergestellten Papierblatts ergaben sich die in Tabelle 1 aufgeführten Werte. Hervorzuheben ist das verhältnismäßig große Volumen und die gute Reißfestigkeit des Blatts, die den erfindungsgemäß aus den ausgedienten Transportsäcken gewonnenen Zellstoff besonders als Zuschlagstoff für recycliertes Papier geeignet machen.

Qualität					
Art					
Bemerkungen		Kurzfaser			
Eingangsdatum		08.07.94			
Bearbeitet am		11.07.94			
Prüfungsnummer		322			
Blattaigensehaften					
Stoffweite	%				
Blattweite	%	86,5			
Mahlgrad	°SR	12			
Flächengewicht	g/m²	72,9			
Dicke	mm	166			
Volumen	x-fach	2,28			
Reißlänge	m	1547			
Wasserstoff	mN/m/m	431			
Dehnung	%	0,75			
Luft [Gurley]	s/100ml	0,2			
Luft [Bendtsen]	ml/min	> 3000			
Biegesteifigkeit [5°]	N/mm	0,33			
Opazität	%	76,5			
Trockengehalt	%				
Blattasche [580°C]	%	0,97			
Blattasche [920°C]	%	0,86			
Festigkeitswert	g/Asche	61			
Festigkeitswert	mg/Asche	60			
Extrakt [CH2Cl2]	%				
Spittergehalt	%	—			

Patentansprüche

1. Verfahren zur Entsorgung ausgedienter Transportsäcke aus verwebten natürlichen Fasermaterialien, wie beispielsweise Sisal, Jute, Hanf, Baumwolle oder dergleichen, dadurch gekennzeichnet, daß die Transportsäcke zu einem Grund- oder Zuschlagstoff für die zellstoffverarbeitende Industrie verarbeitet und insbesondere als Rohstoff bei der Papierherstellung eingesetzt werden.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß Transportsäcke aus unterschiedlichen Fasermaterialien gemeinsam verarbeitet werden.
3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Transportsäcke ohne vorherige Vermischung mit anderen Fasermaterialien verarbeitet werden.
4. Verfahren nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die Transportsäcke vorzugsweise faserschonend mechanisch zerkleinert werden.
5. Verfahren nach Anspruch 4, dadurch gekennzeichnet, daß das Sackgewebe in einzelne Fetzen und Faserbündel zerkleinert wird.
6. Verfahren nach Anspruch 5, dadurch gekennzeichnet, daß das Sackgewebe zerrissen wird.

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7. Verfahren nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß die Transportsäcke, die Fetzen oder Faserbündel chemisch aufgeschlossen werden.

8. Verfahren nach Anspruch 7, dadurch gekennzeichnet, daß die Transportsäcke, die Fetzen oder Faserbündel vor einem chemischen Aufschluß vorzugsweise durch Waschen gereinigt werden.

9. Verfahren nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß das Fasermaterial zu Zellstoff verarbeitet wird.

10. Verfahren nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß den Transportsäcken, den Fetzen oder Faserbündeln ein Oxidationsmittel zugesetzt wird.

11. Verfahren nach Anspruch 10, dadurch gekennzeichnet, daß die Transportsäcke, die Fetzen oder Faserbündel in einem Behälter mit Wasserstoffperoxid vermischt werden.

12. Verfahren nach Anspruch 10 oder 11, dadurch gekennzeichnet, daß den Transportsäcken, den Fetzen oder Faserbündeln Wasser und eine Säure zugesetzt und die Mischung erwärmt wird.

13. Verfahren nach Anspruch 12, dadurch gekennzeichnet, daß der Mischung eine stark alkalisch wirkende Lauge oder Alkalien zugesetzt werden.

14. Verfahren nach Anspruch 13, dadurch gekennzeichnet, daß der Mischung nach Ablauf einer vorgegebene Verweilzeit eine Säure zugesetzt und der pH-Wert auf einen Wert von weniger als 3 abgesenkt wird.

15. Verfahren nach Anspruch 14, dadurch gekennzeichnet, daß der pH-Wert nach einem Aufschäumen durch Zugabe einer alkalisch wirkenden Substanz auf einen Wert im schwach basischen Bereich angehoben wird.

16. Verfahren nach Anspruch 15, dadurch gekennzeichnet, daß der Mischung anschließend ein Zucker zugesetzt wird.

17. Verfahren nach Anspruch 16, gekennzeichnet durch eine anschließende Trocknung und Auswalzung der abgeschöpften Zellstoffasern.

United States Patent [19]
Didwania et al.

[11] Patent Number: 4,735,682
[45] Date of Patent: Apr. 5, 1988

[54] METHOD FOR RECOVERY OF
CELLULOSIC FIBERS CONTAINING LATEX
SOLIDS FROM LATEX BONDED BROKE

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[21] Appl. No.: 918,841

[22] Filed: Oct. 14, 1986

Related U.S. Application Data

[63] Continuation of Ser. No. 703,700, Feb. 21, 1985, abandoned.

[51] Int. Cl.⁴ D21C 5/02; D21B 1/32

[52] U.S. Cl. 162/8; 162/191

[58] Field of Search 162/5, 4, 8, 60, 191

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Primary Examiner—S. Leon Bashore

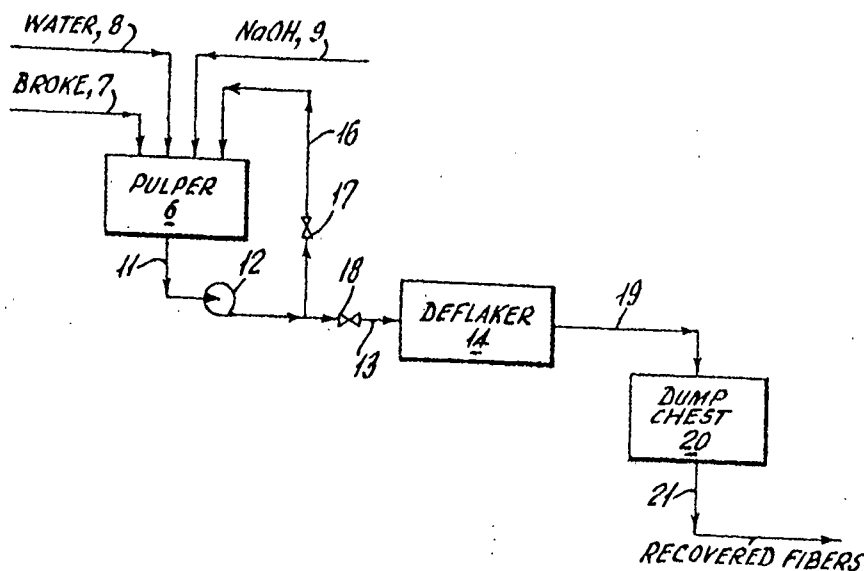
Assistant Examiner—K. M. Hastings

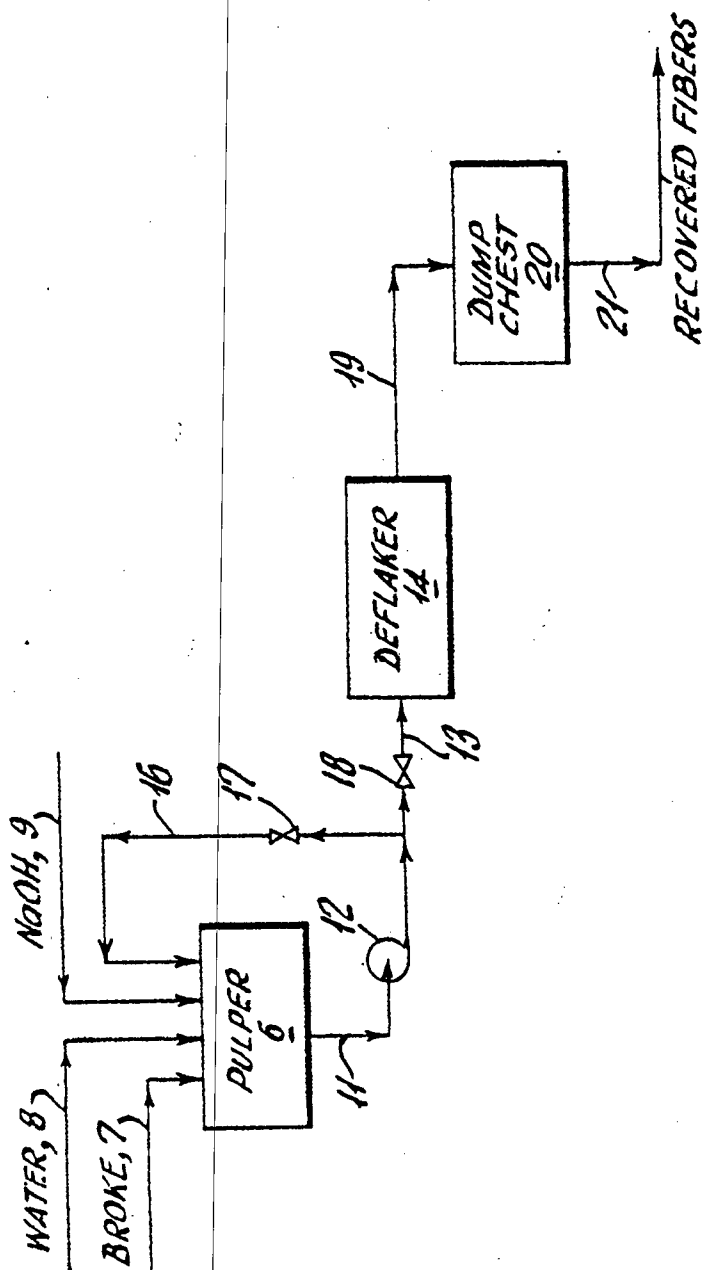
Attorney, Agent, or Firm—William A. Aguele; Harry W. Hargis, III; Thomas H. Whaley

[57] ABSTRACT

Cellulosic fibers containing latex solids are recovered from latex bonded broke by agitation of the broke in an aqueous alkaline solution having an alkali metal hydroxide concentration of 0.5 to 1.5 mol percent for a period of time in the range of ten minutes to four hours. The resulting fibers containing cured latex solids may be added to conventional papermaking fibers in amounts as high as 10 to 15 percent by weight for the production of facial quality tissue to produce a high quality product web.

1 Claim, 1 Drawing Sheet





METHOD FOR RECOVERY OF CELLULOSIC FIBERS CONTAINING LATEX SOLIDS FROM LATEX BONDED BROKE

This is a continuation of application Ser. No. 703,700, filed Feb. 21, 1985, now abandoned.

This invention relates to a process for the recovery of paper-making fibers from latex bonded broke or paper containing latex.

In the manufacture of paper it is desirable to reuse, with a minimum of loss, the waste paper or broke which results during the normal course of production. The disintegration of paper broke to a fibrous state is usually accomplished by repulping in water by mechanical agitation, optionally in combination with chemical treatment. The resulting pulp suspension is returned to the papermaking cycle without further processing. Repulping conditions are preferably of such a nature that the papermaking fibers in the broke will be separated from one another and from the various nonfibrous constituents of the paper with a minimum amount of mechanical or chemical damage to the fibers. Repulping has worked well in the case of broke containing rosin size, clay, ink and ink binders, as well as for wet strength broke containing thermosetting wet-strength resins, such as cationic amine-modified urea-formaldehyde resins, melamineformaldehyde resins, cationic resins prepared by reacting epichlorohydrin with a polyamide of a saturated dicarboxylic acid and a polyalkylene polyamine, and cationic resins prepared by reacting epichlorohydrin with a polyalkylene polyamine. However, a repulping problem does arise in the production of certain coated papers used for high quality offset printing where the paper is coated with a substantially water resistant coating, such as latex.

Conventional methods for repulping latex bonded broke have not been satisfactory. Cured latex solids, which result from the use of latex for bonding air laid webs, is difficult to separate from the cellulosic fibers. Although separation may be effected by chemical treatment or mechanical action, if excessive mechanical action is employed, the energy input and loss of usable fibers may be prohibitive; if excessive chemical treatment is employed, the latex will separate from the fibers but must be removed from the repulping system to avoid subsequent problems during use of the recovered fibers in papermaking. In addition, excessive chemical treatment tends to leave the latex tacky and hard to handle, further compounding its disposal problem.

The prior art in this area describes various methods for repulping broke by freeing the individual paper fibers from the non-fibrous bonding materials, which are then separated from the fibers. U.S. Pat. No. 3,245,868 to Espenmiller et al., discloses a process for recovering papermaking fibers from paper broke which has been treated by a wet strength thermosetting resin by treating the broke with acid for a period of time sufficient to hydrolyze the resin followed by washing the fibers free of resin. U.S. Pat. No. 3,425,897 to Murphy, describes a defiberizing process where the waste wet strength paper is cooked at elevated temperatures and pressure under alkaline conditions. After the initial defiberizing there is further treatment under milder conditions with simultaneous mechanical agitation. U.S. Pat. No. 3,047,452 to De Vos, describes a process for disintegration of paper broke, having a protein-bonded coating insolubilized by formaldehyde, and containing latex

wherein the hardened protein binder is hydrolyzed in the presence of proteolytic enzymes. Finally, U.S. Pat. No. 3,766,001 to Gleason, et al., describes a process for the recovery of pulp from waste paper containing various types of inks, resins, and resinous or hot melt type adhesives by cooking the paper in an aqueous solution containing sodium hydroxide, sodium carbonate, sodium or ammonium bicarbonate and sodium borate followed by water washing of the recovered fibers.

The present invention provides a method for treating latex bonded broke or paper containing latex for recovery of the fibers for reuse in papermaking in which latex solids remain on the individual papermaking fibers which are separated from one another in a repulping operation making them suitable for reuse in the papermaking process without the necessity for removal of the latex solids or disposal of environmentally detrimental wastes.

Briefly the process of repulping latex bonded broke comprises simultaneously subjecting the latex bonded broke to initial fiberization by mechanical agitation in the presence of an aqueous alkaline solution, e.g., caustic soda solution, followed by substantially complete defiberization in a conventional deflaking operation.

The process is illustrated in the accompanying drawing which is a diagrammatic flow sheet showing the basic steps in the process.

Shredded latex bonded broke is added to pulper 6 through line 7 together with sufficient water from line 8 and sodium hydroxide from line 9 to provide a pulp containing about 6 weight percent broke, based on the dry weight of the broke, and an aqueous alkaline solution having a sodium hydroxide concentration in the range of 0.5 to 5 mol percent. The pulper is of conventional design, such as that described in U.S. Pat. No. 3,073,535.

Latex bonded papers which may be processed by the method of this invention include those wherein the latex solids are ethylene vinyl acetate copolymers, copolymers of acrylic esters and vinyl acetate, and ethylene polyvinyl chlorides. The mechanical action of the pulper in the presence of an aqueous alkaline solution containing 0.5 mol percent or more caustic results in up to 60 to 70 defiberization of the broke in the pulper.

The pulp from pulper 6 containing partially separated fibers, with the latex still adhering to the fibers, is removed from the pulper 6 through line 11 by pump 12 and after washing with water (not illustrated) introduced through line 13 to deflaker 14 wherein substantially complete defiberization takes place. As illustrated, pulp from pump 12 may be recirculated to pulper 6 through line 16 as controlled by valve 17, or passed to deflaker 14 at a rate controlled by valve 18. The deflaker 14 may be any various types commercially available, including parallel disc, conical, concentric or matted type deflakers, well known in the art. The action of the deflaker 14 causes the fibers to separate from one another but does not cause the latex to separate free from the fibers. The fibers with latex solids still attached thereto are discharged from flaker 14 through line 19 to a dump chest 20 and drawn off through line 21 for use in making up fiber finish for wet laid web formation. Unexpectedly, the latex solids content of the recovered fibers is not detrimental to their usefulness in conventional wet laid web forming processes wherein they may be blended with papermaking fibers free from latex solids to produce toilet tissue and towels.

In the following examples, which illustrate the process of this invention, the broke employed was that from a commercial air laid product in which ethylene vinyl acetate latex is used as a binder during formation of the web and subsequently cured by drying.

A number of test runs were carried out in a Beloit Jones pilot plant to determine whether broke from paper toweling manufactured by air laying wood cellulose fibers bonded on both sides with an ethylene vinyl acetate copolymer latex at an add on level of 23.8 weight percent with an 80 percent or higher cure. The results of these tests are reported in the following examples.

EXAMPLE 1

Latex bonded broke was dispersed in water to form a pulp containing 6 weight percent broke (dry basis) with sodium hydroxide of 1.5 mol percent, and subjected to repulping in a Beloit Jones repulper. After 45 minutes repulping with 55 horsepower-day/ton (HPD/T) energy input the resulting pulp was removed and screened. Approximately 20 weight percent of the broke was fiberized.

EXAMPLE 2

The test was repeated by repulping broke at the same pulp and alkali concentrations as in Example 1 in the pulper for ten minutes and then processed in a deflaker at 37 HPD/T for five minutes. The same amount of total energy input (55 HPD/T) resulted in reduction in the percentage undefiberized broke to about 10%.

The effluent and pulp samples from the broke subjected to the pulper and deflaker treatments were examined for latex solids using the Measurex Analyzer. Results (Table 1) show that on a relative basis there appears to be a directional increase in the latex solids content in rejected knits and in fines. Overall, the latex solids content in screened pulp is not significantly changed. This indicates that the latex solids are not significantly separated from the fibers. Electron microscopic examination showed that after pulper/deflaker treatments, the broke fibers, even though not interbonded with latex solids were still coated with the latex solids. The processed broke pulp sheets were found to have fiber crossings with sharp edges, and were essentially free from particles or clumps of fibers.

TABLE 1

Latex Solids on Processed Broke Pulp	
	Latex Solids Weights %
Non-processed Broke	22.4
Processed Broke Pulp	
Washed Pulp	20.1
Washed Pulp Classified on .006" screen:	
Acceptable	18.8
Reject Knits	23.6
Fines (100 mesh)	25.4

EXAMPLE 3

In another set of test runs, samples of the latex bonded broke of Example 1 were repulped at 0.5 mol% NaOH concentration and at 1.5 mol% NaOH concentration. At 40 HPD/T energy input, the percentage yield, of acceptable repulped broke fibers that passed through 0.006 inch cut and were retained on 100 mesh, was 45 weight percent at 0.5 mol % NaOH concentration and 65 weight percent at 1.5 mol % NaOH.

EXAMPLE 4

Latex bonded broke from the same source as in Example 1 with 1.5 mol % NaOH concentration were repulped at 18 HPD/T energy input and then 12 HPD/T additional energy input was made in a deflaker. A yield of 75% was achieved. Yield was not increased on additional input of energy in the deflaker. When the same test run was made with 0.5 mol % NaOH concentration, a 75% yield was reached at 35 HPD/T total energy input.

EXAMPLE 5

Defibered and repulped broke containing latex solids prepared according to Example 2 was added at 10% and 15% levels dry weight to a good quality furnish consisting of 50/50 Northern softwood and hardwood species. Laboratory handsheets which were uncompacted and creped to simulate commercial tissue sheets were made up from the original furnish and from the modified furnish formulations. It was found that with good quality furnish tensile values of the handsheets were increased, bulk was somewhat decreased and softness was decreased; the observed effects are more pronounced at 15% addition than at 10% addition.

EXAMPLE 6

Defibered and repulped broke containing latex solids prepared according to Example 2 was added to 100% secondary fiber furnish and handsheets made up as in Example 5. The presence of repulped broke improved the quality of the appearance of the handsheets, while the bulk, tensile strengths and hand softness were not changed significantly.

The foregoing examples demonstrate that latex bonded broke may be treated with relatively low concentrations of sodium hydroxide effecting defiberization without separation of latex from the fibers and that the resulting defiberized and repulped broke may be added to conventional cellulosic papermaking fibers and wet laid to form a high quality web.

We claim:

1. A process for the recovery of wood cellulose fibers coated with cured latex solids from air laid latex bonded paper broke wherein the latex is selected from the group consisting of latices of ethylene vinyl acetate copolymers, copolymers of acrylic esters and vinyl acetate, and ethylene polyvinyl chlorides which consists essentially of:

- repulping the broke by agitation in an aqueous alkaline solution having alkali metal hydroxide concentration in the range of 0.5 to 1.5 mol percent without substantial separation of the cured latex solids,
- subjecting the pulp comprising broke fibers and associated latex solids from step (a) to deflaking for a period of time sufficient to substantially complete defiberization of cellulose fibers without substantial separation of the cured latex solids therefrom and without substantial degradation of the fibers,
- recovering cellulose fibers from the broke as individualized fibers containing a major portion of the cured latex solids from step (b),
- dispersing fibers containing the cured latex solids as recovered in step (c) in admixture with other cellulosic papermaking fibers in an aqueous dispersion to form a papermaking fiber furnish, and
- forming a fibrous tissue web from the fiber furnish prepared in step (d).

* * * * *

PATENT SPECIFICATION



Convention Date (United States of America) : Sept. 27, 1945. **615,169**

Application Date (In United Kingdom) : July 31, 1946 No. 22758/46.

Complete Specification Accepted : Jan. 3, 1949.

Index at acceptance:—Class 96, A3a.

COMPLETE SPECIFICATION

Bedplates for Beaters for Paper-making

We, E. D. JONES & SONS COMPANY, a Company organized under the laws of the State of Massachusetts, United States of America, of Pittsfield, Massachusetts, United States of America, assignees of DWIGHT E. JONES, a citizen of the United States of America, of 27, Wellesley Street, Pittsfield, Massachusetts, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to beaters such as are used in the paper-making art for processing paper making materials, and it is directed more particularly to the construction and mounting of the bedplates for such beaters.

According to some of the prior art, metal bedplates were made to receive several separately formed metal cutting bars, spaced apart with wood or metal packings between them, and secured together by bolts or rivets. This composite bedplate was then assembled in a shoe or holder, commonly termed a plate box, being held therein by means of wood packings located on either side of the bedplate and between it and the wall of the plate box.

It has been customary to make those wood packings in several side-by-side pieces with at least one piece tapered so that, when the complete assembly is fitted together, this tapered piece can be used wedge-wise to make the whole assembly tight. In cases where the treatment materials would exert an abrasive action, the top of the wood packings has been covered with metal to prevent the wood from being washed or worn away. The said plate box has usually been tapered lengthwise and vertically, so that when it is inserted in its pocket in the beater it is held tight.

Also, according to other prior art, bedplates have been cast of very hard materials with integral cutting edges forming part of the base material. These plates

[Price 2/-]

have been rough along their length and it has been necessary to pack the space between their sides and the wall of the plate box with wood, or in some cases the plates have been inserted directly into the beater, as with bedplates made of stone, but even then the space between the plate and the opening in the beater needs to be packed with wood.

According to this invention, a one-piece bedplate is formed to have integral cutting bars on its working face by having grooves machined in such working face according to any desired pattern or arrangement, and is secured to a support or base on which it is mounted so that the whole assembly may be readily and easily slipped into a plate box opening in the beater without the necessity of a plate box, the bedplate and the said support being made to a size corresponding to that of the conventional plate box, and so that they will fit tightly in the opening which is provided in the beater for the plate box.

The plate construction may be made of any metal desired, depending upon the requirements of a particular paper mill and the spacing and arrangement of the blading may be as desired since the same is not dependent on or limited in any way to filler bars as in the prior art.

Not only may the spacing of the blading be as desired, but the so-called pattern thereof may be varied to suit conditions. In fact, the blading presenting a certain arrangement or pattern may be entirely removed by machining and another pattern of blading be formed in the bedplate.

In the accompanying drawing, examples of the invention are illustrated:

Fig. 1 is a plan of the end portions of a bedplate construction embodying the novel features of the invention;

Fig. 2 is a cross-sectional elevation on the line 2-2 of Fig. 1;

Fig. 3 is a view similar to that of Fig. 1 shewing another arrangement or pattern of blading; and

Fig. 4 is a vertical section of a beater having (for the purpose of contrast) the novel bedplate construction of this invention and a prior art construction associated therewith.

As shewn in Fig. 2, a base or support 2 is provided, which will preferably be made from metal and in such form and size as to be receivable directly in the beater and at the same time rigidly support the bedplate in proper relation to the beater roll.

A bedplate 4 is provided, which on its working face, by a suitable machining operation, is formed to have spaced slots or grooves 6 which provide spaced cutting blades or bars 8. The working face of the plate or faces of the bars will be arranged to provide the proper curvature for the coaction of the bars with those of a beater roll.

The bedplate and support may be secured together by any suitable means. For illustrative purpose, however, the components are secured together by cap screws 10, as shewn. There may be as many cap screws as desired so that the bedplate is secured to the base in a rigid and secure manner.

An extension 12 may be provided on the plate 4 or the support 2 for engagement by a positioning and withdrawal tool adapted to facilitate removal of the construction from the beater. Such tool would have a head to fit in the T-slot 12', for pulling purposes.

The bedplate 4 may be made from various metals such as stainless steel, non-ferrous metals or the like, depending upon the conditions under which it will be used, and the grooves or slots 8 may be provided by any well known machining operation to form the desired blading.

The blading and the spacing thereof, as well as the width and height of the cutting bars, may be as desired, and according to the machining operation selected. The arrangement or pattern of the blading may be varied within wide limits and the blading may be changed or varied by machining off the upper face of the bedplate and providing a different arrangement or pattern, means being provided in such cases to increase the height of the new working face with respect of the supports in the beater.

A plate 4' in Fig. 3, has grooves 6' and blading 8' so as to provide more or less diagonally-arranged cutting bars from

which it will be understood that patterns 60 of blading may be varied within wide limits.

The improved construction provides rigidity, so as to eliminate vibration.

In Fig. 4, which shews a cross section through a beater 16, a roll is represented by 18 which has radially extending cutting bars 20. A frame is represented by 22 in which are disposed a bedplate 24 of prior art construction and bedplates 26 embodying the novel features of this invention. Said figure illustrates the relationship of a bedplate and beater roll for the coaction of the cutting bars.

The means associated with the beater for receiving the bedplate may be varied to suit conditions but will be such as to readily and easily receive the bedplate and hold the same relative to the beater roll for the coaction of the cutting bars.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

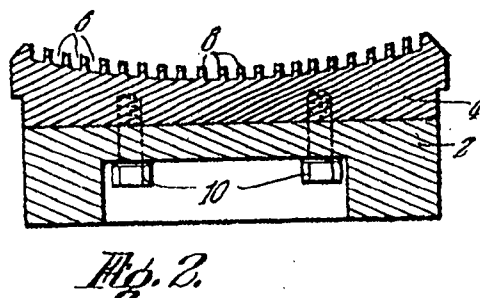
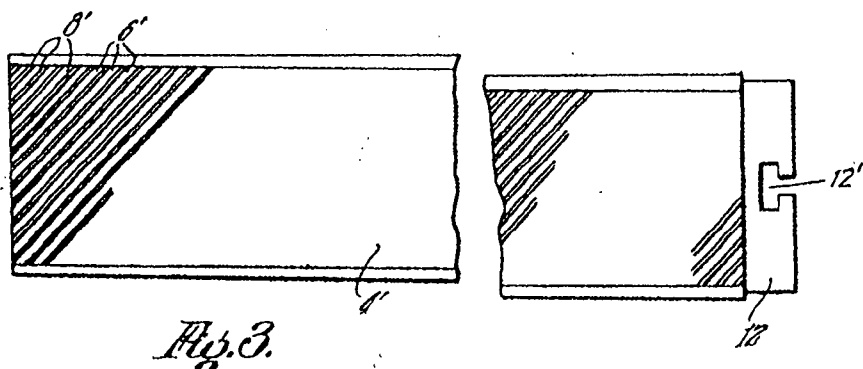
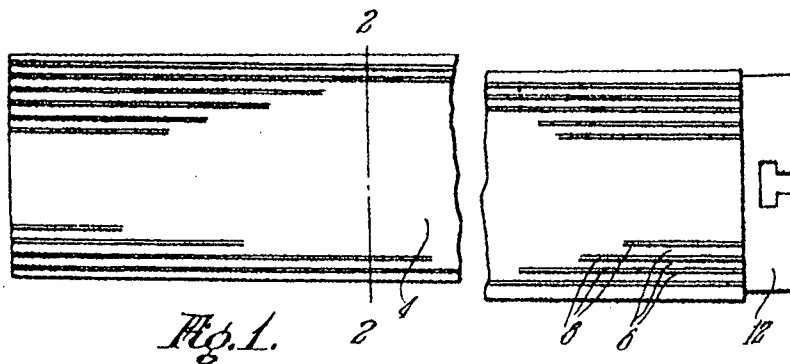
1. A unitary bedplate for a beater, formed to have integral cutting bars on its working face by having grooves machined in such working face according to any desired pattern or arrangement, and secured to a support or base on which it is mounted so that the whole assembly may be readily and easily slipped into a plate box opening in the beater, without the necessity of a plate box, the bedplate and the said support being made to a size corresponding to that of the conventional plate box, and so that they will fit tightly in the opening which is provided in the beater for the plate box.
2. A bedplate according to claim 1 having an extension at one end for engagement by a positioning and withdrawal tool for the purpose set forth.
3. A bedplate for a beater substantially according to either of the examples herein described with reference to Figs. 1, 2 and 3 of the accompanying drawings.
4. A beater or the like having a bedplate construction according to any of claims 1 to 3.

Dated this 30th day of July, 1946.

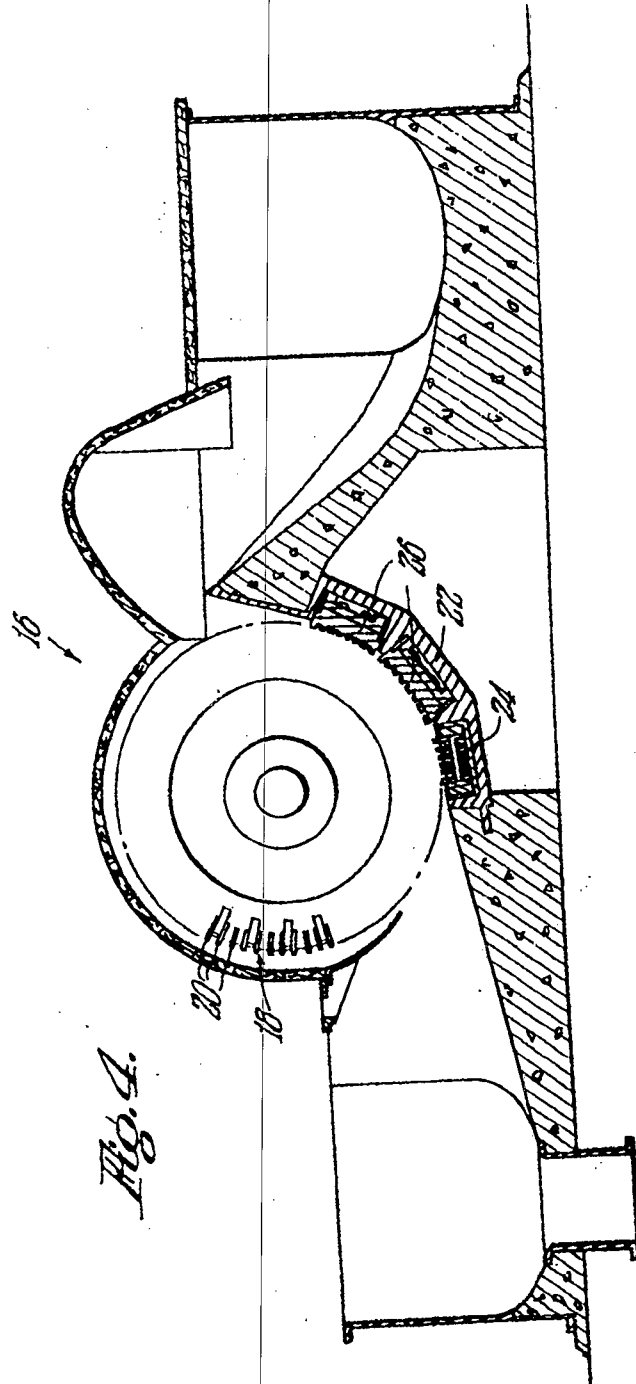
For the Applicants,
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Chartered Patent Agents,
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July 14, 1931.

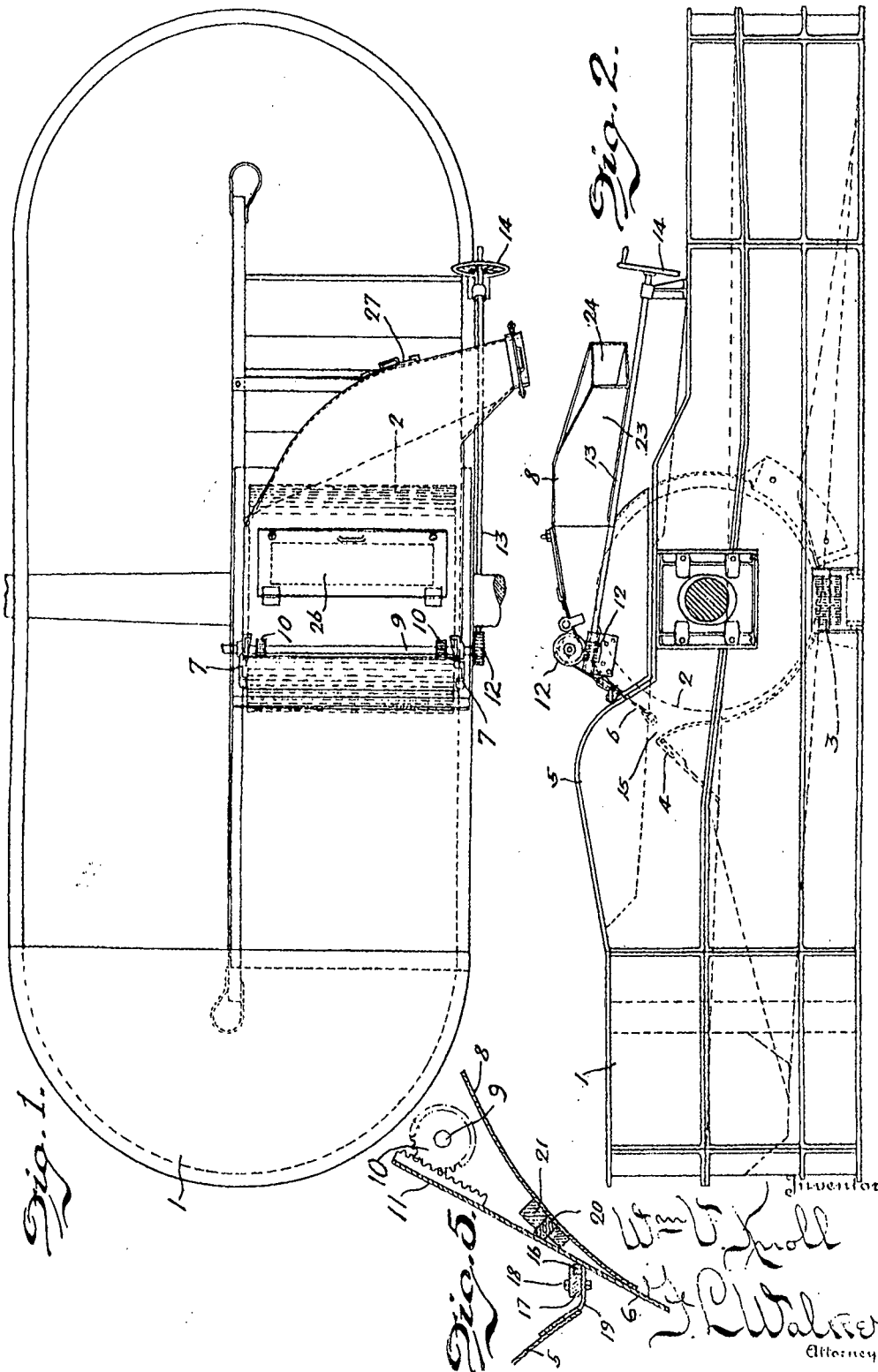
W. V. KNOLL

1,815,007

BEATER ENGINE

Filed Aug. 6, 1928

2 Sheets-Sheet 1



July 14, 1931.

W. V. KNOLL

1,815,007

BEATER ENGINE

Filed Aug. 6, 1928

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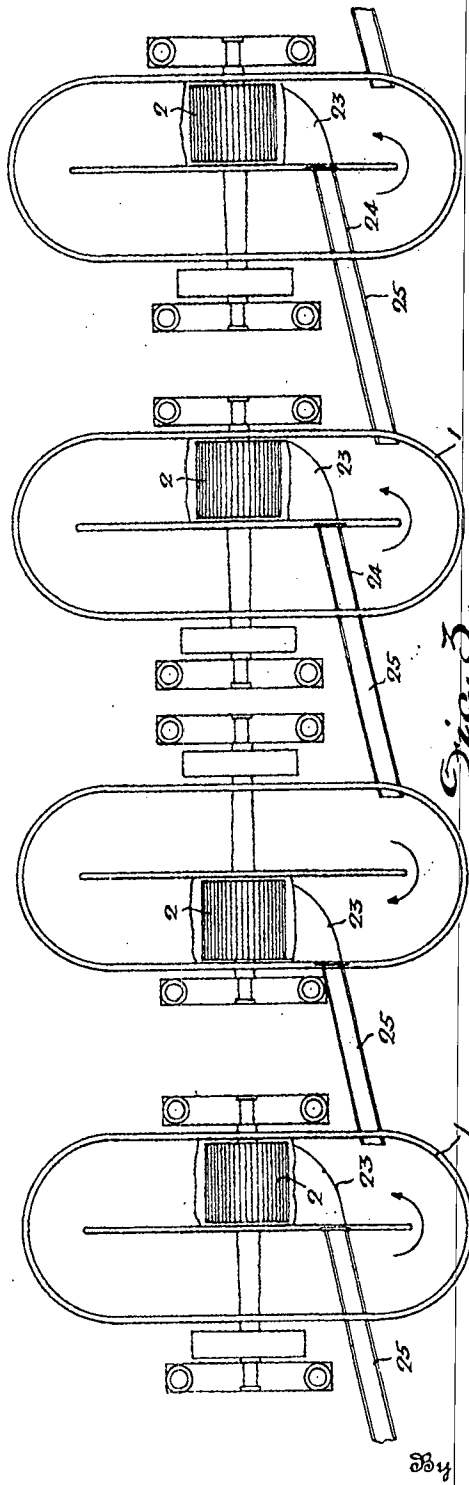


Fig. 3.

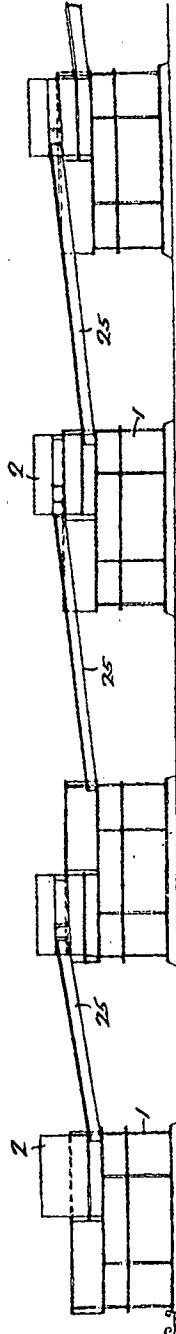


Fig. 4.

William V. Knoll
J. R. Walker
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UNITED STATES PATENT OFFICE

WILLIAM V. KNOLL, OF DAYTON, OHIO, ASSIGNOR TO MIDWEST-FULTON MACHINE CO.,
OF DAYTON, OHIO, A CORPORATION OF OHIO

BEATER ENGINE

Application filed August 6, 1928. Serial No. 297,841.

My invention relates to pulp making, and fiber liberation, and more particularly to a system of beater engines, and means for progressively transferring from one beater engine to another pulp portions which have been reduced to required conditions.

In the present construction a number of beater engines, preferably though not necessarily, of the Hollander type are arranged in series and interconnected by conduits through which the finished product discharged from one beater engine is conveyed to another for reworking. Each beater engine is equipped with a deflector plate adjustably positioned above the usual backfall at the rear side of the beater roll. Such beater engines are further provided with receiving pans leading to the offtake conduit, which receiving pans are located slightly below the top of the periphery of the roll and at the forward side thereof. In operation the coarse and uncompleted portions of the pulp passing the roll are delivered over the backfall and beneath the deflector plate to continue their circuitous path in the beater engine for reworking. The lighter and finished particles of pulp are carried upwardly by the action of the roll and are discharged forwardly from the top of the roll by centrifugal influence into the receiving pan from which such pulp portion is conducted to the succeeding beater engine of the series. Means is provided for adjusting the deflector plate to permit a greater or less volume of the pulp to be passed between the backfall and such plate to continue its flow through the beater engine. This adjustment of the plate regulates the quantity and to some extent the character of the pulp to be discharged from the engine and affords, in effect, a selective volume control by which the pulp in the successive beaters of the series may be maintained at a constant level.

The object of the invention is to simplify the construction, as well as the means and mode of operation, of beater engines, whereby they will not only be cheapened in construction, but will be more efficient in use, positive in operation, uniform in action,

easily controlled, and unlikely to get out of repair.

A further and important object of the invention is to provide selective means for progressively removing from the beaten pulp the finished portion and for continuing in the flowing pulp stream the unfinished portion for reworking.

A further object of the invention is to provide a selective volume control for beater engines by which the quantity of pulp discharged may be accurately regulated.

A further object of the invention is to provide an adjustable deflector plate in co-operative relation with the beater roll and backfall of a beater engine, and to provide means for adjusting such deflector plate from the front of the engine.

A further and important object of the invention is to provide improved means for trapping the refined and finished portions of the pulp, and for conveying the same from the beater engine.

With the above primary and other incidental objects in view, as will more fully appear in the specification, the invention consists of the features of construction, the parts and combinations thereof, and the mode of operation, or their equivalents, as hereinafter described and set forth in the claims.

Referring to the accompanying drawings, wherein is shown the preferred, but obviously not necessarily, the only form of embodiment of the invention, Fig. 1 is a top plan view of a beater engine to which the present invention has been applied. Fig. 2 is a side elevation thereof. Fig. 3 is a top plan view illustrating the interconnection of a series of beater engines for a progressive treatment of the pulp. Fig. 4 is an end elevation of the beater installation shown in Fig. 3. Fig. 5 is a detail of the deflector plate mounting and its actuating means.

Like parts are indicated by similar characters of reference throughout the several views.

Referring to the drawings, 1 is the vat or tub of the beater, in which is mounted

the roll or drum 2 coacting with the usual bed plate 3, and discharging the beaten pulp over the backfall 4. A portion of the vat or tub 1 is provided with a cover or hood 5 beyond the beater roll 2. This is the usual construction of a Hollander type beater, and forms no part, per se, of the present invention.

Located rearwardly of the beater roll 2 and extending into channel spaced relation with the backfall 4 is a vertically adjustable deflector plate 6. This plate is slidably mounted in guides or ways 7 upon supporting brackets located at opposite sides of the hood 8 enclosing the upper portion of the beater roll. Mounted in such brackets at opposite sides of the beater roll hood is a transverse shaft 9 carrying gear pinions 10 intermeshing with rack bars 11 upon the forward and under side of the inclined deflector plate. The shaft 9 is rotated to slidably adjust the deflector plate by means of a worm and worm gear 12 actuated by a shaft 13 carrying at its forward end adjacent to the vat or tub 1 a hand wheel 14. By rotating the hand wheel 14 the shaft 9 is in turn rotated to thereby raise and lower the deflector plate, varying the outlet orifice 15 for pulp intermediate the backfall 4 and the lower margin of the plate 6.

The opening in the cover section through which the deflector plate projects is sealed at one side of the plate by a strip of packing material 16 clamped between a clamp bar 17 connected by stud bolts 18 with an extension 19 of the vat or tub cover 5. At the opposite side of the adjustable plate there is provided a packing strip of hemp or other suitable material held between transverse bars 21 which may be secured to the beater roll hood 8 but which in practice merely rest thereon loosely, and hold the packing material 20 in contact with the adjustable plate by gravity, due to the curvature or inclination of the beater roll hood.

At its forward end the beater roll hood 8 communicates with a covered receiving compartment or pan 23, which extends the full width of the beater roll 2 and is inclined downwardly and forwardly from a level slightly below the top of the periphery of such roll. The pulp receiving compartment or pan 23 is contracted laterally through a discharge outlet 24, preferably provided with a gate or cutoff valve from which outlet leads a conduit 25 to the next succeeding beater engine of the series. The receiving compartment 23 and interconnecting conduits 25 between succeeding beater engines are preferably inclined at such degree as to induce a flow of the selected or separated pulp by gravity from one beater engine to the other. It will be understood, however, that screw conveyors or other pulp

impelling means may be employed in lieu of gravity conduits.

In the normal operation of a beater engine, the heavier portions of the pulp are impelled over the backfall 4 by the rotation of the wheel in a constantly flowing stream which continues its way about the mid-feather of the tub or vat, returning to the roll for reworking. At the same time the more finely reduced portions of the pulp are discharged from the wheel by centrifugal influence through paths of higher trajectory, depending upon the relative size and weight of the pulp particles. Such finely divided portions are thus carried above the normal flowing pulp stream and are ordinarily projected into space. In the present construction, the adjustable deflector plate 6 is arranged to intercept a greater or less proportion of the reduced pulp thus discharged by centrifugal influence above the level of the pulp stream, permitting only a limited portion thereof of the heavier or coarser particles having a low trajectory to pass through the opening 15 intermediate the backfall 4 and the lower margin of the deflector plate.

The more finely divided portions of the pulp are carried upwardly by the rotation of the roll, and discharged forwardly from the top thereof by centrifugal influence into the receiving compartment or pan 23. By varying the elevation of the deflector plate 6 in its relation to the top of the backfall, a greater or less quantity of refined pulp is caused to thus pass over the top of the revolving roll and into the receiving compartment. The apparatus thus automatically selects or separates the refined pulp from the unrefined or coarse portions, the degree of fineness being regulated by the adjustment of the deflector plate. The adjustment of this plate 6 thus affords a selective volume control as well as a grading selector for the separation of the refined from the coarse pulp.

The interconnection of the plurality of beater engines in series by means of the interconnecting pulp conduits 25 afford a continuous flow system in which, as rapidly as the pulp is conditioned in one engine, it is discharged therefrom and conveyed to the next beater engine of the series for further treatment, while the coarse material is retained in the beater engine and returned to the roll for reworking. By adjusting the deflector plates of different beater engines proportionately to the output thereof, the pulp level in the succeeding beaters of the series may be maintained substantially constant.

A door 26 is provided in the top of the beater roll hood to permit inspection of the roll or removal of any refuse material. Likewise the receiving compartment or pan 23 is provided in one side thereof with an

access opening provided with a closure 27 to permit the observation of the flow of selected pulp.

Having thus described by invention, I claim:

1. In a beater engine, or the like, the combination with a beater roll and back fall, an adjustable deflector plate located at the discharge side of the roll and in spaced relation above the backfall and permitting the flow of the pulp stream therebetween, but intercepting pulp material discharged by centrifugal influence in a trajectory above the level of the pulp stream said deflector plate being adjustable toward and from the back fall in a direction substantially tangential to a circle concentric with the axis of the roll, and a receiving compartment located forwardly of the beater roll into which the lighter portions of pulp will be discharged by centrifugal influence from the roll, said compartment having an outlet discharging beyond the beater engine.

2. The combination with a beater engine including a beater roll and backfall, of a deflector plate located in spaced relation above the backfall and adjustable relative thereto to vary the intermediate space while maintaining substantially uniform spaced relation with the beater roll, and a receiver for pulp located forwardly of the roll and in proximate relation with the top of the periphery thereof.

3. The combination with a beater engine, including a beater roll, and a backfall over which the pulp stream flows under influence of the roll, of a downwardly and rearwardly inclined deflector plate for intercepting pulp material discharged by centrifugal influence from said roll above the level of the pulp stream, and a receiver located at the forward side of the roll into which the intercept material is discharged.

4. The combination with a beater engine, including a beater roll and a backfall, of an adjustable deflector plate located in spaced relation above the backfall said deflector plate being mounted for reciprocatory motion in a plane inclined downwardly and away from the beater roll and toward the backfall and a receiver for fined pulp located at the opposite side of the roll.

5. The combination with a beater engine, including a beater roll, and a backfall, of a deflector plate adjustable toward and from the back fall to vary the intermediate space through which pulp is discharged by the roll without materially varying the throat space intermediate the deflector plate and roll through which material is carried by the roll for discharge over the top thereof and a receiver located at the opposite side of the roll onto which fined material carried beyond said aforementioned discharge space is discharged.

6. The combination with a beater engine, including a beater roll, and a backfall, of an adjustable deflector plate variably positioned above the backfall and in constant spaced relation with the roll, and distantly operated means for adjusting the deflector plate toward and from the backfall.

7. The combination with a beater engine, including a roll and a backfall, of a deflector plate adjustably positioned above the backfall, rack bars carried by the plate, gear pinions engaged by the rack bars, a worm and gear actuating means for the gear pinions, and an operating shaft for the worm and gear connection extending into proximity with the end of the beater engine.

8. The combination with a beater engine, including a roll and backfall, of a reciprocatory deflector plate located above the backfall and intercepting the material discharged by centrifugal influence from the roll in a trajectory above the level of the pulp stream, and adjusting means for the deflector plate located beyond the side of the roll opposite the said deflector plate and operatively connected therewith.

9. The combination with a beater engine, including a roll and a backfall, of downwardly and rearwardly inclined adjustable deflector plate located above the backfall and separating the material discharged from the roll through a trajectory above the level of the normal pulp stream, whereby a portion of such material is permitted to return to the pulp stream, and the remainder diverted therefrom, a revoluble adjusting shaft for said deflector plate extending past the roll and therebeyond, and an operative connection between said shaft and the deflector plate for reciprocating the latter in its downwardly and rearwardly inclined plane.

10. The combination with a beater engine, including a roll and a backfall over which a portion of the pulp is discharged in a flowing stream, while lighter portions of the pulp are discharged by centrifugal influence from the periphery of the roll in a reverse direction, of a reciprocatory deflector plate inclined downwardly and away from the roll above the backfall, toward and from which it is slidingly adjustable, a housing through which the plate projects, and yielding packing means supported upon the housing and engaging the reciprocatory deflector plate.

11. The combination with a beater engine including a roll and a backfall over which a portion of the pulp is discharged in a flowing stream, while lighter portions of the pulp are discharged by centrifugal influence from the periphery of the roll in a reverse direction of a reciprocatory deflector plate inclined downwardly and away from the roll above the backfall, toward and from which it is slidingly adjustable, and operat-

Nov. 13, 1934.

C. M. BRYAN

1,980,253

PAPER MAKING APPARATUS

Filed April 3, 1933

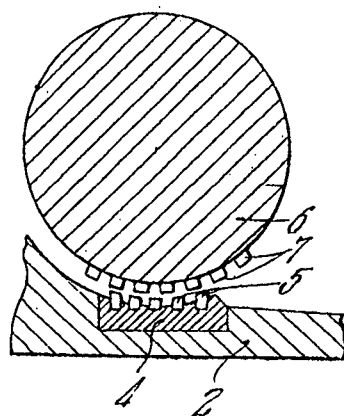
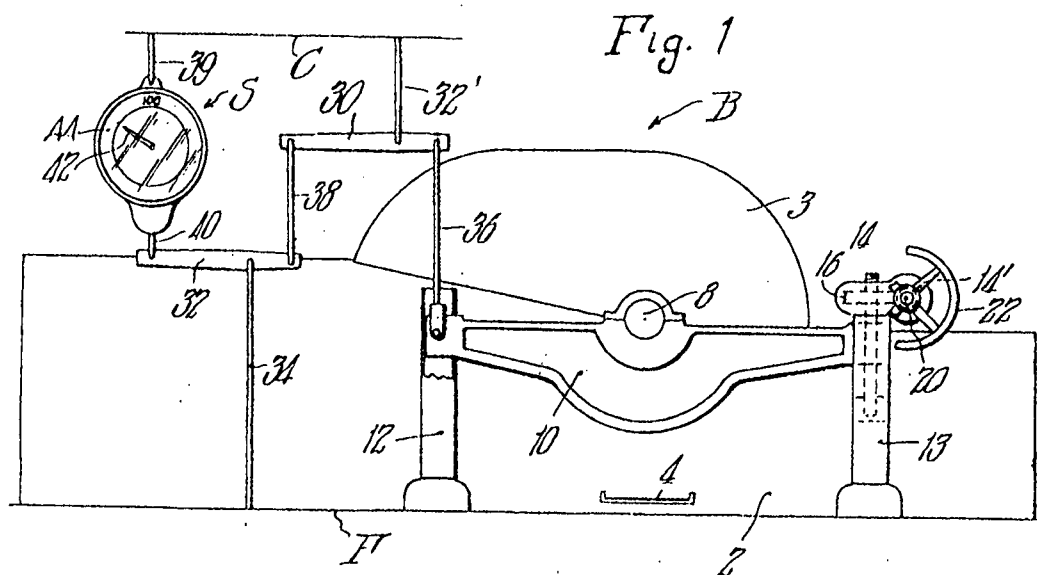


Fig. 2

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Patented Nov. 13, 1934

1,980,253

UNITED STATES PATENT OFFICE

1,980,253

PAPER MAKING APPARATUS

Cassius M. Bryan, West Springfield, Mass.

Application April 3, 1933, Serial No. 664,223

1 Claim. (Cl. 92—24)

This invention relates to improvements in paper-making apparatus and is directed more particularly to improvements in beaters and the like and methods of operating beaters.

5 The principal objects of the invention are directed to the provision of improvements in a beater or similar apparatus to facilitate the easy and efficient setting of the roll and operating thereof.

10 As is well-known, a beater or similar apparatus comprises a roll which is rotatable above a bed plate or plates and co-operates therewith so that paper-making stock such as fibers in water may be passed between the roll and plate. In operation more or less pressure is exerted by the roll to bring about certain chemical and/or physical changes in the fibers of the stock being acted upon by the machine.

15 By means of a beater machine, the fibers may be cut without beating, the machine may operate for wet beating, or there may be a combined wet beating and cutting. Whether the machine is being operated for wet beating or cutting depends largely upon the roll pressure, the distance of the roll from the bed plate, and the resistance or consistency of the paper-making stock. In practice, in order to obtain the desired results, it is necessary that the roll be operated for successive different periods of time and/or at different roll clearances and/or pressures throughout a cycle of operations.

20 It is recognized as being difficult, if not impossible, to determine the roll pressure at different settings of the roll and in fact it is probably unknown what the roll pressure is. In the ordinary machine of the type referred to, lighter bars support opposite ends of the roll shaft and are adjustable at one end for varying the distance between the periphery of the roll and said bed plate in order to obtain different roll pressures or operating conditions and results.

25 It is recognized as being difficult, if not impossible, to determine the roll pressure at different settings of the roll and in fact it is probably unknown what the roll pressure is. In the ordinary machine of the type referred to, lighter bars support opposite ends of the roll shaft and are adjustable at one end for varying the distance between the periphery of the roll and said bed plate in order to obtain different roll pressures or operating conditions and results.

30 This distance between the roll and bed plate may be varied according to the consistency or nature of the stock in order to vary the pressure and thereby vary the results obtained. It is not only difficult however to manipulate the adjustments to bring about the desired results but it is likewise difficult to duplicate results or to actually know what is taking place.

35 It is the universal practice for a skilled beater operator to be guided almost entirely by certain senses, such as the feel of the stock from time to time and the sound of what he believes to be taking place. It is usual for the operator to place his foot on the bed plate which projects outside the

machine so he may sense the vibrations and altogether he is guided by the senses in making the necessary adjustments with the hopes of obtaining the results desired. There is no definiteness as to what is actually taking place or any definite way of knowing the actual operating conditions.

40 Attempts have been made to adjust the roll relative to the bed plate by means of various mechanisms and various instruments have been used to indicate the movements of the roll supporting bars. Such mechanisms, however, have not been used with great success because of loss of motion of the parts and the fact that the roll is moved but a few thousandths of an inch to produce great differences in results and any wear or inaccuracies in the parts are not compensated for.

45 According to my invention, means is provided for moving the roll towards and away from the bed plate whereby it is possible to fix the roll in various adjusted positions relative to the bed plate.

50 With the roll thus adjustably fixed in some position and with paper-making material being acted upon by the roll, the novel mechanism of the invention includes indicating means to indicate a certain pressure condition which exists between the roll and bed plate at that particular position of the roll. Certain indications indicate certain related conditions of pressure. When certain results are obtained under certain conditions as evidenced by a certain indication, it is, of course, possible to create that same condition at a subsequent time. In other words, by moving or adjusting the roll, the indicator may be brought to a certain point to thereby indicate a certain related pressure condition between the roll and bed plate which it is desired to bring about in order to obtain a certain function and result.

55 Over a cycle of operations it is possible to adjust the roll in such a manner that certain conditions of pressure prevail over pre-determined lengths of time which conditions are indicated by the indicator. In that way, it is possible to operate the machine and substantially duplicate a series of conditions and provide uniform results so as to facilitate substantial accuracy in manufacture and uniformity of product in all its important respects.

60 Various and numerous novel objects and advantages of the invention will be hereinafter more fully referred to in connection with the accompanying description wherein the invention in the form at present preferred is disclosed, reference

being had to the accompanying drawing, wherein:

Fig. 1 is a side elevational view of a beater apparatus having the novel features of the invention associated therewith, and

Fig. 2 is a sectional view through a roll and bed plate of the beater shown in Fig. 1.

Referring now to the drawing in detail the invention will be fully described.

In Fig. 1 there is shown a beater B in a more or less diagrammatic way which includes a vat 2 of the usual form. A bed plate is shown at 4, above which is a roll 6. The bed plate 4 and roll 6 may be of the usual form and carry a plurality of co-acting bars such as 5 and 7. The roll is driven in the usual manner and its shaft 8 is journaled in lighter-bars such as 10 disposed at opposite sides of the beater.

Lighter posts 12 and 13 such as shown, are arranged in pairs at the rear and forward sides of the vat. Ordinarily the bars 10 are pivoted at one of their ends to the posts, such as the posts at the left. Their other ends are adjustable up and down so that the roll may be moved relative to the bed plate.

According to this invention, the lighter bars 10 are not pivoted in the posts 12 in the ordinary manner. Their other ends, or right hand ends, are movable in the posts 13 and are in threaded engagement with screws 14. The screw members 14 are rotatable by means of toothed members 14' and 16 associated therewith and with an operating cross shaft 20 carrying a hand wheel 22.

In the ordinary construction with the lighter bars 10 pivoted to posts 12, the lighter bars are raised and lowered by rotation of the shaft 20. This may be done by turning the hand wheel 22 so as to move the roll 6 towards and away from the bed plate whereby the said roll will act with different pressures on material passing between the roll and bed plate.

According to this invention in order to facilitate the setting of the roll 6 relative to the bed plate and create a desired condition, I provide a mechanism which may be said to indicate various conditions or roll pressures. This is accomplished in a broad way by what may be called weighing the roll. The weight of the roll on the lighter bars varies as it is supported or resisted by the paper-making stock passing between the roll and bed plate and these various weights are indicated so that the operator may adjust the roll according to the indications and bring about various desired operating conditions.

To explain the invention, I have shown in Fig. 1 certain mechanism at a somewhat enlarged scale which is adapted to operate to bring about the desired results.

A lever 30 is pivoted on a rod 32' which may extend from a ceiling C while another lever 32 is associated with a rod 34 extending from the floor F. A rod 36 connects one end of the lever 30 to the free end of the lighter bar 10 while a rod 38 connects the other end of the lever 30 and the lever 32. An indicating device which may be in the form of a scale S is suspended from the ceiling in any suitable way as by means of a rod 39. This scale has the usual weight-supporting or weight-sensitive element such as a rod 40 which is ordinarily movable to some extent relative to the scale and is connected to the other end of the lever 32.

The scale S may be of any well-known form having a pointer 42 which rotates relative to a

dial 44. The dial 44 of the scale may be graduated with any indicia desired. It will be appreciated that various weights applied to the part 40 of the scale will move the pointer 42 thereof into register with various graduations or indicia of the dial 44.

The beater roll 6, in order to function for the purposes intended, usually weighs several thousand pounds. The levers and links described constitute in the preferred embodiment of the invention connections between the indicator unit or scale and the lighter bar so that one end of the bar and a portion of the roll is actually supported and weighed by the scale. When the roll is away from the bed-plate with no stock therebetween, the scale will be affected so that its pointer 42 will register with a certain graduation on the dial.

For instance, with the roll out of contact with the bed plate and with no material between the roll and plate, the roll is supported by the scale so that the pointer may register with such a numeral as 100 on the dial and thus indicate one hundred pounds which may be the full capacity of the scale. Such an indication will mean that the roll is not bearing on either material or paper-making stock. On moving the hand wheel 22 so as to move the bar 10 up and down the pointer will remain in register with the indicia 100 of the dial of the scale so long as the roll does not contact with the said bed plate or with stock between it and said plate.

With the machine in operation, however, and with the roll set at some operating distance from the bed plate and while material is being passed between the roll and bed plate, the roll is then supported to some extent or its weight is resisted by the material. As the roll is thus supported or resisted, its weight is less than 100 so that the pointer is moved to some other indication. That is, material between the roll and bed plate changes the indicated weight of the roll on the lighter bar and causes the pointer to move. Thus when the pointer is in register with a certain graduation, the operator knows that a certain related operating condition exists and that a certain related roll pressure has been obtained. In other words, with the pointer at or in register with the given designation on the dial it may safely be assumed that the roll is operating at some rather definite pressure related to the indication.

By rotating the hand wheel and, thereby, the shaft 20, the screws 14 may be rotated and in this way, the right hand ends of the bars may be raised or lowered so that the roll is raised or lowered. As will be seen, a change in the position of the roll brings about a change of condition or pressure and a corresponding change in the position of the pointer of the scale.

Having determined through a cycle of operations what certain successive operating or pressure conditions are desirable and which are indicated by certain related positions of the pointer, it is possible to duplicate those conditions by adjusting the roll so that the pointer is positioned at those indications which are related to the certain conditions desired.

It will be possible instead of connecting the weighing unit to one end of one of the lighter bars to connect the same to corresponding ends of both lighter bars or even to suspend the lighter bars entirely from the scale.

It will be observed that the apparatus in effect operates to weigh the roll on the lighter bar or to indicate its weight as it is affected by the resisting influence of material between the roll and plate.

Since a so-called effective weight of the roll is indicated on the scale and the pressure at which the roll is then operating has a relation to the indicated weight, it is possible by manipulating the roll up and down to arrive at that indicated weight to produce the desired pressure or operating condition related to the indicated weight. This all facilitates economy and efficiency in operation and at the same time makes it possible to provide pre-determined conditions and resultant definite operating effects.

Supplemental to the indicating means in the form of the scale shown it may be desirable to employ a recording apparatus which may be acted upon by the lever mechanism and thereby graphically illustrate the operating conditions and changes therein relative to a time unit or units over a cycle of operation.

Various changes and modifications may be made in the form of the apparatus without departing from the spirit and scope of the invention therefor what it is desired to claim and secure by Letters Patent of the United States is:

A beater apparatus for paper pulp and like material comprising in combination, a rigid support,

a vat rigidly supported by said support, a bed plate associated with the inside of said vat, a pair of vertically extending supporting post members having their lower ends rigidly associated with said support in spaced relation, a lighter bar extending between said post members, and a horizontally disposed beater roll co-operating with said bed plate rotatably supported within said vat by said lighter bar at a point intermediate the opposite ends of the bar, one of said post members and one end of the lighter bar having means associated therewith whereby said lighter bar may be moved vertically into various positions of adjustment to adjust the said roll relative to the bed plate, the other end of the lighter bar being arranged relative to the other post member for unrestrained vertical movements, and weighing mechanism responsive to up and down movements entirely supporting said other end of the lighter bar and including indicating means to indicate the variance in the weight of said lighter bar and roll accordingly as said one end of the bar is moved vertically to adjust said roll.

CASSIUS M. BRYAN.

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75	150

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⑤④ Verfahren zur Entsorgung ausgedienter Transportsäcke aus verwebten natürlichen Fasermaterialien

⑤⑦ Die Erfindung betrifft ein Verfahren zur Entsorgung ausgedienter Transportsäcke aus verwebten natürlichen Fasermaterialien, wie beispielsweise Sisal, Jute, Hanf, Baumwolle und dergleichen. Um eine Verwertung der bislang verbrannten oder deponierten Transportsäcke zu ermöglichen, sieht die Erfindung vor, die Transportsäcke zu einem Grund- oder Zuschlagstoff für die Zellstoffverarbeitende Industrie zu verarbeiten und sie insbesondere als Rohstoff für die Papierherstellung einzusetzen.

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Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

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4/34

Beschreibung

Die Erfindung betrifft ein Verfahren zur Entsorgung ausgedienter Transportsäcke aus verwebten natürlichen Fasermaterialien, wie beispielsweise Sisal, Jute, Hanf, Baumwolle und dergleichen.

Weltweit werden täglich Tausende von Tonnen von Gütern, wie Getreide, Kaffee, Kakao oder dergleichen in Säcken aus den genannten oder anderen natürlichen Fasermaterialien transportiert, insbesondere Güter aus Ländern der Dritten Welt, wo diese Säcke sehr preiswert hergestellt werden. Nach ihrer Anlandung in der Bundesrepublik oder anderen Industrieländern gibt es für die entleerten und ausgedienten Transportsäcke allerdings keine Verwendung mehr, so daß allein in der Bundesrepublik wöchentlich mehrere zehntausend dieser Transportsäcke als Abfall deponiert oder in Müllverbrennungsanlagen verbrannt werden. Beide Verfahren sind jedoch relativ teuer; das erstere wegen des relativ großen Volumens der leeren Säcke und das letztere wegen der anlage- und emissionsbedingt hohen Betriebskosten der Müllverbrennungsanlagen. Außerdem wird vom Gesetzgeber verlangt, zur Schonung natürlicher Ressourcen und der Umwelt Reststoffe zunehmend einer Wiederverwendung zuzuführen, zu nutzbaren Gütern zu verarbeiten oder in sonstiger Weise zu verwerten. Eine Verwertung dieser insbesondere in den Überseehäfen anfallenden Transportsäcke wurde bisher vermutlich deshalb nicht in Betracht gezogen, weil die Säcke einerseits mit Resten ihres vorherigen Inhalts verunreinigt sind und andererseits je nach Herkunft und Verwendungszweck aus unterschiedlichen Fasermaterialien bestehen.

Ausgehend hiervon liegt der Erfindung die Aufgabe zugrunde, ein Verfahren der eingangs genannten Art zu entwickeln, das eine Verwertung der ausgedienten Transportsäcke ermöglicht.

Diese Aufgabe wird erfindungsgemäß dadurch gelöst, daß die Transportsäcke zu einem Grund- oder Zuschlagstoff für die Zellstoffverarbeitende Industrie verarbeitet und insbesondere als Rohstoff bei der Papierherstellung eingesetzt werden. Der Erfindung liegt der Gedanke zugrunde, die in den Säcken enthaltenen Fasern dort zu nutzen, wo bisher überwiegend auf andere Art gewonnene natürliche Fasern, wie Holzfasern verwendet werden. Dadurch können einerseits die Kosten für die Entsorgung eingespart und andererseits die natürlichen Recourcen geschont werden.

Eine bevorzugte Ausgestaltung der Erfindung sieht dabei vor, daß Transportsäcke aus unterschiedlichen Fasermaterialien gemeinsam verarbeitet werden, ohne sie jedoch zuvor mit anderen Fasermaterialien zu vermischen. Dem ersteren liegt der Gedanke zugrunde, daß die Herkunft der Fasern bei der Zellstoffverarbeitung in den meisten Fällen gegenüber den Eigenschaften der Fasern, wie beispielsweise ihrer Länge, Biegsamkeit oder dergleichen zurücktritt, wobei die gewünschten Eigenschaften gerade bei den sehr haltbaren, für Transportsäcke verwendeten Fasern in sehr viel stärkerem Maße vorhanden sind, als beispielsweise bei Holzfasern. Gegen eine Vermischung mit anderen Fasermaterialien, auch mit anderen Textilfasern spricht, daß es sich bei den Fasermaterialien der Transportsäcke im Gegensatz zu Fasermaterialien aus Altkleidersammlungen oder dergleichen nahezu durchweg um ungebleichte und ungefärbte Fasern handelt, so daß eine vorangehende Entfärbung entbehrlich ist, während umgekehrt ein Bleichvorgang zur Entfernung der natürlichen Faserfarbe benötigt wird. Da außerdem fast ausschließlich Lebensmittel in den Transportsäcken verwendet werden, sind diese im Gegensatz zu vielen Textilien falls überhaupt dann nur mit lebensmittelverträglichen Chemikalien behandelt worden, so daß eine getrennte Verarbeitung auch einen Einsatz zur Herstellung von Zellstoffprodukten gestattet, die in der Lebensmittelindustrie Verwendung finden.

Bei der erfindungsgemäßen Verwertung der Transportsäcke werden diese bevorzugt nach einer faserschonenden mechanischen Zerkleinerung durch Zerreißen in einzelne Fetzen und/oder Faserbündel chemisch aufgeschlossen, um sie zu Zellstoff zu verarbeiten. Bei starker Verschmutzung der Säcke kann vor oder nach der Zerkleinerung ein zusätzlicher Reinigungsschritt vorgesehen sein.

Im folgenden wird die Erfindung anhand eines Ausführungsbeispiels näher erläutert:

Ausführungsbeispiel

Im Hamburger Hafen angefallene ausgediente Lebensmitteltransportsäcke unterschiedlichster Herkunft und Zusammensetzung, jedoch ausschließlich aus Naturfasern und größtenteils aus Jutefasern bestehend, wurden ohne vorherige Reinigung grob zerkleinert und in einem Behälter in wäßrigem Milieu durch Zugabe eines Oxidationsmittels, bevorzugt von Wasserstoffperoxid und einer Säure, beispielsweise Ascorbinsäure aufgeschlossen, wobei der Behälter extern erwärmt wurde, bis sich unter Aufschäumen und teilweiser Entfärbung der Fasern eine sichtbare Oxidationsreaktion zeigte. In diesem Stadium konnte der Bleichvorgang durch Zugabe von Ätznatron oder einem anderen stark alkalisch wirkenden Stoff oder einer Lauge verzögert werden.

Bevorzugt wurde dann nach einer vorgegebenen Verweilzeit der pH-Wert der Mischung auf etwa 2 abgesenkt und nach dem Aufschäumen beispielsweise durch Zugabe von Natriumbicarbonat auf einen schwach sauren Wert, vorzugsweise auf 6 angehoben. Bei der danach einsetzenden Nachbleichung wurde eine geringe Dosis eines Zuckers zugesetzt, wobei sich die Fasern zu einer flauschigen weißen Masse aus Zellstoff verdichteten.

Bei einer anschließenden Prüfung eines aus dem Zellstoff hergestellten Papierblatts ergaben sich die in Tabelle 1 aufgeführten Werte. Hervorzuheben ist das verhältnismäßig große Volumen und die gute Reißfestigkeit des Blatts, die den erfindungsgemäß aus den ausgedienten Transportsäcken gewonnenen Zellstoff besonders als Zuschlagstoff für recycliertes Papier geeignet machen.

Qualität						
Art						
Bemerkungen		Kurzfaser				
Eingangsdatum	08.07.94					
Bearbeitet am	11.07.94					
Prüfungsnummer	322					
Blattaigensehaften						
Stoffweiße	%					
Blattweiße	%	86,5				
Mahlgrad	SR	12				
Flächengewicht	g/m²	72,9				
Dicke	mm	166				
Volumen	x-fach	2,28				
Reißlänge	m	1547				
Weilerreißf.	mN*m/m	431				
Dehnung	%	0,75				
Luft [Gurley]	s/100ml	0,2				
Luft [Bendtsen]	ml/min	> 3000				
Biegesteifigkeit [5°]	N/mm	0,33				
Opazität	%	76,5				
Trockengehalt	%					
Blattasche [580°C]	%	0,97				
Blattasche [920°C]	%	0,86				
Festigkeitswert	g/Asche	61				
Festigkeitswert	mg/Asche	60				
Extrakt [CH2Cl2]	%					
Splittergehalt	%	—				

Patentansprüche

- Verfahren zur Entsorgung ausgedienter Transportsäcke aus verwebten natürlichen Fasermaterialien, wie beispielsweise Sisal, Jute, Hanf, Baumwolle oder dergleichen, dadurch gekennzeichnet, daß die Transportsäcke zu einem Grund- oder Zuschlagstoff für die zellstoffverarbeitende Industrie verarbeitet und insbesondere als Rohstoff bei der Papierherstellung eingesetzt werden.
- Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß Transportsäcke aus unterschiedlichen Fasermaterialien gemeinsam verarbeitet werden.
- Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Transportsäcke ohne vorherige Vermischung mit anderen Fasermaterialien verarbeitet werden.
- Verfahren nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die Transportsäcke vorzugsweise faserschonend mechanisch zerkleinert werden.
- Verfahren nach Anspruch 4, dadurch gekennzeichnet, daß das Sackgewebe in einzelne Fetzen und Faserbündel zerkleinert wird.
- Verfahren nach Anspruch 5, dadurch gekennzeichnet, daß das Sackgewebe zerrissen wird.

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7. Verfahren nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß die Transportsäcke, die Fetzen oder Faserbündel chemisch aufgeschlossen werden.

8. Verfahren nach Anspruch 7, dadurch gekennzeichnet, daß die Transportsäcke, die Fetzen oder Faserbündel vor einem chemischen Aufschluß vorzugsweise durch Waschen gereinigt werden.

9. Verfahren nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß das Fasermaterial zu Zellstoff verarbeitet wird.

10. Verfahren nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß den Transportsäcken, den Fetzen oder Faserbündeln ein Oxidationsmittel zugesetzt wird.

11. Verfahren nach Anspruch 10, dadurch gekennzeichnet, daß die Transportsäcke, die Fetzen oder Faserbündel in einem Behälter mit Wasserstoffperoxid vermischt werden.

12. Verfahren nach Anspruch 10 oder 11, dadurch gekennzeichnet, daß den Transportsäcken, den Fetzen oder Faserbündeln Wasser und eine Säure zugesetzt und die Mischung erwärmt wird.

13. Verfahren nach Anspruch 12, dadurch gekennzeichnet, daß der Mischung eine stark alkalisch wirkende Lauge oder Alkalien zugesetzt werden.

14. Verfahren nach Anspruch 13, dadurch gekennzeichnet, daß der Mischung nach Ablauf einer vorgegebene Verweilzeit eine Säure zugesetzt und der pH-Wert auf einen Wert von weniger als 3 abgesenkt wird.

15. Verfahren nach Anspruch 14, dadurch gekennzeichnet, daß der pH-Wert nach einem Aufschäumen durch Zugabe einer alkalisch wirkenden Substanz auf einen Wert im schwach basischen Bereich angehoben wird.

16. Verfahren nach Anspruch 15, dadurch gekennzeichnet, daß der Mischung anschließend ein Zucker zugesetzt wird.

17. Verfahren nach Anspruch 16, gekennzeichnet durch eine anschließende Trocknung und Auswalzung der abgeschöpften Zellstofffasern.

United States Patent [19]
Didwania et al.

[11] Patent Number: 4,735,682
[45] Date of Patent: Apr. 5, 1988

- [54] METHOD FOR RECOVERY OF
CELLULOSIC FIBERS CONTAINING LATEX
SOLIDS FROM LATEX BONDED BROKE
- [75] Inventors: Hanuman P. Didwania, Lisle, Ill.;
Robert J. Eber, Appleton, Wis.
- [73] Assignee: James River-Norwalk, Inc., Norwalk,
Conn.
- [21] Appl. No.: 918,841
- [22] Filed: Oct. 14, 1986

Related U.S. Application Data

- [63] Continuation of Ser. No. 703,700, Feb. 21, 1985, abandoned.
- [51] Int. Cl.⁴ D21C 5/02; D21B 1/32
- [52] U.S. Cl. 162/8; 162/191
- [58] Field of Search 162/5, 4, 8, 60, 191

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- 3,047,452 7/1962 De Vos 162/5
- 3,245,868 4/1966 Espenmiller et al. 162/8
- 3,262,838 7/1966 Vieth et al. 162/8
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- 3,766,001 10/1973 Gleason et al. 162/8
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Primary Examiner—S. Leon Bashore

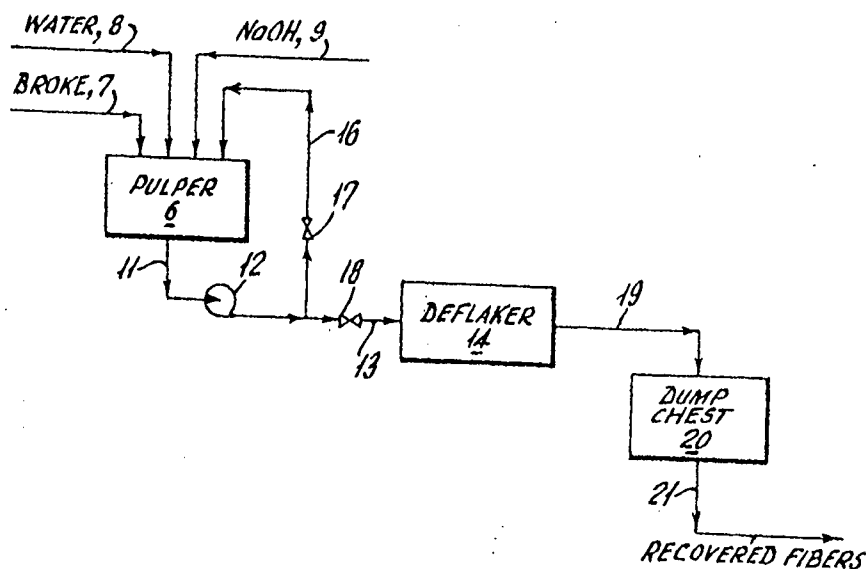
Assistant Examiner—K. M. Hastings

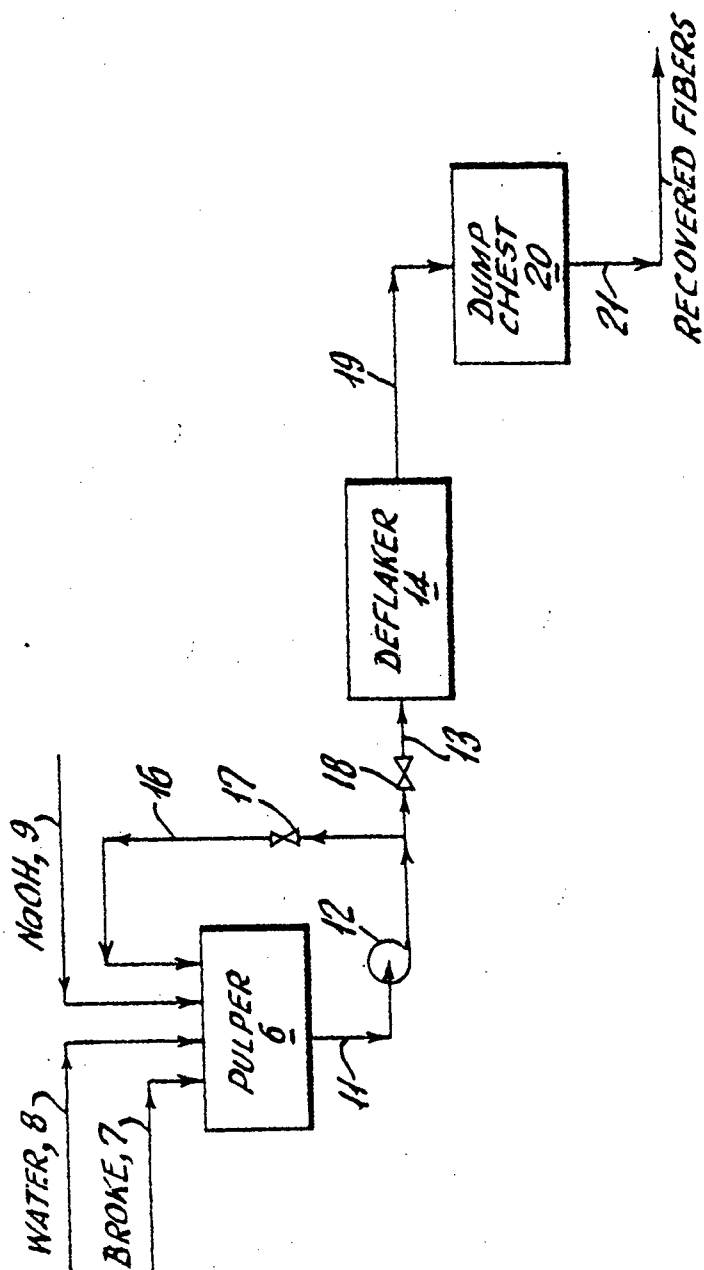
Attorney, Agent, or Firm—William A. Aguele; Harry W. Hargis, III; Thomas H. Whaley

[57] ABSTRACT

Cellulosic fibers containing latex solids are recovered from latex bonded broke by agitation of the broke in an aqueous alkaline solution having an alkali metal hydroxide concentration of 0.5 to 1.5 mol percent for a period of time in the range of ten minutes to four hours. The resulting fibers containing cured latex solids may be added to conventional papermaking fibers in amounts as high as 10 to 15 percent by weight for the production of facial quality tissue to produce a high quality product web.

1 Claim, 1 Drawing Sheet





METHOD FOR RECOVERY OF CELLULOSIC FIBERS CONTAINING LATEX SOLIDS FROM LATEX BONDED BROKE

This is a continuation of application Ser. No. 703,700, filed Feb. 21, 1985, now abandoned.

This invention relates to a process for the recovery of paper-making fibers from latex bonded broke or paper containing latex.

In the manufacture of paper it is desirable to reuse, with a minimum of loss, the waste paper or broke which results during the normal course of production. The disintegration of paper broke to a fibrous state is usually accomplished by repulping in water by mechanical agitation, optionally in combination with chemical treatment. The resulting pulp suspension is returned to the papermaking cycle without further processing. Repulping conditions are preferably of such a nature that the papermaking fibers in the broke will be separated from one another and from the various nonfibrous constituents of the paper with a minimum amount of mechanical or chemical damage to the fibers. Repulping has worked well in the case of broke containing rosin size, clay, ink and ink binders, as well as for wet strength broke containing thermosetting wet-strength resins, such as cationic amine-modified urea-formaldehyde resins, melamineformaldehyde resins, cationic resins prepared by reacting epichlorohydrin with a polyamide of a saturated dicarboxylic acid and a polyalkylene polyamine, and cationic resins prepared by reacting epichlorohydrin with a polyalkylene polyamine. However, a repulping problem does arise in the production of certain coated papers used for high quality offset printing where the paper is coated with a substantially water resistant coating, such as latex.

Conventional methods for repulping latex bonded broke have not been satisfactory. Cured latex solids, which result from the use of latex for bonding air laid webs, is difficult to separate from the cellulosic fibers. Although separation may be effected by chemical treatment or mechanical action, if excessive mechanical action is employed, the energy input and loss of usable fibers may be prohibitive; if excessive chemical treatment is employed, the latex will separate from the fibers but must be removed from the repulping system to avoid subsequent problems during use of the recovered fibers in papermaking. In addition, excessive chemical treatment tends to leave the latex tacky and hard to handle, further compounding its disposal problem.

The prior art in this area describes various methods for repulping broke by freeing the individual paper fibers from the non-fibrous bonding materials, which are then separated from the fibers. U.S. Pat. No. 3,245,868 to Espenmiller et al., discloses a process for recovering papermaking fibers from paper broke which has been treated by a wet strength thermosetting resin by treating the broke with acid for a period of time sufficient to hydrolyze the resin followed by washing the fibers free of resin. U.S. Pat. No. 3,425,897 to Murphy, describes a defiberizing process where the waste wet strength paper is cooked at elevated temperatures and pressure under alkaline conditions. After the initial defiberizing there is further treatment under milder conditions with simultaneous mechanical agitation. U.S. Pat. No. 3,047,452 to De Vos, describes a process for disintegration of paper broke, having a protein-bonded coating insolubilized by formaldehyde, and containing latex

wherein the hardened protein binder is hydrolyzed in the presence of proteolytic enzymes. Finally, U.S. Pat. No. 3,766,001 to Gleason, et al., describes a process for the recovery of pulp from waste paper containing various types of inks, resins, and resinous or hot melt type adhesives by cooking the paper in an aqueous solution containing sodium hydroxide, sodium carbonate, sodium or ammonium bicarbonate and sodium borate followed by water washing of the recovered fibers.

The present invention provides a method for treating latex bonded broke or paper containing latex for recovery of the fibers for reuse in papermaking in which latex solids remain on the individual papermaking fibers which are separated from one another in a repulping operation making them suitable for reuse in the papermaking process without the necessity for removal of the latex solids or disposal of environmentally detrimental wastes.

Briefly the process of repulping latex bonded broke comprises simultaneously subjecting the latex bonded broke to initial fiberization by mechanical agitation in the presence of an aqueous alkaline solution, e.g., caustic soda solution, followed by substantially complete defiberization in a conventional deflaking operation.

The process is illustrated in the accompanying drawing which is a diagrammatic flow sheet showing the basic steps in the process.

Shredded latex bonded broke is added to pulper 6 through line 7 together with sufficient water from line 8 and sodium hydroxide from line 9 to provide a pulp containing about 6 weight percent broke, based on the dry weight of the broke, and an aqueous alkaline solution having a sodium hydroxide concentration in the range of 0.5 to 5 mol percent. The pulper is of conventional design, such as that described in U.S. Pat. No. 3,073,535.

Latex bonded papers which may be processed by the method of this invention include those wherein the latex solids are ethylene vinyl acetate copolymers, copolymers of acrylic esters and vinyl acetate, and ethylene polyvinyl chlorides. The mechanical action of the pulper in the presence of an aqueous alkaline solution containing 0.5 mol percent or more caustic results in up to 60 to 70 defiberization of the broke in the pulper.

The pulp from pulper 6 containing partially separated fibers, with the latex still adhering to the fibers, is removed from the pulper 6 through line 11 by pump 12 and after washing with water (not illustrated) introduced through line 13 to deflaker 14 wherein substantially complete defiberization takes place. As illustrated, pulp from pump 12 may be recirculated to pulper 6 through line 16 as controlled by valve 17, or passed to deflaker 14 at a rate controlled by valve 18. The deflaker 14 may be any various types commercially available, including parallel disc, conical, concentric or matted type deflakers, well known in the art. The action of the deflaker 14 causes the fibers to separate from one another but does not cause the latex to separate free from the fibers. The fibers with latex solids still attached thereto are discharged from flaker 14 through line 19 to a dump chest 20 and drawn off through line 21 for use in making up fiber finish for wet laid web formation. Unexpectedly, the latex solids content of the recovered fibers is not detrimental to their usefulness in conventional wet laid web forming processes wherein they may be blended with papermaking fibers free from latex solids to produce toilet tissue and towels.

In the following examples, which illustrate the process of this invention, the broke employed was that from a commercial air laid product in which ethylene vinyl acetate latex is used as a binder during formation of the web and subsequently cured by drying.

A number of test runs were carried out in a Beloit Jones pilot plant to determine whether broke from paper toweling manufactured by air laying wood cellulose fibers bonded on both sides with an ethylene vinyl acetate copolymer latex at an add on level of 23.8 weight percent with an 80 percent or higher cure. The results of these tests are reported in the following examples.

EXAMPLE 1

Latex bonded broke was dispersed in water to form a pulp containing 6 weight percent broke (dry basis) with sodium hydroxide of 1.5 mol percent, and subjected to repulping in a Beloit Jones repulper. After 45 minutes repulping with 55 horsepower-day/ton (HPD/T) energy input the resulting pulp was removed and screened. Approximately 20 weight percent of the broke was fiberized.

EXAMPLE 2

The test was repeated by repulping broke at the same pulp and alkali concentrations as in Example 1 in the pulper for ten minutes and then processed in a deflaker at 37 HPD/T for five minutes. The same amount of total energy input (55 HPD/T) resulted in reduction in the percentage undefiberized broke to about 10%.

The effluent and pulp samples from the broke subjected to the pulper and deflaker treatments were examined for latex solids using the Measurex Analyzer. Results (Table 1) show that on a relative basis there appears to be a directional increase in the latex solids content in rejected knits and in fines. Overall, the latex solids content in screened pulp is not significantly changed. This indicates that the latex solids are not significantly separated from the fibers. Electron microscopic examination showed that after pulper/deflaker treatments, the broke fibers, even though not interbonded with latex solids were still coated with the latex solids. The processed broke pulp sheets were found to have fiber crossings with sharp edges, and were essentially free from particles or clumps of fibers.

TABLE 1

Latex Solids on Processed Broke Pulp	
	Latex Solids Weights %
Non-processed Broke	22.4
Processed Broke Pulp	
Washed Pulp	20.1
Washed Pulp Classified on .006" screen:	
Acceptable	18.8
Reject Knits	23.6
Fines (100 mesh)	25.4

EXAMPLE 3

In another set of test runs, samples of the latex bonded broke of Example 1 were repulped at 0.5 mol% NaOH concentration and at 1.5 mol% NaOH concentration. At 40 HPD/T energy input, the percentage yield, of acceptable repulped broke fibers that passed through 0.006 inch cut and were retained on 100 mesh, was 45 weight percent at 0.5 mol % NaOH concentration and 65 weight percent at 1.5 mol % NaOH.

EXAMPLE 4

Latex bonded broke from the same source as in Example 1 with 1.5 mol % NaOH concentration were repulped at 18 HPD/T energy input and then 12 HPD/T additional energy input was made in a deflaker. A yield of 75% was achieved. Yield was not increased on additional input of energy in the deflaker. When the same test run was made with 0.5 mol % NaOH concentration, a 75% yield was reached at 35 HPD/T total energy input.

EXAMPLE 5

Defibered and repulped broke containing latex solids prepared according to Example 2 was added at 10% and 15% levels dry weight to a good quality furnish consisting of 50/50 Northern softwood and hardwood species. Laboratory handsheets which were uncompact and creped to simulate commercial tissue sheets were made up from the original furnish and from the modified furnish formulations. It was found that with good quality furnish tensile values of the handsheets were increased, bulk was somewhat decreased and softness was decreased; the observed effects are more pronounced at 15% addition than at 10% addition.

EXAMPLE 6

Defibered and repulped broke containing latex solids prepared according to Example 2 was added to 100% secondary fiber furnish and handsheets made up as in Example 5. The presence of repulped broke improved the quality of the appearance of the handsheets, while the bulk, tensile strengths and hand softness were not changed significantly.

The foregoing examples demonstrate that latex bonded broke may be treated with relatively low concentrations of sodium hydroxide effecting defiberization without separation of latex from the fibers and that the resulting defiberized and repulped broke may be added to conventional cellulosic papermaking fibers and wet laid to form a high quality web.

We claim:

1. A process for the recovery of wood cellulose fibers coated with cured latex solids from air laid latex bonded paper broke wherein the latex is selected from the group consisting of latices of ethylene vinyl acetate copolymers, copolymers of acrylic esters and vinyl acetate, and ethylene polyvinyl chlorides which consists essentially of:

- repulping the broke by agitation in an aqueous alkaline solution having alkali metal hydroxide concentration in the range of 0.5 to 1.5 mol percent without substantial separation of the cured latex solids,
- subjecting the pulp comprising broke fibers and associated latex solids from step (a) to deflaking for a period of time sufficient to substantially complete defiberization of cellulose fibers without substantial separation of the cured latex solids therefrom and without substantial degradation of the fibers,
- recovering cellulose fibers from the broke as individualized fibers containing a major portion of the cured latex solids from step (b),
- dispersing fibers containing the cured latex solids as recovered in step (c) in admixture with other cellulosic papermaking fibers in an aqueous dispersion to form a papermaking fiber furnish, and
- forming a fibrous tissue web from the fiber furnish prepared in step (d).

* * * * *

PATENT SPECIFICATION



Convention Date (United States of America): Sept. 27, 1945.

615,169

Application Date (In United Kingdom): July 31, 1946

No. 22758/46.

Complete Specification Accepted: Jan. 3, 1949.

Index at acceptance:—Class 96, A3a.

COMPLETE SPECIFICATION

Bedplates for Beaters for Paper-making

We, E. D. JONES & SONS COMPANY, a Company organized under the laws of the State of Massachusetts, United States of America, of Pittsfield, Massachusetts, United States of America, assignees of DWIGHT E. JONES, a citizen of the United States of America, of 27, Wellesley Street, Pittsfield, Massachusetts, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to beaters such as are used in the paper-making art for processing paper making materials, and it is directed more particularly to the construction and mounting of the bedplates for such beaters.

According to some of the prior art, metal bedplates were made to receive several separately formed metal cutting bars, spaced apart with wood or metal packings between them, and secured together by bolts or rivets. This composite bedplate was then assembled in a shoe or holder, commonly termed a plate box, being held therein by means of wood packings located on either side of the bedplate and between it and the wall of the plate box.

It has been customary to make those wood packings in several side-by-side pieces with at least one piece tapered so that, when the complete assembly is fitted together, this tapered piece can be used wedge-wise to make the whole assembly tight. In cases where the treatment materials would exert an abrasive action, the top of the wood packings has been covered with metal to prevent the wood from being washed or worn away. The said plate box has usually been tapered lengthwise and vertically, so that when it is inserted in its pocket in the beater it is held tight.

Also, according to other prior art, bedplates have been cast of very hard materials with integral cutting edges forming part of the base material. These plates

[Price 2/-]

have been rough along their length and it has been necessary to pack the space between their sides and the wall of the plate box with wood, or in some cases the plates have been inserted directly into the beater, as with bedplates made of stone, but even then the space between the plate and the opening in the beater needs to be packed with wood.

According to this invention, a one-piece bedplate is formed to have integral cutting bars on its working face by having grooves machined in such working face according to any desired pattern or arrangement, and is secured to a support or base on which it is mounted so that the whole assembly may be readily and easily slipped into a plate box opening in the beater without the necessity of a plate box, the bedplate and the said support being made to a size corresponding to that of the conventional plate box, and so that they will fit tightly in the opening which is provided in the beater for the plate box.

The plate construction may be made of any metal desired, depending upon the requirements of a particular paper mill and the spacing and arrangement of the blading may be as desired since the same is not dependent on or limited in any way to filler bars as in the prior art.

Not only may the spacing of the blading be as desired, but the so-called pattern thereof may be varied to suit conditions. In fact, the blading presenting a certain arrangement or pattern may be entirely removed by machining and another pattern of blading be formed in the bedplate.

In the accompanying drawing, examples of the invention are illustrated:

Fig. 1 is a plan of the end portions of a bedplate construction embodying the novel features of the invention;

Fig. 2 is a cross-sectional elevation on the line 2-2 of Fig. 1;

Fig. 3 is a view similar to that of Fig. 1 shewing another arrangement or pattern of blading; and

Fig. 4 is a vertical section of a beater having (for the purpose of contrast) the novel bedplate construction of this invention and a prior art construction associated therewith.

As shewn in Fig. 2, a base or support 2 is provided, which will preferably be made from metal and in such form and size as to be receivable directly in the beater and at the same time rigidly support the bedplate in proper relation to the beater roll.

A bedplate 4 is provided, which on its working face, by a suitable machining operation, is formed to have spaced slots or grooves 6 which provide spaced cutting blades or bars 8. The working face of the plate or faces of the bars will be arranged to provide the proper curvature for the coaction of the bars with those of a beater roll.

The bedplate and support may be secured together by any suitable means. For illustrative purpose, however, the components are secured together by cap screws 10, as shewn. There may be as many cap screws as desired so that the bedplate is secured to the base in a rigid and secure manner.

An extension 12 may be provided on the plate 4 or the support 2 for engagement by a positioning and withdrawal tool adapted to facilitate removal of the construction from the beater. Such tool would have a head to fit in the T-slot 12', for pulling purposes.

The bedplate 4 may be made from various metals such as stainless steel, non-ferrous metals or the like, depending upon the conditions under which it will be used, and the grooves or slots 8 may be provided by any well known machining operation to form the desired blading.

The blading and the spacing thereof, as well as the width and height of the cutting bars, may be as desired, and according to the machining operation selected. The arrangement or pattern of the blading may be varied within wide limits and the blading may be changed or varied by machining off the upper face of the bedplate and providing a different arrangement or pattern, means being provided in such cases to increase the height of the new working face with respect of the supports in the beater.

A plate 4' in Fig. 3, has grooves 6' and blading 8' so as to provide more or less diagonally-arranged cutting bars from

which it will be understood that patterns 60 of blading may be varied within wide limits.

The improved construction provides rigidity, so as to eliminate vibration.

In Fig. 4, which shews a cross section through a beater 16, a roll is represented by 18 which has radially extending cutting bars 20. A frame is represented by 22 in which are disposed a bedplate 24 of prior art construction and bedplates 26 embodying the novel features of this invention. Said figure illustrates the relationship of a bedplate and beater roll for the coaction of the cutting bars.

The means associated with the beater for receiving the bedplate may be varied to suit conditions but will be such as to readily and easily receive the bedplate and hold the same relative to the beater roll for the coaction of the cutting bars.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A unitary bedplate for a beater, formed to have integral cutting bars on its working face by having grooves machined in such working face according to any desired pattern or arrangement, and secured to a support or base on which it is mounted so that the whole assembly may be readily and easily slipped into a plate box opening in the beater, without the necessity of a plate box, the bedplate and the said support being made to a size corresponding to that of the conventional plate box, and so that they will fit tightly in the opening which is provided in the beater for the plate box.

2. A bedplate according to claim 1 having an extension at one end for engagement by a positioning and withdrawal tool for the purpose set forth.

3. A bedplate for a beater substantially according to either of the examples herein described with reference to Figs. 1, 2 and 3 of the accompanying drawings.

4. A beater or the like having a bedplate construction according to any of claims 1 to 3.

Dated this 30th day of July, 1946.

For the Applicants,
WILSON, GUNN & ELLIS,
Chartered Patent Agents,
54/56, Market Street, Manchester I.

135

[This Drawing is a reproduction of the Original on a reduced scale.]

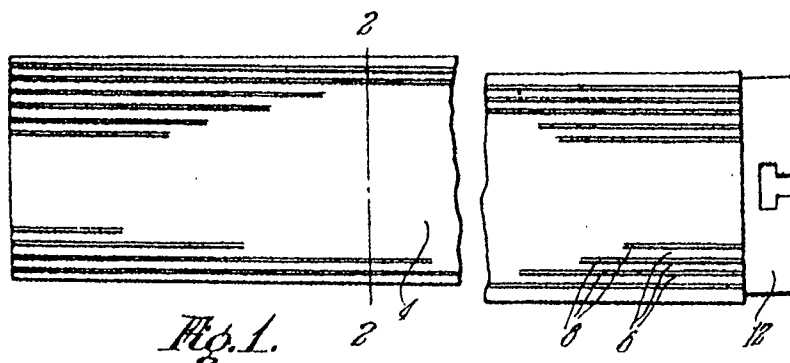


Fig. 1.

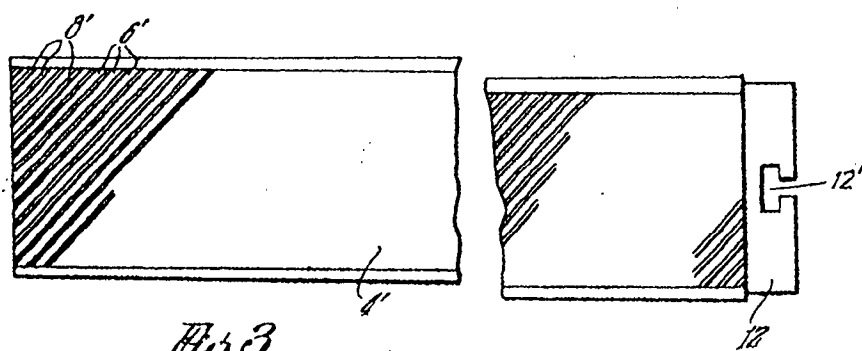


Fig. 3.

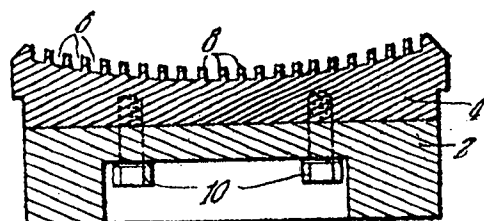
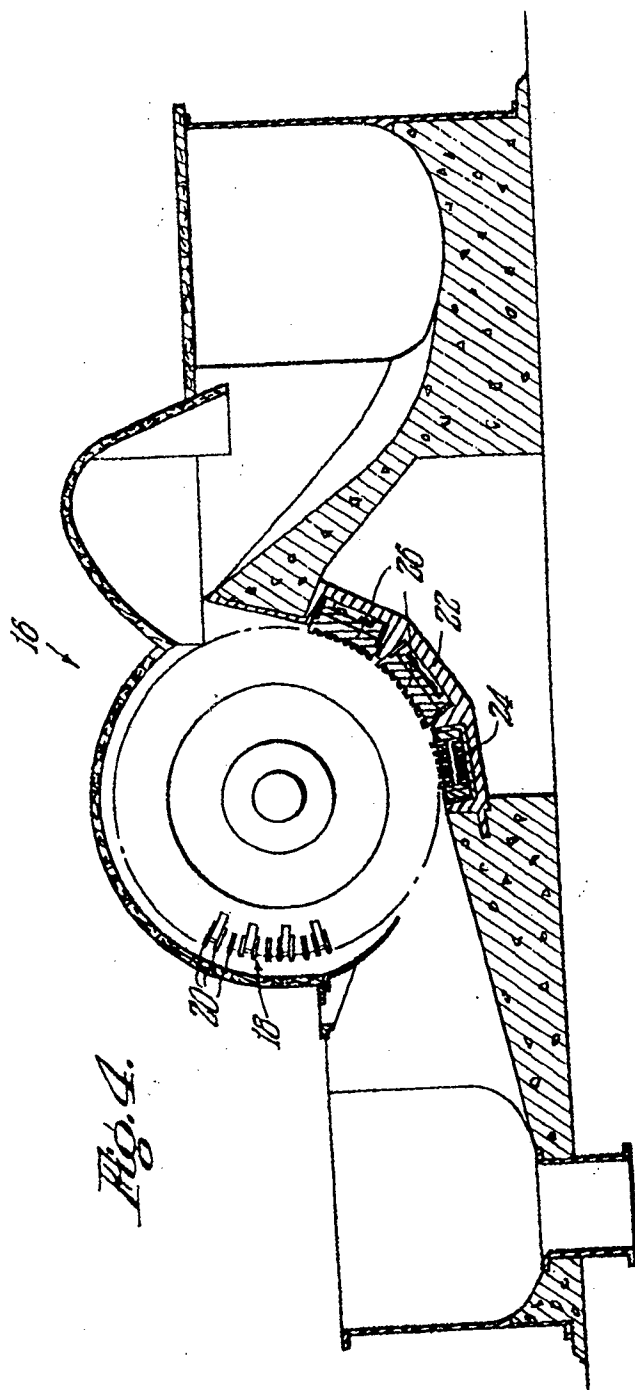


Fig. 2.

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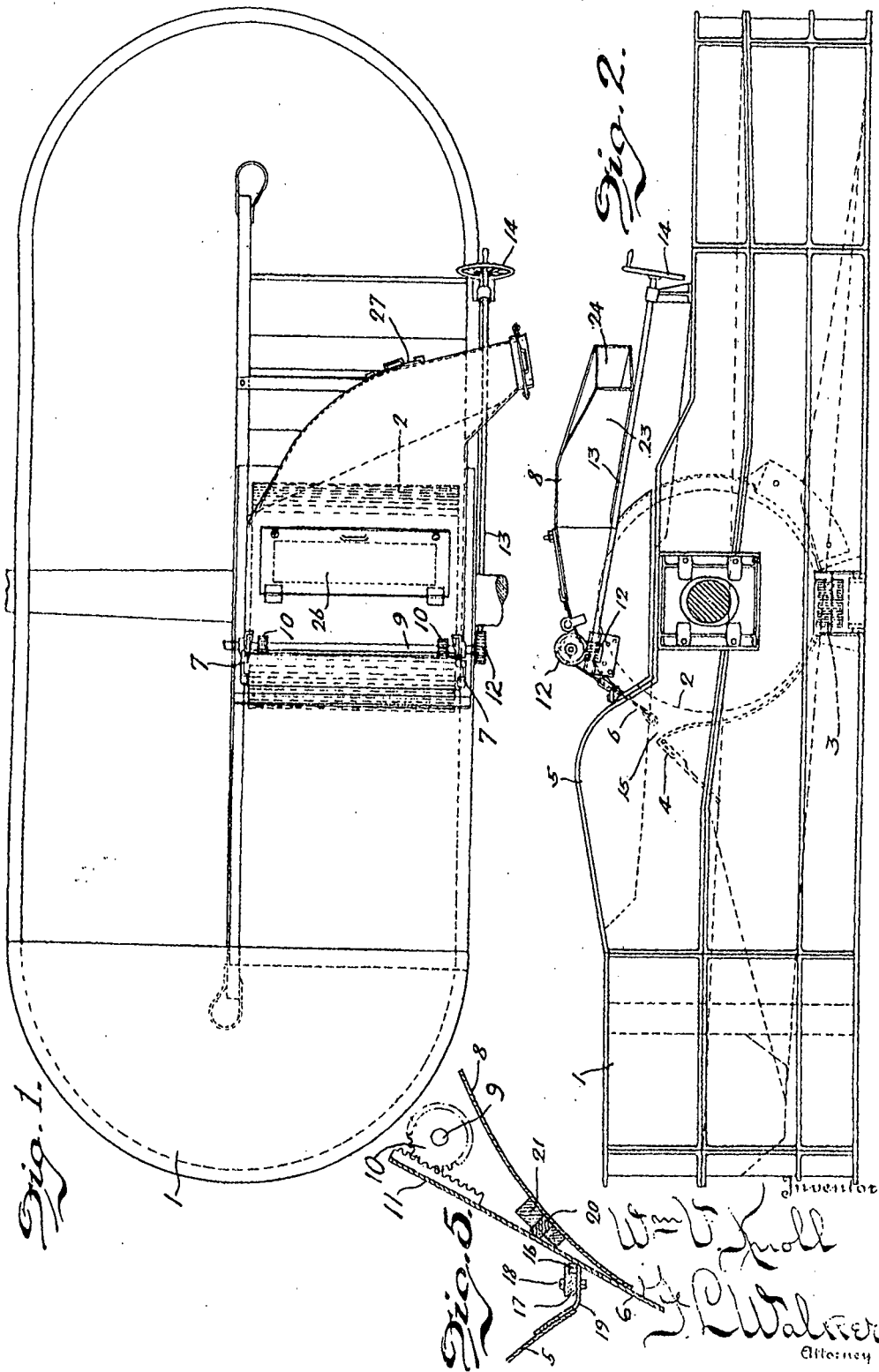
July 14, 1931.

W. V. KNOLL
BEATER ENGINE

1,815,007

Filed Aug. 6, 1928

2 Sheets-Sheet 1



Wm V Knoll
J P Walker
Attorney

July 14, 1931.

W. V. KNOLL

1,815,007

BEATER ENGINE

Filed Aug. 6, 1928

2 Sheets-Sheet 2

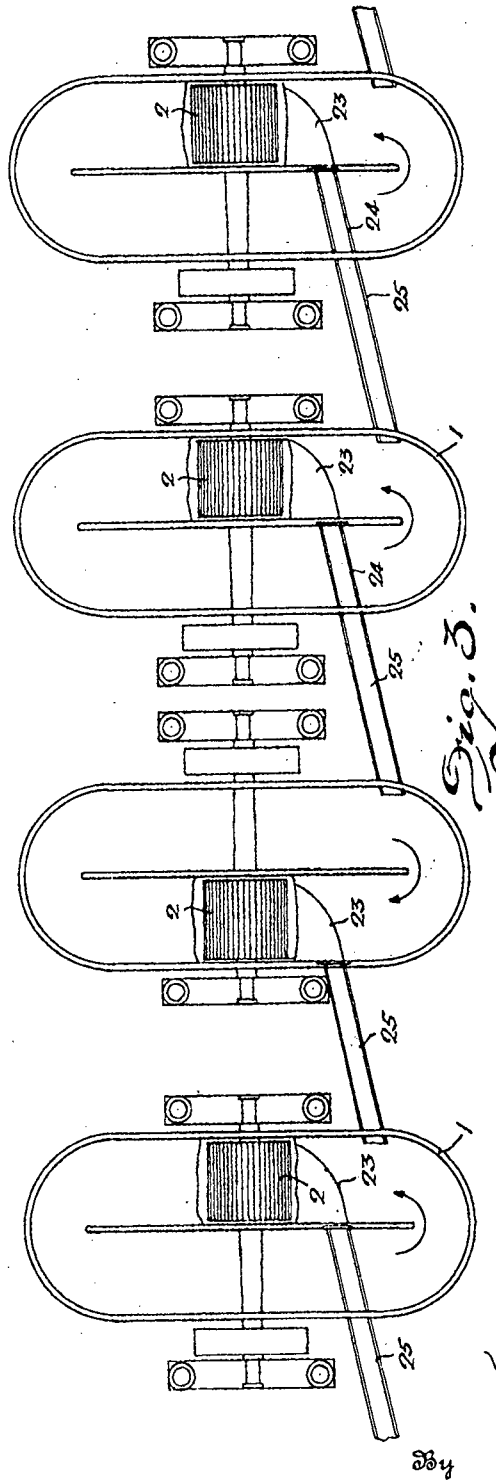


Fig. 3.

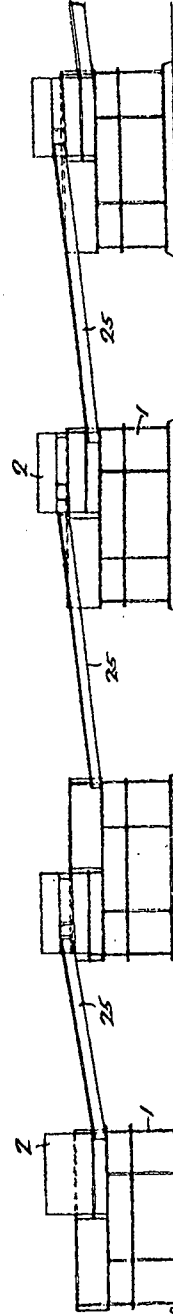


Fig. 4.

William V. Knoll
J. R. Walker
Attorney

UNITED STATES PATENT OFFICE

WILLIAM V. KNOLL, OF DAYTON, OHIO, ASSIGNOR TO MIDWEST-FULTON MACHINE CO.,
OF DAYTON, OHIO, A CORPORATION OF OHIO

BEATER ENGINE

Application filed August 6, 1928. Serial No. 297,841.

My invention relates to pulp making, and fiber liberation, and more particularly to a system of beater engines, and means for progressively transferring from one beater engine to another pulp portions which have been reduced to required conditions.

In the present construction a number of beater engines, preferably though not necessarily, of the Hollander type are arranged in series and interconnected by conduits through which the finished product discharged from one beater engine is conveyed to another for reworking. Each beater engine is equipped with a deflector plate adjustably positioned above the usual backfall at the rear side of the beater roll. Such beater engines are further provided with receiving pans leading to the offtake conduit, which receiving pans are located slightly below the top of the periphery of the roll and at the forward side thereof. In operation the coarse and uncompleted portions of the pulp passing the roll are delivered over the backfall and beneath the deflector plate to continue their circuitous path in the beater engine for reworking. The lighter and finished particles of pulp are carried upwardly by the action of the roll and are discharged forwardly from the top of the roll by centrifugal influence into the receiving pan from which such pulp portion is conducted to the succeeding beater engine of the series. Means is provided for adjusting the deflector plate to permit a greater or less volume of the pulp to be passed between the backfall and such plate to continue its flow through the beater engine. This adjustment of the plate regulates the quantity and to some extent the character of the pulp to be discharged from the engine and affords, in effect, a selective volume control by which the pulp in the successive beaters of the series may be maintained at a constant level.

The object of the invention is to simplify the construction, as well as the means and mode of operation, of beater engines, whereby they will not only be cheapened in construction, but will be more efficient in use, positive in operation, uniform in action,

easily controlled, and unlikely to get out of repair.

A further and important object of the invention is to provide selective means for progressively removing from the beaten pulp the finished portion and for continuing in the flowing pulp stream the unfinished portion for reworking.

A further object of the invention is to provide a selective volume control for beater engines by which the quantity of pulp discharged may be accurately regulated.

A further object of the invention is to provide an adjustable deflector plate in co-operative relation with the beater roll and backfall of a beater engine, and to provide means for adjusting such deflector plate from the front of the engine.

A further and important object of the invention is to provide improved means for trapping the refined and finished portions of the pulp, and for conveying the same from the beater engine.

With the above primary and other incidental objects in view, as will more fully appear in the specification, the invention consists of the features of construction, the parts and combinations thereof, and the mode of operation, or their equivalents, as hereinafter described and set forth in the claims.

Referring to the accompanying drawings, wherein is shown the preferred, but obviously not necessarily, the only form of embodiment of the invention, Fig. 1 is a top plan view of a beater engine to which the present invention has been applied. Fig. 2 is a side elevation thereof. Fig. 3 is a top plan view illustrating the interconnection of a series of beater engines for a progressive treatment of the pulp. Fig. 4 is an end elevation of the beater installation shown in Fig. 3. Fig. 5 is a detail of the deflector plate mounting and its actuating means.

Like parts are indicated by similar characters of reference throughout the several views.

Referring to the drawings, 1 is the vat or tub of the beater, in which is mounted

the roll or drum 2 coacting with the usual bed plate 3, and discharging the beaten pulp over the backfall 4. A portion of the vat or tub 1 is provided with a cover or hood 5 beyond the beater roll 2. This is the usual construction of a Hollander type beater, and forms no part, per se, of the present invention.

Located rearwardly of the beater roll 2 and extending into channel spaced relation with the backfall 4 is a vertically adjustable deflector plate 6. This plate is slidably mounted in guides or ways 7 upon supporting brackets located at opposite sides of the hood 8 enclosing the upper portion of the beater roll. Mounted in such brackets at opposite sides of the beater roll hood is a transverse shaft 9 carrying gear pinions 10 intermeshing with rack bars 11 upon the forward and under side of the inclined deflector plate. The shaft 9 is rotated to slidably adjust the deflector plate by means of a worm and worm gear 12 actuated by a shaft 13 carrying at its forward end adjacent to the vat or tub 1 a hand wheel 14. By rotating the hand wheel 14 the shaft 9 is in turn rotated to thereby raise and lower the deflector plate, varying the outlet orifice 15 for pulp intermediate the backfall 4 and the lower margin of the plate 6.

The opening in the cover section through which the deflector plate projects is sealed at one side of the plate by a strip of packing material 16 clamped between a clamp bar 17 connected by stud bolts 18 with an extension 19 of the vat or tub cover 5. At the opposite side of the adjustable plate there is provided a packing strip of hemp or other suitable material held between transverse bars 21 which may be secured to the beater roll hood 8 but which in practice merely rest thereon loosely, and hold the packing material 20 in contact with the adjustable plate by gravity, due to the curvature or inclination of the beater roll hood.

At its forward end the beater roll hood 8 communicates with a covered receiving compartment or pan 23, which extends the full width of the beater roll 2 and is inclined downwardly and forwardly from a level slightly below the top of the periphery of such roll. The pulp receiving compartment or pan 23 is contracted laterally through a discharge outlet 24, preferably provided with a gate or cutoff valve from which outlet leads a conduit 25 to the next succeeding beater engine of the series. The receiving compartment 23 and interconnecting conduits 25 between succeeding beater engines are preferably inclined at such degree as to induce a flow of the selected or separated pulp by gravity from one beater engine to the other. It will be understood, however, that screw conveyors or other pulp

impelling means may be employed in lieu of gravity conduits.

In the normal operation of a beater engine, the heavier portions of the pulp are impelled over the backfall 4 by the rotation of the wheel in a constantly flowing stream which continues its way about the mid-feather of the tub or vat, returning to the roll for reworking. At the same time the more finely reduced portions of the pulp are discharged from the wheel by centrifugal influence through paths of higher trajectory, depending upon the relative size and weight of the pulp particles. Such finely divided portions are thus carried above the normal flowing pulp stream and are ordinarily projected into space. In the present construction, the adjustable deflector plate 6 is arranged to intercept a greater or less proportion of the reduced pulp thus discharged by centrifugal influence above the level of the pulp stream, permitting only a limited portion thereof of the heavier or coarser particles having a low trajectory to pass through the opening 15 intermediate the backfall 4 and the lower margin of the deflector plate.

The more finely divided portions of the pulp are carried upwardly by the rotation of the roll, and discharged forwardly from the top thereof by centrifugal influence into the receiving compartment or pan 23. By varying the elevation of the deflector plate 6 in its relation to the top of the backfall, a greater or less quantity of refined pulp is caused to thus pass over the top of the revolving roll and into the receiving compartment. The apparatus thus automatically selects or separates the refined pulp from the unrefined or coarse portions, the degree of fineness being regulated by the adjustment of the deflector plate. The adjustment of this plate 6 thus affords a selective volume control as well as a grading selector for the separation of the refined from the coarse pulp.

The interconnection of the plurality of beater engines in series by means of the interconnecting pulp conduits 25 afford a continuous flow system in which, as rapidly as the pulp is conditioned in one engine, it is discharged therefrom and conveyed to the next beater engine of the series for further treatment, while the coarse material is retained in the beater engine and returned to the roll for reworking. By adjusting the deflector plates of different beater engines proportionately to the output thereof, the pulp level in the succeeding beaters of the series may be maintained substantially constant.

A door 26 is provided in the top of the beater roll hood to permit inspection of the roll or removal of any refuse material. Likewise the receiving compartment or pan 23 is provided in one side thereof with an

access opening provided with a closure 27 to permit the observation of the flow of selected pulp.

Having thus described by invention, I claim:

1. In a beater engine, or the like, the combination with a beater roll and back fall, an adjustable deflector plate located at the discharge side of the roll and in spaced relation above the backfall and permitting the flow of the pulp stream therebetween, but intercepting pulp material discharged by centrifugal influence in a trajectory above the level of the pulp stream said deflector plate being adjustable toward and from the back fall in a direction substantially tangential to a circle concentric with the axis of the roll, and a receiving compartment located forwardly of the beater roll into which the lighter portions of pulp will be discharged by centrifugal influence from the roll, said compartment having an outlet discharging beyond the beater engine.

2. The combination with a beater engine including a beater roll and backfall, of a deflector plate located in spaced relation above the backfall and adjustable relative thereto to vary the intermediate space while maintaining substantially uniform spaced relation with the beater roll, and a receiver for pulp located forwardly of the roll and in proximate relation with the top of the periphery thereof.

3. The combination with a beater engine, including a beater roll, and a backfall over which the pulp stream flows under influence of the roll, of a downwardly and rearwardly inclined deflector plate for intercepting pulp material discharged by centrifugal influence from said roll above the level of the pulp stream, and a receiver located at the forward side of the roll into which the intercept material is discharged.

4. The combination with a beater engine, including a beater roll and a backfall, of an adjustable deflector plate located in spaced relation above the backfall said deflector plate being mounted for reciprocatory motion in a plane inclined downwardly and away from the beater roll and toward the backfall and a receiver for fined pulp located at the opposite side of the roll.

5. The combination with a beater engine, including a beater roll, and a backfall, of a deflector plate adjustable toward and from the back fall to vary the intermediate space through which pulp is discharged by the roll without materially varying the throat space intermediate the deflector plate and roll through which material is carried by the roll for discharge over the top thereof and a receiver located at the opposite side of the roll onto which fined material carried beyond said aforementioned discharge space is discharged.

6. The combination with a beater engine, including a beater roll, and a backfall, of an adjustable deflector plate variably positioned above the backfall and in constant spaced relation with the roll, and distantly operated means for adjusting the deflector plate toward and from the backfall.

7. The combination with a beater engine, including a roll and a backfall, of a deflector plate adjustably positioned above the backfall, rack bars carried by the plate, gear pinions engaged by the rack bars, a worm and gear actuating means for the gear pinions, and an operating shaft for the worm and gear connection extending into proximity with the end of the beater engine.

8. The combination with a beater engine, including a roll and backfall, of a reciprocatory deflector plate located above the backfall and intercepting the material discharged by centrifugal influence from the roll in a trajectory above the level of the pulp stream, and adjusting means for the deflector plate located beyond the side of the roll opposite the said deflector plate and operatively connected therewith.

9. The combination with a beater engine, including a roll and a backfall, of downwardly and rearwardly inclined adjustable deflector plate located above the backfall and separating the material discharged from the roll through a trajectory above the level of the normal pulp stream, whereby a portion of such material is permitted to return to the pulp stream, and the remainder diverted therefrom, a revoluble adjusting shaft for said deflector plate extending past the roll and therebeyond, and an operative connection between said shaft and the deflector plate for reciprocating the latter in its downwardly and rearwardly inclined plane.

10. The combination with a beater engine, including a roll and a backfall over which a portion of the pulp is discharged in a flowing stream, while lighter portions of the pulp are discharged by centrifugal influence from the periphery of the roll in a reverse direction, of a reciprocatory deflector plate inclined downwardly and away from the roll above the backfall, toward and from which it is slidingly adjustable, a housing through which the plate projects, and yielding packing means supported upon the housing and engaging the reciprocatory deflector plate.

11. The combination with a beater engine including a roll and a backfall over which a portion of the pulp is discharged in a flowing stream, while lighter portions of the pulp are discharged by centrifugal influence from the periphery of the roll in a reverse direction of a reciprocatory deflector plate inclined downwardly and away from the roll above the backfall, toward and from which it is slidingly adjustable, and operat-

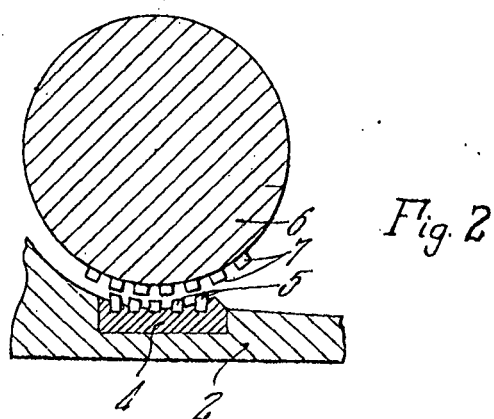
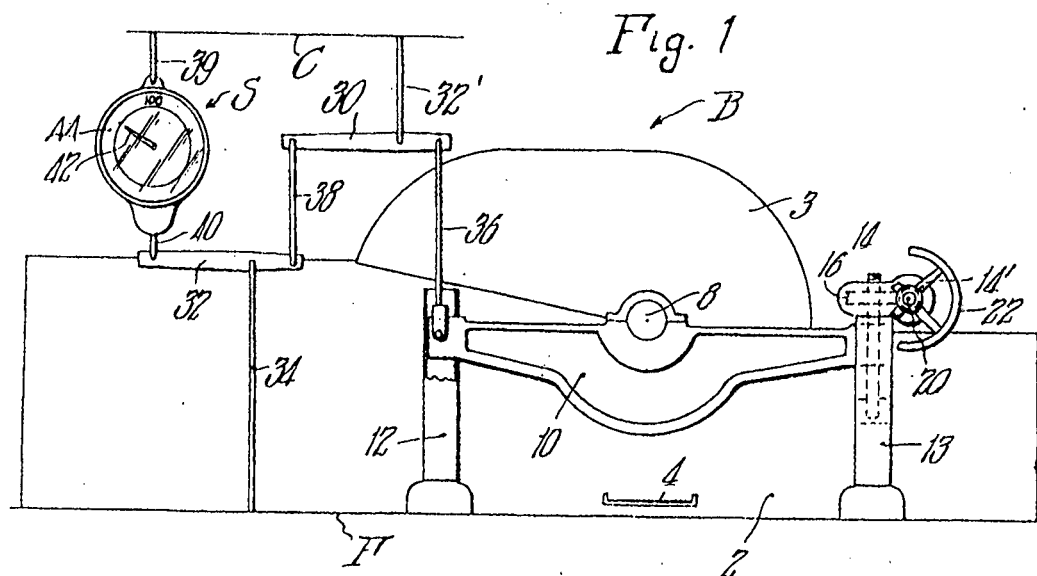
Nov. 13, 1934.

C. M. BRYAN

1,980,253

PAPER MAKING APPARATUS

Filed April 3, 1933



INVENTOR.
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BY
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ATTORNEY.

UNITED STATES PATENT OFFICE

1,980,253

PAPER MAKING APPARATUS

Cassius M. Bryan, West Springfield, Mass.

Application April 3, 1933, Serial No. 664,223

1 Claim. (Cl. 92—24)

This invention relates to improvements in paper-making apparatus and is directed more particularly to improvements in beaters and the like and methods of operating beaters.

5 The principal objects of the invention are directed to the provision of improvements in a beater or similar apparatus to facilitate the easy and efficient setting of the roll and operating thereof.

10 As is well-known, a beater or similar apparatus comprises a roll which is rotatable above a bed plate or plates and co-operates therewith so that paper-making stock such as fibers in water may be passed between the roll and plate. In operation more or less pressure is exerted by the roll to bring about certain chemical and/or physical changes in the fibers of the stock being acted upon by the machine.

By means of a beater machine, the fibers may 20 be cut without beating, the machine may operate for wet beating, or there may be a combined wet beating and cutting. Whether the machine is being operated for wet beating or cutting depends largely upon the roll pressure, the distance of the 25 roll from the bed plate, and the resistance or consistency of the paper-making stock. In practise, in order to obtain the desired results, it is necessary that the roll be operated for successive different periods of time and/or at different roll clearances and/or pressures throughout a cycle of operations.

It is recognized as being difficult, if not impossible, to determine the roll pressure at different settings of the roll and in fact it is probably unknown what the roll pressure is. In the ordinary machine of the type referred to, lighter bars support opposite ends of the roll shaft and are adjustable at one end for varying the distance between the periphery of the roll and said bed plate 40 in order to obtain different roll pressures or operating conditions and results.

This distance between the roll and bed plate may be varied according to the consistency or nature of the stock in order to vary the pressure 45 and thereby vary the results obtained. It is not only difficult however to manipulate the adjustments to bring about the desired results but it is likewise difficult to duplicate results or to actually know what is taking place.

50 It is the universal practise for a skilled beater operator to be guided almost entirely by certain senses, such as the feel of the stock from time to time and the sound of what he believes to be taking place. It is usual for the operator to place his 55 foot on the bed plate which projects outside the

machine so he may sense the vibrations and altogether he is guided by the senses in making the necessary adjustments with the hopes of obtaining the results desired. There is no definiteness as to what is actually taking place or any definite way of knowing the actual operating conditions.

Attempts have been made to adjust the roll relative to the bed plate by means of various mechanisms and various instruments have been used to indicate the movements of the roll supporting bars. Such mechanisms, however, have not been used with great success because of loss of motion of the parts and the fact that the roll is moved but a few thousandths of an inch to produce great differences in results and any wear or inaccuracies in the parts are not compensated for.

According to my invention, means is provided for moving the roll towards and away from the bed plate whereby it is possible to fix the roll in various adjusted positions relative to the bed plate.

With the roll thus adjustably fixed in some position and with paper-making material being acted upon by the roll, the novel mechanism of the invention includes indicating means to indicate a certain pressure condition which exists between the roll and bed plate at that particular position of the roll. Certain indications indicate certain related conditions of pressure. When certain results are obtained under certain conditions as evidenced by a certain indication, it is, of course, possible to create that same condition at a subsequent time. In other words, by moving or adjusting the roll, the indicator may be brought to a certain point to thereby indicate 90 a certain related pressure condition between the roll and bed plate which it is desired to bring about in order to obtain a certain function and result.

Over a cycle of operations it is possible to adjust the roll in such a manner that certain conditions of pressure prevail over pre-determined lengths of time which conditions are indicated by the indicator. In that way, it is possible to operate the machine and substantially duplicate 100 a series of conditions and provide uniform results so as to facilitate substantial accuracy in manufacture and uniformity of product in all its important respects.

Various and numerous novel objects and advantages of the invention will be hereinafter more fully referred to in connection with the accompanying description wherein the invention in the form at present preferred is disclosed, reference 110

being had to the accompanying drawing, wherein:

Fig. 1 is a side elevational view of a beater apparatus having the novel features of the invention associated therewith, and

Fig. 2 is a sectional view through a roll and bed plate of the beater shown in Fig. 1.

Referring now to the drawing in detail the invention will be fully described.

In Fig. 1 there is shown a beater B in a more or less diagrammatic way which includes a vat 2 of the usual form. A bed plate is shown at 4, above which is a roll 6. The bed plate 4 and roll 6 may be of the usual form and carry a plurality of co-acting bars such as 5 and 7. The roll is driven in the usual manner and its shaft 8 is journaled in lighter-bars such as 10 disposed at opposite sides of the beater.

Lighter posts 12 and 13 such as shown, are arranged in pairs at the rear and forward sides of the vat. Ordinarily the bars 10 are pivoted at one of their ends to the posts, such as the posts at the left. Their other ends are adjustable up and down so that the roll may be moved relative to the bed plate.

According to this invention, the lighter bars 10 are not pivoted in the posts 12 in the ordinary manner. Their other ends, or right hand ends, are movable in the posts 13 and are in threaded engagement with screws 14. The screw members 14 are rotatable by means of toothed members 14' and 16 associated therewith and with an operating cross shaft 20 carrying a hand wheel 22.

In the ordinary construction with the lighter bars 10 pivoted to posts 12, the lighter bars are raised and lowered by rotation of the shaft 20. This may be done by turning the hand wheel 22 so as to move the roll 6 towards and away from the bed plate whereby the said roll will act with different pressures on material passing between the roll and bed plate.

According to this invention in order to facilitate the setting of the roll 6 relative to the bed plate and create a desired condition, I provide a mechanism which may be said to indicate various conditions or roll pressures. This is accomplished in a broad way by what may be called weighing the roll. The weight of the roll on the lighter bars varies as it is supported or resisted by the paper-making stock passing between the roll and bed plate and these various weights are indicated so that the operator may adjust the roll according to the indications and bring about various desired operating conditions.

To explain the invention, I have shown in Fig. 1 certain mechanism at a somewhat enlarged scale which is adapted to operate to bring about the desired results.

A lever 30 is pivoted on a rod 32' which may extend from a ceiling C while another lever 32 is associated with a rod 34 extending from the floor F. A rod 36 connects one end of the lever 30 to the free end of the lighter bar 10 while a rod 38 connects the other end of the lever 30 and the lever 32. An indicating device which may be in the form of a scale S is suspended from the ceiling in any suitable way as by means of a rod 39. This scale has the usual weight-supporting or weight-sensitive element such as a rod 40 which is ordinarily movable to some extent relative to the scale and is connected to the other end of the lever 32.

The scale S may be of any well-known form having a pointer 42 which rotates relative to a

dial 44. The dial 44 of the scale may be graduated with any indicia desired. It will be appreciated that various weights applied to the part 40 of the scale will move the pointer 42 thereof into register with various graduations or indicia of the dial 44.

The beater roll 6, in order to function for the purposes intended, usually weighs several thousand pounds. The levers and links described constitute in the preferred embodiment of the invention connections between the indicator unit or scale and the lighter bar so that one end of the bar and a portion of the roll is actually supported and weighed by the scale. When the roll is away from the bed-plate with no stock therebetween, the scale will be affected so that its pointer 42 will register with a certain graduation on the dial.

For instance, with the roll out of contact with the bed plate and with no material between the roll and plate, the roll is supported by the scale so that the pointer may register with such a numeral as 100 on the dial and thus indicate one hundred pounds which may be the full capacity of the scale. Such an indication will mean that the roll is not bearing on either material or paper-making stock. On moving the hand wheel 22 so as to move the bar 10 up and down the pointer will remain in register with the indicia 100 of the dial of the scale so long as the roll does not contact with the said bed plate or with stock between it and said plate.

With the machine in operation, however, and with the roll set at some operating distance from the bed plate and while material is being passed between the roll and bed plate, the roll is then supported to some extent or its weight is resisted by the material. As the roll is thus supported, or resisted, its weight is less than 100 so that the pointer is moved to some other indication. That is, material between the roll and bed plate changes the indicated weight of the roll on the lighter bar and causes the pointer to move. Thus when the pointer is in register with a certain graduation, the operator knows that a certain related operating condition exists and that a certain related roll pressure has been obtained. In other words, with the pointer at or in register with the given designation on the dial it may safely be assumed that the roll is operating at some rather definite pressure related to the indication.

By rotating the hand wheel and, thereby, the shaft 20, the screws 14 may be rotated and in this way, the right hand ends of the bars may be raised or lowered so that the roll is raised or lowered. As will be seen, a change in the position of the roll brings about a change of condition or pressure and a corresponding change in the position of the pointer of the scale.

Having determined through a cycle of operations what certain successive operating or pressure conditions are desirable and which are indicated by certain related positions of the pointer, it is possible to duplicate those conditions by adjusting the roll so that the pointer is positioned at those indications which are related to the certain conditions desired.

It will be possible instead of connecting the weighing unit to one end of one of the lighter bars to connect the same to corresponding ends of both lighter bars or even to suspend the lighter bars entirely from the scale.

It will be observed that the apparatus in effect operates to weigh the roll on the lighter bar or to indicate its weight as it is affected by the resisting influence of material between the roll and plate.

Since a so-called effective weight of the roll is indicated on the scale and the pressure at which the roll is then operating has a relation to the indicated weight, it is possible by manipulating the roll up and down to arrive at that indicated weight to produce the desired pressure or operating condition related to the indicated weight. This all facilitates economy and efficiency in operation and at the same time makes it possible to provide pre-determined conditions and resultant definite operating effects.

Supplemental to the indicating means in the form of the scale shown it may be desirable to employ a recording apparatus which may be acted upon by the lever mechanism and thereby graphically illustrate the operating conditions and changes therein relative to a time unit or units over a cycle of operation.

Various changes and modifications may be made in the form of the apparatus without departing from the spirit and scope of the invention therefor what it is desired to claim and secure by Letters Patent of the United States is:

A beater apparatus for paper pulp and like material comprising in combination, a rigid support,

a vat rigidly supported by said support, a bed plate associated with the inside of said vat, a pair of vertically extending supporting post members having their lower ends rigidly associated with said support in spaced relation, a lighter bar extending between said post members, and a horizontally disposed beater roll co-operating with said bed plate rotatably supported within said vat by said lighter bar at a point intermediate the opposite ends of the bar, one of said post members and one end of the lighter bar having means associated therewith whereby said lighter bar may be moved vertically into various positions of adjustment to adjust the said roll relative to the bed plate, the other end of the lighter bar being arranged relative to the other post member for unrestrained vertical movements, and weighing mechanism responsive to up and down movements entirely supporting said other end of the lighter bar and including indicating means to indicate the variance in the weight of said lighter bar and roll accordingly as said one end of the bar is moved vertically to adjust said roll.

CASSIUS M. BRYAN.

30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150

Nov. 10, 1931.

B. C. HOPE

1,831,004

BEATER ROLL ADJUSTER AND INDICATOR

Filed Jan. 27, 1931

2 Sheets-Sheet 1

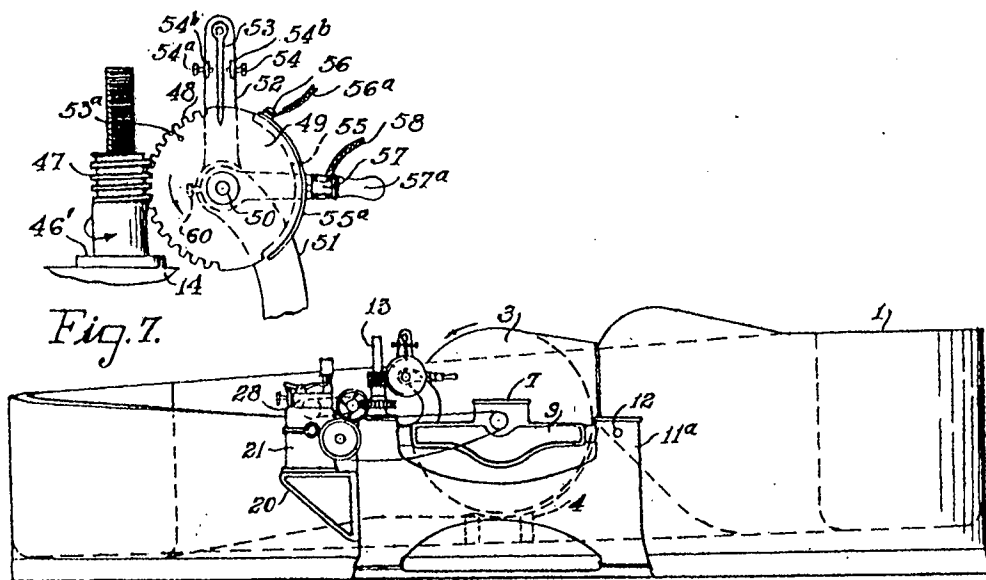


Fig. 7.

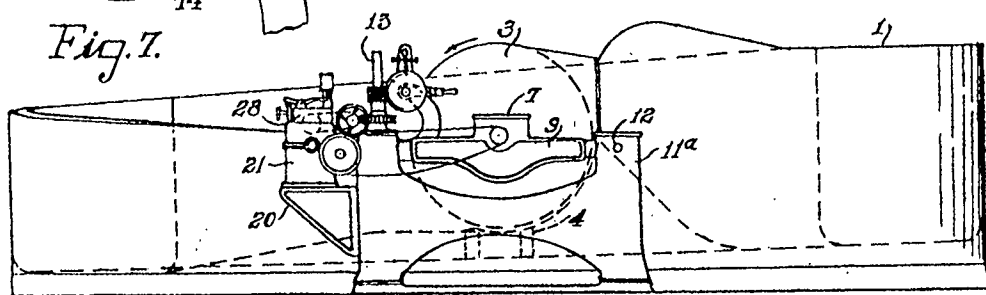


Fig. 1.

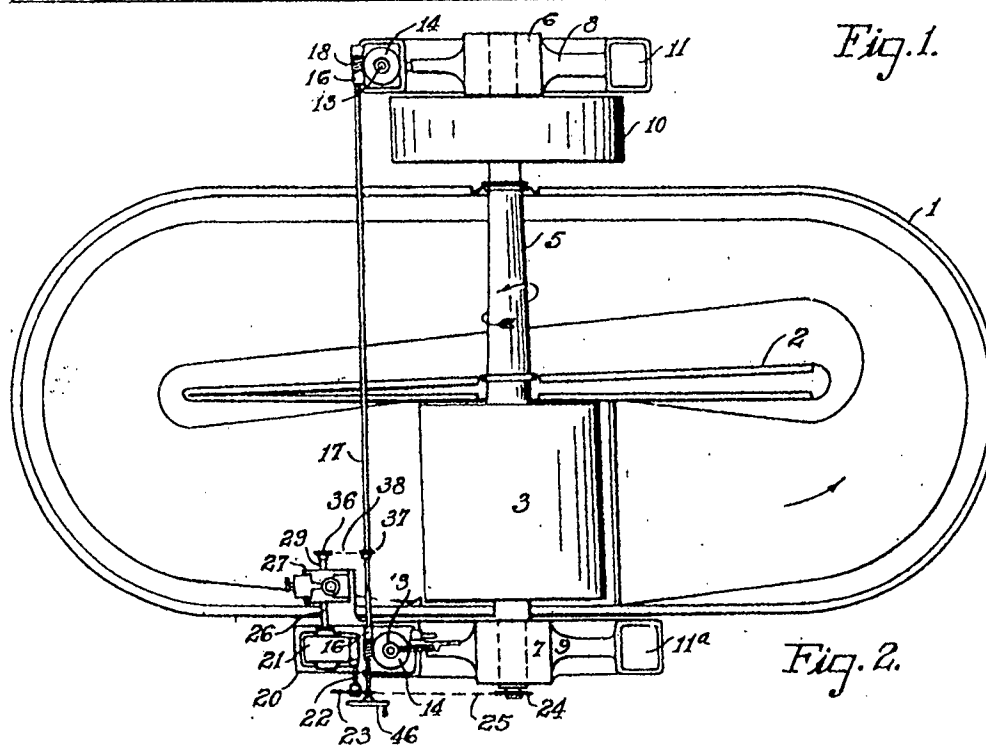


Fig. 2.

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Nov. 10, 1931.

B. C. HOPE

1,831,004

BEATER ROLL ADJUSTER AND INDICATOR

Filed Jan. 27, 1931

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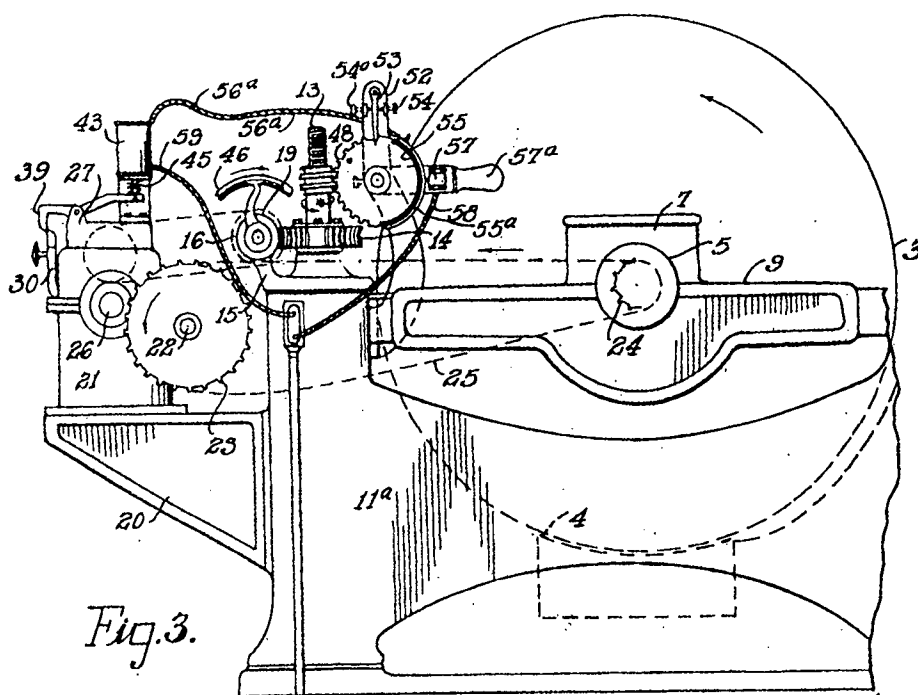


Fig. 3.

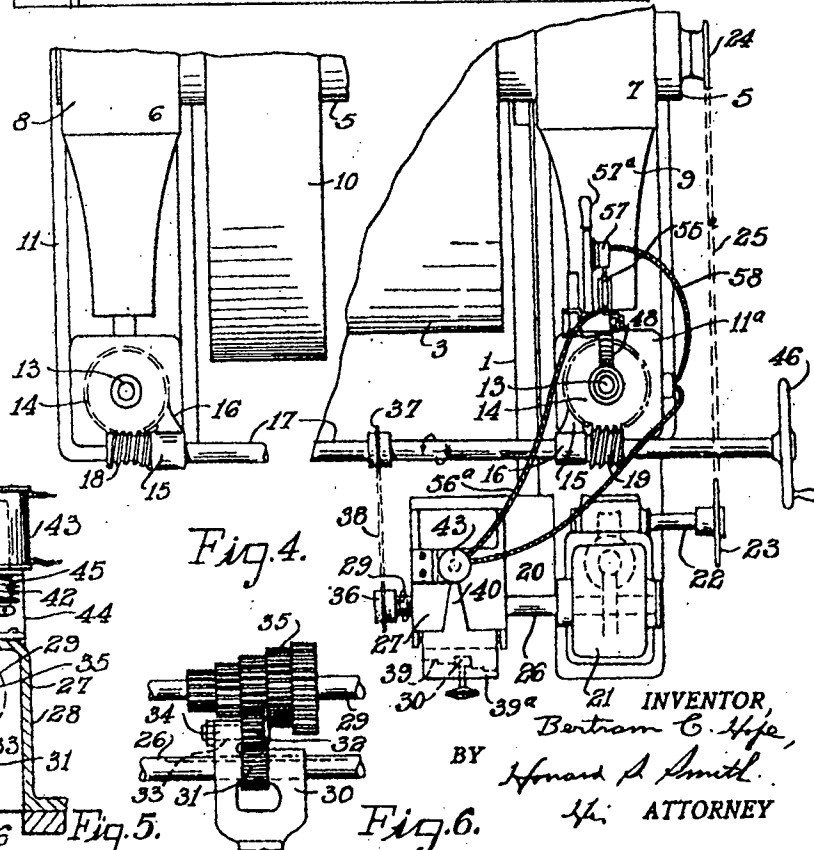


Fig. 4.

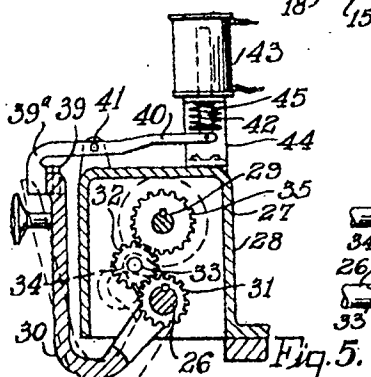


Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE

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BEATER ROLL ADJUSTER AND INDICATOR

Application filed January 27, 1931. Serial No. 511,479.

My invention relates to new and useful improvements in beater roll adjusters and indicators.

My invention relates particularly to beaters employed in papermaking to reduce wood pulp or other papermaking fibres to a pulp of the proper fineness in a liquid mass.

As usually employed the beater comprises a tub equipped with a stationary bed plate over which the beater roll is positioned transversely of the tub.

The beater roll is adjustable vertically to vary the clearance between the roll and the bed plate, and after the tub is charged with the stock and liquid the beater roll is gradually lowered toward the bed plate as the stock becomes comminuted to thus reduce the stock to a desired hydration and freeness. This lowering of the beater roll has been accomplished manually and mechanically, but at a fixed rate with respect to the speed of the beater roll.

This manual or the fixed mechanical lowering of the beater roll leaves much to be desired in the proper and economical preparation of paper stock, for with the manual operation there is uncertainty of the skill of the operator, while with the mechanical operation it is known that stocks require different beating periods, and where a fixed mechanical lowering is employed it is impossible to vary the beating time allowed.

One of the important objects of my invention is to provide a gradual automatic mechanical lowering of the beater roll at various speeds to thus alter the beating time to suit the stock.

It is another object of my invention to permit the continued operation of the beater roll after it has been lowered to the "down" position to permit the making of a hydration and freeness test without interrupting the beater operation.

Another important object of my invention is to provide electrical means for disengaging the lowering mechanism at any predetermined point.

A still further object of my invention is to provide an adjustable gage and indicator that will permit the preparation of a uniform

stock and indicate the position of the beater roll relative to the bed plate.

Other important and incidental objects of my invention will be brought out in the annexed specification and subjoined claims.

In the accompanying drawings Figure 1 is a side view of a conventional beater equipped with my beater roll adjuster and indicator.

Figure 2 is a plan view of a conventional beater equipped with my beater roll adjuster and indicator.

Figure 3 is an enlarged side view of my beater roll adjuster and indicator.

Figure 4 is an enlarged plan view showing a portion of a beater tub equipped with my beater roll adjuster and indicator.

Figure 5 is a sectional view through my electrically controlled gear shift.

Figure 6 is another sectional view of my electrically controlled gear shift showing the change gears.

And Figure 7 is a detail view of my contactor and indicator mechanism.

Referring now to Figures 1 and 2, I have shown a conventional beater construction, employing a tub 1 having a mid-feather 2 to provide for the circulation of the pulp around its ends and under a beater roll 3 positioned between the mid-feather and one side of the tub 1.

The beater roll 3 may be of any suitable construction equipped with fly bars or knives that co-act with the top concave surface of a bed plate 4. The bed plate is fixedly secured in the bottom of the tub and substantially below the beater roll to provide a grinding action on the pulp as it passes between the two.

The beater roll is provided with a shaft 5 extending transversely of the tub and mid-feather, and has its ends journaled in bearings 6 and 7 in lighter bars 8 and 9, positioned at each side of the beater tub.

The lighter bar 8 is positioned at a greater distance from the tub than the lighter bar 9, to receive on the shaft, between it and the tub, a drive pulley 10. (See Figure 2.) The lighter bars 8 and 9 are mounted within frames 11 and 11a to which one end of each bar is secured by a pivot 12, in the frames.

The opposite free ends of each of the lighter bars are pivotally connected to worm screws 13 that extend vertically through the top of the frames 11 and receive on their projecting ends worm gears 14.

Secured to each of the side frames below the gears 14 is a bracket support 15 for a bearing 16. The bearings 16 receive therethrough a shaft 17, that has secured thereto worm gears 18 and 19 that mesh with the gears 14.

Extending forwardly from and attached to the frames 11 below the bracket support 15 is a bracket 20 to which is attached a double reduction worm gear unit 21, and having a laterally extending driven shaft 22 to which there is secured a sprocket 23. (See Figures 3 and 4.)

Secured to the beater roll shaft 5 adjacent the frame 11a, is a sprocket 24, to receive a sprocket chain 25 for a driving connection with the sprocket 23, to thus impart motion to the latter when the beater roll is operated.

The reduction unit 21, which is of conventional form, has projecting from its side opposite the shaft 22, a drive shaft 26, to which is attached a gear shift and magnetic release 27, likewise mounted on the bracket 20. (See Figures 3 and 4.)

The gear shift and magnetic release 27 comprises a housing 28 in the sides of which are journaled the shaft 26 and a change gear shaft 29. (See Figure 5.)

Freely mounted on the shaft 26 is a forked L shaped arm 30, between whose forked ends and slidably keyed to the shaft 26, is a gear 31 adapted to engage an idler gear 32, rotatably mounted on a stud 33 secured in an angular extension 34 of the arm 30. (See Figure 5.)

Keyed on the shaft 29 within the housing 28 is a series of stepped gears 35, and keyed to the outer end of the shaft 29 is a sprocket 36, arranged to co-act with a similar sprocket 37 on the shaft 17 to impart motion to the latter through a chain 38. Now, when the beater roll 3 is rotated through the means previously described, motion will be imparted to the drive shaft 26 at a reduced speed through the reduction unit 21.

When the desired speed for the shaft 17 is selected, the arm 30 is shifted laterally to bring the gear 31 into alignment with the desired one of the stepped gears 35. Then the free end of the arm 30 is raised to rotate the idler gear 32 into engagement with the latter; and the shaft 29 will be rotated.

When the arm 30 is raised, its free end is engaged by one of a series of notches 39 on the inside face of the latch 39a, integral with a latch bar 40, pivoted at 41. The opposite free end of the bar 40 is pivotally connected to the lower end of a solenoid plunger 42. The plunger 42 is supported within the solenoid magnet 43, that is mounted on a bracket 44 from the top of the housing 28.

Now, as long as the magnet is energized, the plunger 42 will be drawn into it and the latch 39a will hold the gears 31, 32 and 35 in driving engagement, and the shaft 29 will rotate the worm gear 14 through the worms 18 and 19. When the worm gears 14 revolve on the worm screws 13, the beater roll 3 will be gradually lowered at a uniform speed until the electrical circuit through the solenoid and indicator is broken.

When the circuit is broken, a compression spring 45, surrounding the plunger 42, will force the plunger downwardly and release the latch 39a from engagement with the bar 30.

This causes a disengagement of the gears 31, 32 and 35 and the descent of the beater roll 3 will stop. However this does not necessitate stopping the beater roll.

In order to raise the beater roll to any desired "up" position, I have provided on one end of the shaft 17 a hand wheel 46, by which means the shaft 17 may be revolved. (See Figure 4.)

My contactor and indicator mechanism will now be described:

Secured to the gear 14 on the frame 11a is a flanged sleeve 46' having integral with its upper end, a worm 47 that engages a worm gear segment 48. The segment 48 is cut in the periphery of a contactor disc 49, that is rotatably mounted on a stud 50, secured to a bracket 51. The bracket 51 is bolted to the frame 11a and projects upwardly therefrom.

Extending upwardly from the bracket 51 and integral therewith is an arm 52 that has pivoted thereto a depending indicator 53 that is adjustably positioned between oppositely disposed set screws 54-54a that pass through lugs 54b on the arm 52. The lower end of the pointer is intended to register with a gage mark 53a on the segment 48, when the beater roll is in the desired "up" position.

To compensate for the wearing away of the bed plate, the set screws 54-54a may be adjusted to bring the indicator 53 into registry with the gage mark.

Mounted in the face of the contactor disc 49, and opposite the segment 48, is an arcuate insulating strip or band 55 to whose outer face is secured a contact strip 55a that does not have electrical connection with the disc.

One end of the strip 55a is provided with a terminal 56 to receive a flexible lead 56a from the solenoid magnet 43. Positioned to contact the strip 55a is a spring tensioned brush 57, mounted on the horizontally extending gage arm 57a and insulated therefrom.

The arm is rotatably mounted on the stud 50 and is positioned between the bracket 51 and disc 49. Current is supplied to the magnet 43 and brush 57 by leads 58-59 from a source not shown. When it is desired to change the "down" position of the beater roll, it is only necessary to loosen the screw 60 to permit a desired rotation of the arm 57a.

The arrows indicating the direction of rotation of the various parts of the mechanism as shown at Figure 7 refer to the lowering of the beater roll, and as the disc 49 is revolved as indicated, the brush 57 will pass out of contact with the strip 55^a, and cause the magnet 43 to be de-energized. This will cause the gears 31, 32 and 35 to disengage.

It is thus apparent that I have provided a beater roll adjuster and indicator that eliminates the "human element" in the lowering of a beater roll; that I have provided simple, variable, gradual lowering means, and simple control means for automatically stopping the lowering of the rolls without effecting the rotation of the beater roll. I have also provided micrometer accuracy in gaging the "up" position of the roll, and simple means for raising the roll manually likewise without effecting the rotation of the beater roll.

My method of compensating for the wearing away of the bed plate and roll bars is simple and efficient. After setting the roll in the "up" position and observing the position of the brush 57 relative to the strip 55^a, the condition of or time required to complete the pulping operation is evident at any time.

Having described my invention, I claim:

1. In a beater, a tub, a bed plate therein, a beater roll adjustably mounted in the tub above the bed plate, and variable speed mechanism for gradually lowering the beater roll.

2. In a beater, a tub, a bed plate therein, a beater roll adjustably mounted in the tub above the bed plate, and variable speed gear mechanism for gradually lowering the beater roll.

3. In a beater, a tub, a bed plate therein, a beater roll adjustably mounted in the tub above the bed plate, automatic mechanism for gradually lowering the beater roll at a selected speed, and electrical mechanism for disengaging the lowering means at any predetermined point.

4. In a beater, a tub, a bed plate therein, a beater roll adjustably mounted in the tub above the bed plate, automatic mechanism for gradually lowering the beater roll at a selected speed, and magnetic release mechanism for disengaging the lowering means at any predetermined point.

5. In a beater, a tub, a bed plate therein, a beater roll adjustably mounted in the tub above the bed plate, means for lowering the beater roll, a stepped gear connected to the lowering means, driving means, and a slidable gear rotated by the driving means for engagement with one of the stepped gears to actuate the lowering means at a selected speed.

6. In a beater, a tub, a bed plate therein, a beater roll adjustably mounted in the tub above the bed plate, means for lowering the beater roll, a stepped gear connected to the lowering means, driving means, a slidable

gear rotated by the driving means for engagement with one of the stepped gears to actuate the lowering means at a selected speed, and electrical release means for disengaging the shiftable gear from the stepped gear at any predetermined point in the descent of the beater roll.

7. In a beater, a tub, a bed plate therein, a beater roll adjustably mounted in the tub above the bed plate, a stepped gear connected to the lowering means, driving means, a slidable gear rotated by the driving means for engagement with one of the stepped gears to actuate the lowering means at a selected speed, and magnetic release mechanism for disengaging the shiftable gear from the stepped gear at any predetermined point in the descent of the beater roll.

8. In a beater, a tub, a bed plate therein, a beater roll adjustably mounted in the tub above the bed plate, automatic mechanism for gradually lowering the beater roll, means for disengaging the lowering mechanism at any predetermined point, and manual means for raising the beater roll to its "up" position after it has descended to said predetermined point.

9. In a beater, a tub, a bed plate therein, a beater roll adjustably mounted in the tub above the bed plate, automatic mechanism for gradually lowering the beater roll, magnetic release means for disengaging the lowering mechanism to stop the descent of the beater roll, and a manual device for setting the magnetic means to predetermine the distance of downward movement of the beater roll.

10. In a beater, a tub, a bed plate therein, a beater roll adjustably mounted in the tub above the bed plate, automatic mechanism for gradually lowering the beater roll, magnetic release means for disengaging the lowering mechanism, a contact rotated by the lowering mechanism, a contact member adjustable to a set position in engagement with the rotatable contact, and an electrical circuit including the magnetic release means, the rotatable contact and the adjustable contact member, said circuit adapted to be broken to stop the descent of the beater roll when the rotatable contact is moved out of engagement with the adjustable contact member.

11. In a beater, a tub, a bed plate therein, a beater roll adjustably mounted in the tub above the bed plate, automatic mechanism for gradually lowering the beater roll, magnetic release means for disengaging the lowering mechanism, a gear rotated by the automatic lowering mechanism, a second gear in mesh with the first gear, a contact element carried by the second gear, a contact member manually adjustable in engagement with the contact element to a set position thereon, and an electric circuit including the magnetic release means, the contact element carried by the sec-



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①⑨

OE PATENTSCHRIFT

①① Nr. 314 961

⑦③ Patentinhaber: SUMITOMO CHEMICAL COMPANY, LTD.
IN OSAKA (JAPAN)

⑤④ Gegenstand: Verfahren zur Herstellung von kurzen Fasern

⑥① Zusatz zu Patent Nr.

⑥② Ausscheidung aus:

②② ②① Angemeldet am: 12. Oktober 1970, 9372/71

②③ Ausstellungspriorität:

③③ ③② ③① Unionspriorität:

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Längste mögliche Dauer:

④⑤ Ausgegeben am: 10. Mai 1974

⑦② Erfinder:

⑥⑥ Abhängigkeit:

⑤⑥ Druckschriften, die zur Abgrenzung vom Stand der Technik in Betracht gezogen wurden:

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Es ist bereits bekannt, Kunststoffasern dadurch herzustellen, daß man eine Kunststoffolie uniaxial rekt, durch Einwirkung äußerer mechanischer Kräfte, wie Reiben, Drehen, Bürsten oder Behandlung mit gerillten Walzen oder Schlagen zerfasert und die Fasern dann in Stücke schneidet. Es ist ferner bekannt, eine Folie chemisch explodieren zu lassen, um sie zu zerfasern. Diese Verfahren sind jedoch in technischer Hinsicht un-

5 befriedigend, da die Verfahrensstufen kompliziert sind und chemische Verbindungen verwendet werden müssen. Es ist nun Ziel der Erfindung, ein Verfahren zum Herstellen von kurzen Fasern zu schaffen, das einfach und unter geringeren Kosten durchführbar ist und für verschiedenste Zwecke insbesondere für die Papierfabrikation gut brauchbare Fasern liefert.

Dementsprechend bezieht sich die Erfindung auf ein Verfahren zur Herstellung von kurzen Fasern auf Basis 10 von kristallinen Polyolefinen und dieses Verfahren ist gemäß der Erfindung dadurch gekennzeichnet, daß Folien- oder Plattenmaterial aus einem Gemisch von 5 bis 50 Gew. -Teilen eines Äthylen-Vinylacetat-Copolymeren mit einem Vinylacetatgehalt von mindestens 5 Gew. -% oder dessen Verseifungsproduktes mit einem Verseifungsgrad von 1 bis 100% und 100 Gew. -Teilen eines kristallinen Polyolefins insbesondere isotaktisches Polypropylen, Niederdruckpolyäthylen, Hochdruckpolyäthylen, Poly-(4-methylpenten-1), Poly-(3-methylbuten-1), 15 Polybuten-1, Polypenten-1, isotaktisches Polystyrol oder ein kristallines Copolymeres dieser Olefine, dessen Schmelzpunkt höher liegt als der Erweichungspunkt des Äthylen-Vinylacetat-Copolymeren oder dessen Verseifungsproduktes, uniaxial, zweckmäßig in einem Verhältnis von zumindest 3 : 1, zwischen Walzen gereckt wird, wobei der Abstand der Walzenspalte aufeinanderfolgender Walzenpaare mindestens viermal größer ist als die Breite des ursprünglichen Folien- oder Plattenmaterials, anschließend das gereckte Material zerschnitten 20 wird und das zerschnittene Material im wässrigen Medium, insbesondere in einem 0,005 bis 0,1% eines kationischen, anionischen oder nichtionischen Netzmittels enthaltenden wässrigen Medium zu kurzen Fasern vermahlen wird.

Beispiele für die im Verfahren der Erfindung verwendbaren reckfähigen kristallinen Polyolefine sind kristallines Polypropylen, Niederdruck-Polyäthylen und Hochdruck-Polyäthylen, Poly-(4-methyl-penten-1), Poly-(3- 25 -methyl-buten-1), Polybuten-1, Polypenten-1, isotaktisches Polystyrol und kristalline Copolymerisate von Olefinen. Die geeigneten kristallinen Polyolefine haben, wie erwähnt, Schmelzpunkte, die oberhalb des Erweichungspunktes des Äthylen-Vinylacetat-Copolymerisats oder dessen Verseifungsprodukts liegen. Diese Polyolefine können geringe Mengen Stabilisatoren, Entformungsmittel, Antistatika, Pigmente und andere Hilfsstoffe enthalten.

30 Wenn der Anteil des Äthylen-Vinylacetat-Copolymeren oder dessen Verseifungsproduktes im Gemisch mit dem kristallinen Polyolefin unter 5 Gew. -Teile je 100 Gew. -Teile des Polyolefins liegt, hat es nur eine geringe Wirkung als Bindemittel, während bei Verwendung von mehr als 50 Gew. -Teilen beim Recken Schwierigkeiten auftreten.

Zum Vermischen der Polymeren können die üblichen Mischer verwendet werden. Ein geeigneter Mischer 35 ist z. B. eine Strangpresse mit einer Dalmadge-Torpedo-Schnecke.

Das kristalline Polyolefin oder das Gemisch kristalliner Polyolefine wird mit dem Copolymeren oder dessen Verseifungsprodukt zu einer Folie oder einer Platte verarbeitet. Es können die üblichen Vorrichtungen, z. B. Strangpressen mit einer Schlitzdüse oder Folienblasmaschinen verwendet werden, Folien- oder Plattenmaterial, das durch langsames Abkühlen erhalten wurde, läßt sich zu feineren Fasern mahlen als Material, das rasch ab- 40 gekühlt wurde. Beim Recken mit gleichzeitiger Einschnürung des Reckgutes, was durch Recken zwischen Walzen erzielt wird, kann ein besonders hoher Orientierungsgrad vor allem mit Plattenmaterial erreicht werden, das ein stärkeres Recken erlaubt als Folienmaterial. Wenn aber Folien- oder Plattenmaterial gereckt wird, während man die beiden Enden der Folie durch Klammern festhält oder das Recken bei hohen Temperaturen durchgeführt wird, wird die Einschnürung verringert und bloß ein verhältnismäßig niedriger Orientierungsgrad erzielt und 45 dementsprechend das Vermahlen des Reckgutes zu feinen Fasern erschwert. Man kann z. B. Folien- oder Plattenmaterial aus kristallinem Polypropylen mit einer Dichte von mindestens 0,890, aus kristallinem Niederdruck-Polyäthylen mit einer Dichte von mindestens 0,942 oder aus kristallinem Hochdruck-Polyäthylen mit einer Dichte von mindestens 0,919 verwenden. Das Folien- oder Plattenmaterial wird vor dem Recken erhitzt. Die Recktemperatur hängt von der Art des jeweils verwendeten Polymeren ab und liegt unterhalb des Schmelz- 50 punktes des kristallinen Polyolefins. Das uniaxiale Recken wird bei einem Reckverhältnis durchgeführt, das durch das Verhältnis der Umdrehungsgeschwindigkeiten der Beschickungswalze und der Aufwickelwalze bestimmt wird.

Je höher der Kristallinitätsgrad, je höher der Orientierungsgrad und je dünner die Folie, umso leichter läßt sich das Material in Längsrichtung spalten, und umso schwieriger wird das Zerschneiden der Fasern in Querrich- 55 tung. Zur Herstellung feiner Fasern ist es daher erwünscht, das Folien- bzw. Plattenmaterial möglichst stark zu recken und die Folie so dünn wie möglich zu machen. So soll z. B. eine Folie aus isotaktischem Polypropylen nach dem Recken vorzugsweise so dünn sein, daß ihre Doppelbrechung einen Wert von mindestens $2,5 \times 10^{-2}$ besitzt.

Unter einem kristallinen Polyolefin ist ein Polyolefin zu verstehen, welches eine Molekülstruktur hohen 60 Ordnungsgrades besitzt und im Röntgenstrahlenbeugungsspektrum deutlich Kristallstruktur zeigt. Im vorliegenden

Fall ist unter einem kristallinen Polyolefin ein solches zu verstehen, welches, bestimmt durch Röntgenstrahlenbeugungsspektrum, eine Kristallinität von mindestens 30% zeigt.

Das im Rahmen des erfindungsgemäßen Verfahrens einzuhaltende Reckverhältnis beträgt, wie erwähnt, zweckmäßig zumindest 3 : 1, jedoch wird, in der Regel ein möglichst hohes Reckverhältnis eingehalten. Das tatsächlich einzuhaltende Reckverhältnis kann ohne weiteres experimentell optimal festgelegt werden und ist von der Stärke des zu reckenden Folien- oder Plattenmaterials, vom Molekulargewicht des Polyolefins und von den allenfalls vorliegenden Pigmenten od. dgl. abhängig.

Das orientierte Folienmaterial wird gewöhnlich zu Längen von etwa 2 bis 20 mm zerschnitten.

Beim Mahlen in Wasser wird das stark orientierte Material mehr oder weniger stark reorientiert. Hiedurch erhält man gekräuselte und sich leicht verfilzende Fasern. Das Zerfasern zu groben Fasern läßt sich ohne vollständiges Abtrennen des Wassers leichter durchführen. Gegebenenfalls können die groben Fasern zu feineren Fasern weiter verarbeitet werden.

Vorzugsweise wird die Konzentration der Fasern in der Zerfaserungsvorrichtung und in der Vorrichtung zur Herstellung noch feinerer Fasern so hoch wie möglich gehalten, um Störungen im Betrieb zu vermeiden. Das zerschnittene Material aus den Folien oder Platten soll langsam unter allmählichem Erhöhen der Scherkräfte vermahlen werden.

Die erfindungsgemäß hergestellten Fasern lassen sich besonders gut zu einem Faserbrei dispergieren, der von Papierstoff nicht unterschieden werden kann, wenn man dem Mahlwasser 0,005 bis 0,1% eines kationaktiven, anionaktiven oder nichtionischen Netzmittels zusetzt, jedoch lassen sich erfindungsgemäß hergestellte Fasern wegen ihres Gehalts an einem Äthylen-Vinylacetat-Copolymeren auch ohne Verwendung eines Netzmittels gut dispergieren.

Zum Mahlen können die üblichen in der Papierindustrie zur Ganzzeugherstellung verwendeten Mahlapparate verwendet werden. Zur Herstellung von feinfaserigem Ganzzeug können die üblichen Kegel- oder Scheibmühlen verwendet werden.

Das erhaltene Fasermaterial hat eine ausgezeichnete Wärmekapazität und einen sehr guten Griff, ist gekräuselt und eignet sich zur Herstellung von Vliesstoffen oder Bahnen, da die einzelnen Fäden gut voneinander getrennt und miteinander verfilzt sind. Weiterhin kann dieses Fasermaterial auch als Füllstoff verwendet werden. Pulverförmiges Material kann auch zur Herstellung von Bindemitteln und pulverförmigen Formmassen eingesetzt werden. Die erfindungsgemäß hergestellten Fasern lassen sich ohne Verwendung weiterer Zusätze gut zu Papier verarbeiten, wobei die üblichen Papiermaschinen verwendet werden können. Die Papierbahn wird in der Trockenpartie getrocknet und anschließend ohne Druck oder bei einem Druck von unter 50 kg/cm² und bei einer Temperatur oberhalb des Erweichungspunktes des Äthylen-Vinylacetat-Copolymerisats oder dessen Verseifungsproduktes, jedoch unterhalb des Schmelzpunktes des Polyolefins verpreßt, um lediglich das Copolymerisat oder dessen Verseifungsprodukt zu erweichen. Hiedurch werden die Fasern aneinander gebunden und man erhält ein sehr starkes synthetisches Papier. Zur Herstellung glatter Papiere führt man das Papier noch durch Glättpressen.

Das erfindungsgemäße Verfahren wird im folgenden durch Ausführungsbeispiele näher erläutert.

Beispiel 1: 100 Gew. -Teile isotaktischen Polypropylens vom Schmelzindex 8 werden mit 20 Gew. -Teilen eines Äthylen-Vinylacetat-Copolymeren (Vinylacetatgehalt 25 Gew. -%) mittels einer Strangpresse mit einer Schnecke mit einem Schneckendurchmesser von 30 mm, einem Verhältnis von Länge zu Durchmesser von 20 und einer Düsentemperatur von 210°C vermischt. Das Gemisch wird zu einem Stab mit einem Durchmesser von etwa 2 mm stranggepreßt. Der Stab wird zu Scheiben zerschnitten, die in einer Folienblasmaschine mit einem Schneckendurchmesser von 40 mm, einem Verhältnis von Länge zu Durchmesser von 22 und einem Düsendurchmesser von 75 mm und mit Luftkühlung (Lufttemperatur 20°C) zu einem Folienschlauch verarbeitet werden. Der Folienschlauch hat in zusammengefallenem Zustand eine Breite von 120 mm und eine Wandstärke von 0,05 mm.

Der Folienschlauch wird in eine mittels Heißluft auf 130°C erhitzte Reckvorrichtung eingeführt, in der eine Beschickungswalze und eine Aufwickelwalze in einem Abstand von 2 m angeordnet sind. Der Folienschlauch wird infolge der unterschiedlichen Umdrehungsgeschwindigkeiten der beiden Walzen um das 13fache gereckt. Der orientierte Folienschlauch hat in zusammengefallenem Zustand eine Breite von 30 mm und eine Wandstärke von 0,015 mm. Der Folienschlauch wird zu Längen von 10 mm zerschnitten, 120 g der erhaltenen Stücke und 10 l Wasser sowie 40 ml einer 0,5%igen wässrigen Lösung eines nichtionischen Netzmittels werden in eine kleine Mahlvorrichtung mit einem Fassungsvermögen von 23 l gegeben und 5 min ohne Druck, 15 min bei einem Druck von 1 kg, 60 min bei einem Druck von 2 kg und nochmals 60 min bei einem Druck von 3 kg vermahlen. Man erhält Fasern mit einer Länge von 1,0 bis 1,5 mm und einer Breite von 10 bis 30 µ.

250 ml des erhaltenen Faserbreies und 36 ml einer 1,7%igen wässrigen Lösung von Polyvinylalkohol werden gründlich miteinander vermischt, das Gemisch wird mit Wasser auf 1 l aufgefüllt und in einer Papiermaschine verarbeitet, bei einem Druck von 3,5 kg/cm² verpreßt und anschließend bei 50°C getrocknet. Schließlich wird das erhaltene Papier 1 min bei 115°C und einem Druck von 2 kg/cm² geglättet.

Beispiel 2: 100 Gew. -Teile des im Beispiel 1 verwendeten isotaktischen Polypropylens vom Schmelz-

index 8 und 30 Gew. -Teile eines Äthylen-Vinylacetat-Copolymeren, (Schmelzindex 2, Vicat-Erweichungspunkt 83°C, Vinylacetatgehalt 5 Gew. -%) werden gemäß Beispiel 1 vermischt und zu einem Stab mit einem Durchmesser von etwa 2 mm stranggepreßt, der mittels einer Schneidvorrichtung zu Scheiben zerschnitten wird. Die Scheiben werden bei einer Temperatur von 210°C mittels einer Folienblasmaschine mit einem Schnecken-
5 Durchmesser von 40 mm, einem Verhältnis von Länge zu Durchmesser von 22 und einem Düsendurchmesser von 75 mm und unter Verwendung von Kühlluft (Lufttemperatur 20°C) verarbeitet. Man erhält einen Folienschlauch, der in zusammengefallenem Zustand eine Breite von 120 mm und eine Wandstärke von 0,05 mm besitzt.

Der erhaltene Folienschlauch wird in eine Reckvorrichtung eingeführt, die mit Heißluft auf 130°C erhitzt wird. Der Abstand zwischen der Beschickungswalze und der Aufwickelwalze beträgt 2 m. Der Folienschlauch
10 wird infolge der unterschiedlichen Umdrehungsgeschwindigkeiten der beiden Walzen um das 13fache gereckt. Man erhält einen Folienschlauch, der in zusammengefallenem Zustand eine Breite von 30 mm und eine Wandstärke von 0,015 mm besitzt. Der erhaltene Folienschlauch wird zu Längen von 10 mm zerschnitten. 120 g der erhaltenen zerschnittenen Stücke und 10 l Wasser sowie 5 g einer 50 gew. -%igen wässrigen Lösung eines nichtionischen Netzmittels werden in eine kleine Mahlvorrichtung mit einem Fassungsvermögen von 23 l ge-
15 geben, worauf das Gemisch 5 min ohne Belastung, 15 min unter einem Druck von 1 kg, 60 min unter einem Druck von 2 kg und nochmals 60 min unter einem Druck von 3 kg vermahlen wird. Man erhält Fasern mit einer Länge von 1,0 bis 1,5 mm und einer Breite von 10 bis 30 µ.

Die wässrige Stoffsuspension wird auf eine Tappi-Papiermaschine gegeben, mit Wasser auf eine Faserkonzentration von 0,057% verdünnt, die Papierbahn wird gepreßt und in üblicher Weise getrocknet. Anschließend
20 wird die Papierbahn zweimal bei 70°C unter einem linearen Druck von 100 kg/cm bei einer Umdrehungsgeschwindigkeit von 280 Umdr/min mittels eines Dreiwalzen-Kalanders gepreßt und hierauf 10 min bei 140°C und einem Druck von 0,05 kg/cm² zwischen zwei chromplattierten Stahlplatten wärmebehandelt.

Das erhaltene Papier hat folgende physikalische Eigenschaften:

	Flächengewicht	192 g/m ²
25	Zerreißeigenschaft	4,3 kg/15 mm
	Berstfestigkeit	1,5 kg/cm ²
	Zugfestigkeit	98,1 g
	Helligkeit	80%
	Opazität	89%.

30 Das hergestellte Papier aus Synthesefasern hat eine ausgezeichnete Zugfestigkeit im Vergleich zu üblichem Papier und eine der Helligkeit des letzteren etwa gleiche Helligkeit.

PATENTANSPRUCH:

Verfahren zur Herstellung von kurzen Fasern auf Basis von kristallinen Polyolefinen, für die Papierfabrikation, dadurch gekennzeichnet, daß Folien- oder Plattenmaterial aus einem Gemisch von 5 bis
35 50 Gew. -Teilen eines Äthylen-Vinylacetat-Copolymeren mit einem Vinylacetatgehalt von mindestens 5 Gew. -% oder dessen Verseifungsproduktes mit einem Verseifungsgrad von 1 bis 100% und 100 Gew. -Teilen eines kristallinen Polyolefins insbesondere isotaktisches Polypropylen, Niederdruckpolyäthylen, Hochdruckpolyäthylen, Poly-(4-methyl-penten-1), Poly-(3-methylbuten-1), Polybuten-1, Polypenten-1, isotaktisches Polystyrol oder ein kristallines Copolymeres dieser Olefine, dessen Schmelzpunkt höher liegt als der Erweichungspunkt des Äthylen-Vinylacetat-Copolymeren oder dessen Verseifungsproduktes, uniaxial, zweckmäßig in einem
40 Verhältnis von zumindest 3 : 1, zwischen Walzen gereckt wird, wobei der Abstand der Walzenpaale aufeinanderfolgender Walzenpaare mindestens viermal größer ist als die Breite des ursprünglichen Folien- oder Plattenmaterials, anschließend das gereckte Material zerschnitten wird und das zerschnittene Material im wässrigen Medium, insbesondere in einem 0,005 bis 0,1% eines kationischen, anionischen oder nichtionischen Netzmittels enthaltenden wässrigen Medium zu kurzen Fasern vermahlen wird.

①⑨ BUNDESREPUBLIK
DEUTSCHLAND



DEUTSCHES
PATENTAMT

⑫ Offenlegungsschrift
⑪ DE 31 16 005 A 1

⑤① Int. Cl. 3:
D 01 D 5/42

⑳ Aktenzeichen:
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㉒ Offenlegungstag:

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Prüfungsantrag gem. § 44 PatG ist gestellt

⑤④ Verfahren zum Fibrillieren von Spinn- und Spilffasern aus Kunststoff

Die Erfindung betrifft ein Verfahren zum Fibrillieren von Spinn- und Spilffasern aus Kunststoff, beispielsweise aus der Gruppe der PVA- und PAN-Fasern. Zur Erzielung einer Fibrillierung, die den Fasern Eigenschaften verleiht, sie als Zuschlagstoffe für im wesentlichen aus hydraulischen Bindemitteln bestehende Baustoffe oder als Zusätze für die Herstellung von Papier und Pappe sowie Faservliese verwenden zu können, wird vorgeschlagen, die Fasern mit einer Länge unter 40 mm in einer Stoff-Wasser-Suspension mittels steinbestückter Mahlmaschine zu mahlen.
(31 16 005)

DE 31 16 005 A 1

PATENTANWÄLTE

DIPL.-ING. W. MEISSNER (1980)

DIPL.-ING. P. E. MEISSNER

DIPL.-ING. H.-J. PRESTING

Zugelassene Vertreter vor dem

Europäischen Patentamt -

Professional Representatives before the

European Patent Office

Ihr Zeichen

Ihr Schreiben vom

Unsere Zeichen

HERBERTSTR. 22, 1000 BERLIN 33

Pr/Ka

14.04.1981

Ametex AG

CH-8867 Niederurnen

Verfahren zum Fibrillieren von Spinn- und Split-
fasern aus Kunststoff

Patentansprüche

1. Verfahren zum Fibrillieren von Spinn- und Splitfasern aus Kunststoff, beispielsweise aus der Gruppe der PVA- und PAN-Fasern, dadurch gekennzeichnet, daß die Fasern mit einer Länge unter 40 mm in einer Stoff-Wasser-Suspension mittels steinbestückter Mahlmaschine gemahlen werden.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Mahlung der Fasern in einer Mischung mit organischen Fasern pflanzlichen Ursprungs durchgeführt wird.

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INVENTION
BERLINTELEFON:
BERLIN
030/891 60 37
030/892 23 82BANKKONTO:
BERLINER BANK AG.
BERLIN 31
3695716000POSTSCHECKKONTO
W. MEISSNER, BLN-W
122 82 - 109

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3. Verfahren nach Anspruch 2, dadurch gekennzeichnet, daß als organische Fasern Zellstofffasern verwendet werden.
4. Verfahren nach Anspruch 2, dadurch gekennzeichnet, daß die Mahlung in einem Mischungsverhältnis von 1 : 1 zwischen Kunststoff- und organischen Fasern durchgeführt wird.
5. Verfahren nach einem der Ansprüche 2 oder 4, dadurch gekennzeichnet, daß die organischen Fasern in vorge-mahlenem Zustand zugegeben werden.
6. Verfahren nach Anspruch 5, dadurch gekennzeichnet, daß die organischen Fasern auf einen SR-Wert von 15-80°, insbesondere 20-60° vorgemahlen werden.
7. Verfahren nach einem der vorstehenden Ansprüche, da-durch gekennzeichnet, daß die Kunststofffasern eine Länge von 6 - 15 mm haben.
8. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Stoff-Wasser-Suspension ein Emulgator zugesetzt wird.
9. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Stoff-Wasser-Suspension mittels basaltbestückter Mahlmaschine gemahlen wird.
10. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Stoff-Wasser-Suspension mittels korundbestückter Mahlmaschine gemahlen wird.
11. Verwendung der durch das Verfahren nach dem Anspruch 1 fibrillierten Fasern als Zuschlagstoff für im wesent-lichen aus hydraulischen Bindemitteln bestehende Bau-

stoffe.

12. Verwendung der durch das Verfahren nach dem Anspruch 1 fibrillierten Fasern als Zuschlagstoff für die Herstellung von Papier und Karton.
13. Verwendung der durch das Verfahren nach dem Anspruch 1 fibrillierten Fasern als Zusatz für die Herstellung von Filtermedien und hochreißfest ausgerüsteten Tuchern.

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Die Erfindung betrifft ein Verfahren zum Fibrillieren von Spinn- und Splitfasern aus Kunststoff, beispielsweise aus der Gruppe der PVA- und PAN-Fasern.

Im Laufe der letzten Jahre sind in der Industrie für faserverstärkte Zementprodukte in stärker werdendem Maße Anstrengungen gemacht worden, billige neue Fasern für die Zementverstärkung zu finden, welche sich eignen, auf den bisher verwendeten Produktionsanlagen der Asbestzementindustrie verarbeitet zu werden.

Die chemischen und physikalischen Anforderungen, die an Fasern gestellt werden, die sich zur Zementverstärkung eignen, sind äußerst hoch, weil die Fasern möglichst einem Vergleich mit der Asbestfaser standhalten sollen, und zwar insbesondere im Hinblick auf deren hohe Affinität zum Zement.

Es ist bekannt, daß eine der billigsten Arten, um Fasern herzustellen, Produktionsverfahren nach der Film-Faser-Technologie sind. Ausgehend von einem Film werden Fasern durch einen mechanischen Fibrillierungsvorgang hergestellt.

Eine Übersicht über Film-Faser-Technologie ist in einer Arbeit von H. Krässig, J. Polym. Sc. Macromolecular Review, Vol. 12, S. 321 - 410 (1977) gegeben. Durch eine Optimierung bei der Filmherstellung in bezug auf mechanische Festigkeit können nach der Fibrillierung fasrige Materialien erhalten werden, die sich textilen Fasern hinsichtlich Bruchdehnung und Festigkeit in der Verwendung als Verstärkungsfasern überlegen zeigen. Einer der preislich günstigsten thermoplastischen Kunststoffe stellt z.Z. Polypropylen dar. Ausgehend von Polypropy-

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len sind dann auch schon Split-Fasern im Stadium der industriellen Herstellung. Der Einsatz von Polypropylen-Split-Fasern zur Verstärkung von Mörtel wurde schon von Shell Oil beschrieben (US-PS 3,591,395). Der Einsatz von Polypropylen-Split-Fasern zur Herstellung von Faserzement nach der Technologie der Entwässerungsverfahren ist ebenfalls bekannt (DE-AS 28 19 794).

Der Erfindung liegt die Aufgabe zugrunde, ein Verfahren der eingangs genannten Art anzugeben, mit dem eine Fibrillierung von Spinn- und Splitfasern aus Kunststoff erzielt wird, die den behandelten Fasern Eigenschaften verleiht, sie als Zuschlagstoffe für im wesentlichen aus hydraulischen Bindemitteln bestehenden Baustoffen oder als Zusätze für die Herstellung von Papier und Karton sowie für Faservliese verwenden zu können.

Diese Aufgabe wird erfindungsgemäß durch das im Kennzeichen des Patentanspruchs 1 angegebene Merkmal gelöst.

Die weitere Ausbildung des Verfahrens geht aus den Unteransprüchen hervor.

Die mit der Erfindung erzielten Vorteile bestehen im wesentlichen darin, daß aufgrund der Mahlung der Kunststofffasern mittels steinbestückter Mahlmaschine eine nahezu optimale Fibrillierung erreicht wird. Daraus folgt ein besseres Anbringen der Fasern an hydraulischen Bindemitteln und eine bessere Verfilzung der Fasern bei homogener Verteilung untereinander. Es ergibt sich daraus bei der Herstellung von Baustoffen, beispielsweise nach dem bekannten Hatschek-Verfahren, eine gute Vliesbildung und in der Folge davon eine bessere Anlage des Bindemittels an die Fasern.

Mit dem erfindungsgemäßen Verfahren ist es grundsätzlich möglich, eine Reihe von Spinnfasern in ihrer Geometrie so zu be-

einflussen, daß sie auch für andere Anwendungsbereiche, z.B. bei der Verarbeitung von Vliesen, Garnen, Geweben, z.B. für Filtermedien oder hochreißfest ausgerüstete Tücher eine Verbesserung erfahren.

Zur Erläuterung der Erfindung sind nachstehend Beispiele angegeben.

Beispiel 1:

Eine Mischung von Kunststofffasern vom Typ PVA und Sulfat-Zellstoff im Verhältnis 1:1 und einer Stoffdichte von 2% wurde in einer basaltbestückten Mahlmaschine im Umlaufverfahren gemahlen. Abb. IA zeigt die Fasermischung vor der Mahlung, Abb. IB zeigt die Fasermischung nach 16 Minuten Mahldauer.

Beispiel 2:

Eine Mischung von Kunststofffasern vom Typ PAN und Sulfat-Zellstoff im Verhältnis 1:1 und einer Stoffdichte von 2% wurde in einer basaltbestückten Mahlmaschine im Umlaufverfahren gemahlen. Abb. IIA zeigt die Fasermischung vor der Mahlung, Abb. IIB zeigt die Fasermischung nach 13 Minuten Mahldauer.

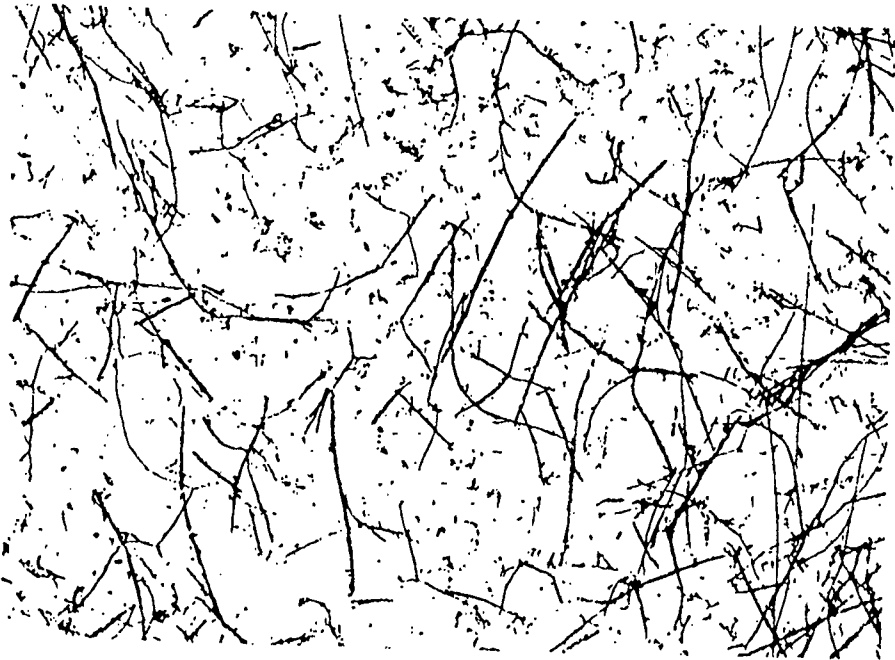
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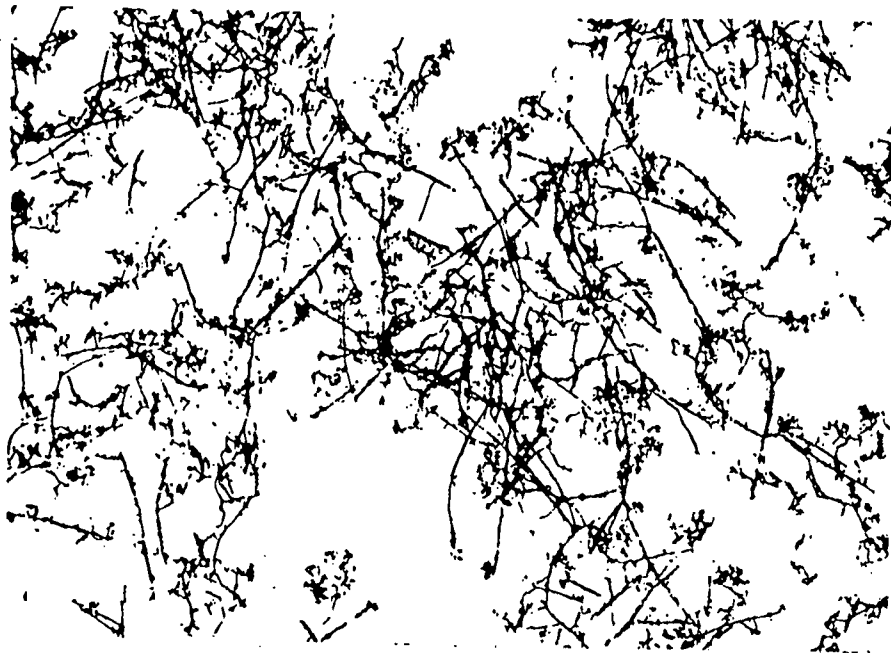
Nummer: 3116005
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Anmeldetag: 14. April 1981
Offenlegungstag: 28. Oktober 1982

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I A



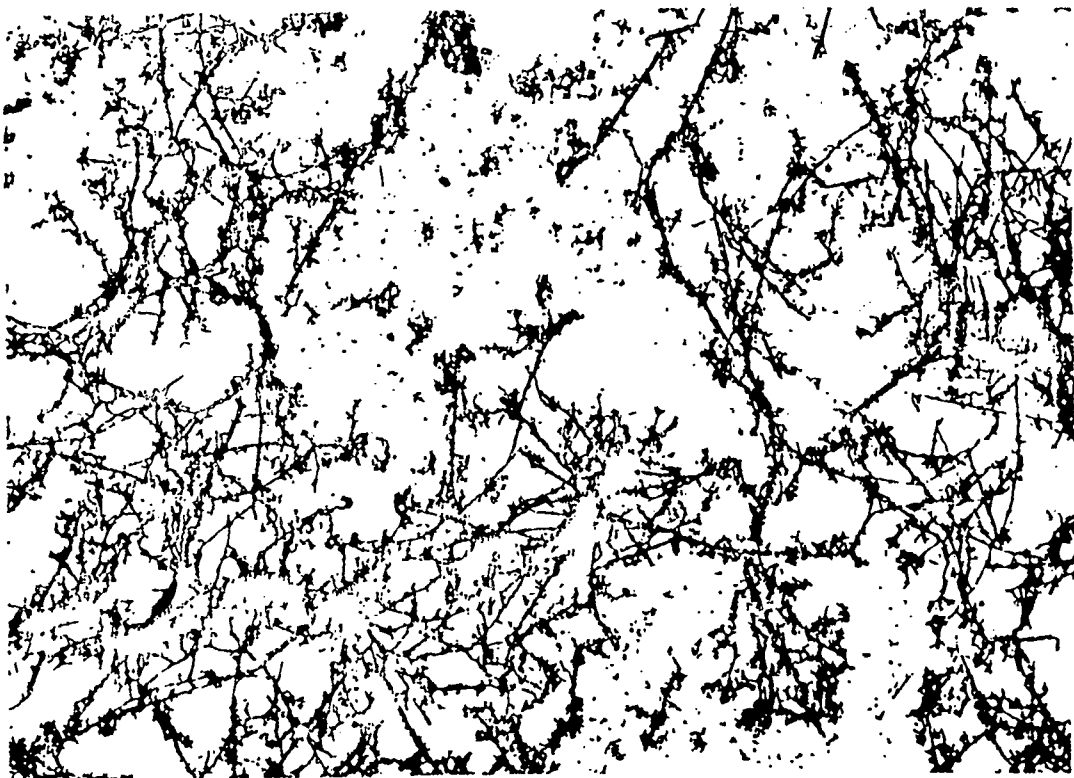
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II A



II B

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Date: 23/09/2002

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REQUISITOS NECESARIOS PARA PRESENTACION Y AGILIZACION DEL
TRAMITE

	USUARIO	RADICADOR
PATENTE DE INVENCION	()	(X)
MODELO DE UTILIDAD	()	(X)
- Indicación de que se solicita la concesión de una patente.	()	(X)
- Datos de identificación del solicitante o de la persona que se presenta la solicitud.	()	(X)
- Descripción de la invención.	()	(X)
- Dibujos de ser estos pertinentes.	()	(X)
- Comprobante de Pago de las tasas establecidas.	()	(X)
COMPLETA ()		
INCOMPLETA ()		
DISEÑO INDUSTRIAL ()		
- Indicación de que se solicita el registro de Diseño Industrial	()	()
- Datos de identificación del solicitante o de la persona que presenta la solicitud.	()	()
- Representación gráfica y fotográfica del Diseño Industrial o muestra del Material que incorpora el diseño.	()	()
- Comprobante de pago de las tasas establecidas	()	()
COMPLETA ()		
INCOMPLETA ()		
ESQUEMA DE TRAZADO ()		
- Indicación de que solicita el registro de un Esquema de trazado.	()	()
- Datos de identificación del solicitante o de la persona que presenta La solicitud.	()	()
- Representación gráfica del esquema de trazado	()	()
- Comprobante de pago de las tasas establecidas.	()	()
COMPLETA ()		
INCOMPLETA ()		

Firma Responsable:
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Fecha:
02 - 05 - 2003