Paper tissues and paper tissue products such as disposable handkerchiefs, kitchen paper towels, toilet paper and facial tissues exhibiting a soft and smooth surface, and a high bulkiness together with a high strength, in order to provide to the user an enhanced functionality and a high degree of comfort during usage. The present invention also relates to the process of making paper tissue and paper tissue products presenting such characteristics.
MICRO FIBER TEXTURED PAPER TISSUE
AND METHOD OF MAKING IT

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation of U.S. application Ser. No. 10/430,918, filed 7 May 2003, pending.

FIELD OF THE INVENTION

[0002] The present invention relates to paper tissues and paper tissue products, such as disposable handkerchiefs, kitchen paper towels, toilet paper and facial tissues. The present invention also relates to the process of making paper tissue and paper tissue products having such improved characteristics.

BACKGROUND OF THE INVENTION

[0003] Paper tissues sometimes called paper webs or sheets, tissues, tissue layers, paper plies or paper tissue webs, and products made there from, such as paper handkerchiefs, paper kitchen towel or toilet paper, find extensive use in modern society and are well known in the art. Such paper tissues are generally made by the layering of cellulose fibers, in a wet form, onto a screen, with the addition of various additives or other ingredients, followed by a drying step. Other process steps, before, during or after the above-mentioned paper making steps are generally targeted at giving the desired properties to the tissue. Converting steps are aimed at creating a finished product from the paper tissue(s).

[0004] Products made from paper tissues can be made by the association of multiple layers of tissues, also called plies, or can comprise a single tissue layer (single ply products). Those plies can be combined and held together in different ways to form the finished product. For example, plies may be held together by embossing and/or by gluing.

[0005] It has long been recognized that important physical attributes of these paper tissues are strength, thickness/bulkiness, softness, smoothness, and absorbency. Softness and smoothness relate to the tactile sensation perceived by the consumer when holding a particular product, rubbing it across the skin, or crumpling it within the hands. The tactile sensation is a combination of several physical properties. The tactile sensation can be well captured by the objective parameters of the physiological surface smoothness (PSS) parameter as known e.g. from U.S. Pat. No. 5,855,738. As important for the tactile sensation of consumers is the thickness/caliper of a tissue product also called bulkiness. Strength is the ability of the product to maintain physical integrity and to resist tearing, bursting, and shredding under conventional use conditions. Absorbency is the measure of the ability of a tissue or product to absorb quantities of liquid, particularly aqueous solutions or dispersions. Overall absorbency as perceived by the consumer is generally considered to be a combination of the total quantity of a liquid given mass of paper tissue or product will absorb at saturation as well as the rate at which the mass absorbs the liquid.

[0006] Relatively thick and yet soft disposable paper products, namely in the form of paper handkerchiefs, are known. For example, Tempo™, sold by The Procter & Gamble Company, is a multi-ply paper product experienced as thick and soft and having a caliper of about 0.3 mm. A high caliper conveys the idea of high dry and wet strength to the consumer. A high wet strength, also referred to as wet burst strength, in particular prevents tearing or bursting which for a paper handkerchief in turn results in contamination of the user’s hand with mucus or other body fluids.

[0007] A common way to enhance the smoothness of the tissue surface is to calender the material. For example U.S. Pat. No. 5,855,738 issued to Weisman et al. describes a calendering step that helps in the manufacture of a smooth high-density tissue. This manufacturing step flattens the surface of the tissue, thus re-orienting and re-bonding the paper fibers at the surface of the paper web. However, calendering reduces considerably the caliper of the paper web, impairing the desired bulkiness of the final product. Methods for creating tissues with high bulkiness have been described, for example in U.S. Pat. No. 5,702,571 and EP 0 696 334 B1, both by Kamps et al. In these references, the tissue’s bulkiness is enhanced by embossing the tissue between a nip formed by one male engraved roll and one female engraved roll. Another example is given in the patent application EP 01103798.3 by K. Hilbig, M. Liplijn and H. Reineheimer, filed on Feb. 16, 2001, and includes the creation of a tri-dimensional structure at the paper surface (via micro-embossing, also called stretch deformation before a calendering step). However, the above-mentioned methods still submit the paper to a calendering step that can reduce the thickness of the paper versus a micro-embossed paper tissue.

[0008] Another way to obtain a smooth paper tissue surface is to submit the paper tissue to a step of brushing. Brushing of tissue is described, for example, in U.S. Pat. No. 3,592,732 issued to Wand et al. in which the tissue is brushed by a rotating brush using an engraved or dented roll as a counter surface. In U.S. Pat. No. 5,180,471, Sauer et al. describes a multi-ply tissue and related method in which the inward surfaces have been brushed. It is believed that the brushing of the paper surface acts on the paper fibers (cellulose fibers) by unbonding one end of the paper fibers close to the surface of the tissue, herein referred to as extending fibers, thus allowing the extending fibers to raise above the paper web surface, thus creating a surface which is smooth to the touch. However, brushing can reduce the strength of the paper web as it modifies the structure of the fibre network forming the paper web and reduces the bonding between the fibers making up the surface of the tissue.

[0009] Despite the efforts in the prior art, each of the above methods present disadvantages affecting one or more of the key characteristics of the paper tissue when trying to improve another one. Thus, there remains a need for paper tissues which combine one or more apparently incompatible features such as a high surface smoothness, a high strength, and a high thickness/bulkiness.

SUMMARY OF THE INVENTION

[0010] The present invention relates to paper tissues comprising cellulose fibers. The tissues have a first and a second surface, and an embossing pattern, which form raised regions surrounded by depressed regions on the first surface. The regions coincide with the respective opposite regions on the second surface of the tissue. The first surface has extending fibers, which have a first and a second end, with the first end being un-bonded to the tissue and the second end being bonded to the tissue. The unbounded ends of the extending fibers are obtainable by brushing of the first surface, such that there are more extending fibers in the raised regions than in the depressed regions.
The present invention also relates to the process for making a paper tissue according to the above. The process comprises the steps of embossing the tissue by passing it between two rolls forming an embossing nip and brushing at least one of the surfaces of the tissue.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 represents a paper handkerchief composed of 3 paper tissues (also called plys or layers), and exhibiting a substantially non-flat/non-uniform surface.

FIG. 2 is a magnified portion of FIG. 1, on which the 3 paper tissues are seen.

FIG. 3 shows the process for making a tissue as shown in FIG. 1.

FIG. 4 shows an enlarged portion of the paper tissue at location 1 of FIG. 3.

FIG. 5 shows an enlarged portion of the paper tissue at location II of FIG. 3.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a paper tissue exhibiting a high level of surface smoothness, softness, strength and/or bulkiness.

The present invention provides a paper tissue surface which is not uniform and presents the desired characteristics in separate regions as well as a method to form such a paper tissue. Specifically, one region is relatively smooth and soft. The smoothness/softness is provided by the presence of loose paper fibre ends, which supports the tactile benefits of the tissue. Strength is provided in a region having a substantially non-altered network of fibers. Bulkiness can be created by the presence of raised and depressed regions and conserved through the process of converting the paper tissue, by both the nature of these process steps and preferably by their determined sequence.

Embossing

Although any known-in-the-art type of embossing can be practiced within the present invention, one preferred embossing step is a so-called micro-embossing or stretch embossing step, also called stretch deformation. One example of a suitable embossing step is described in the European patent application EP 0103798.3 by K. Hilbrig, M. Liplijn and H. Reinheimer, filed on Feb. 16, 2001, in which a very fine pattern is embossed using a low pressure. Embossing can be carried out on one tissue, such as the tissue (13) of FIGS. 3, 4, or 5 or the tissue (2), (3), (4) of FIGS. 1 and 2. Alternatively, embossing can be carried out on a multi-ply entity, such as the tissue (1) of FIG. 1. For simplicity, the tissue (13) of FIG. 3 is described below as a tissue (i.e. a single-ply entity), but the skilled person understands that it can be replaced by a multi-ply entity such as the multi-ply tissue (1) of FIG. 1, without deviating from the present invention.

As shown in FIG. 3, embossing of a paper tissue is generally achieved by passing the tissue or the multiply entity through a nip (8) formed between two embossing rolls (9), (10), at least one embossing roll (9) comprising embossing elements (12). An embossing roll typically comprises a smooth surface and embossing elements (12). Embossing elements (12) are protrusions raising above this surface and having a certain height as measured in a radial direction of the axis of the embossing roll above the smooth roll surface to the utmost point of the protrusion. Embossing elements (12) also have width in a direction parallel to the roll axis and a length in a radial direction. The term width and length as used herein can be the diameter of a round embossing element (12). Such a diameter needs not be constant from the bottom of the embossing element (12) to its top. Preferably, the largest width of an embossing element (12) is on said smooth surface.

The embossing elements (12) can have any shape, such as pyramidal or half spherical, and the cross section of the embossing elements (12) can be circular, oval or square. The embossing elements (12) may form a continuous pattern, but preferably are distinct from each other, such as the smooth surface of the roll forms a continuous plane. In one embodiment of the present invention, the embossing elements (12) are disposed over at least one embossing roll in a very fine pattern, comprising at least 30, 50, 60, 70 or even at least about 80 embossing elements per square centimetre surface area of the embossing roll. The embossing elements (12) are preferably less than about 1 mm in height, but can be less than about 0.8 mm in height, less than about 0.6 mm in height, less than about 0.5 mm in height, less than about 0.4 mm in height, or even less than about 0.3 mm in height.

Preferably the stretch embossing has a ratio of embossed areas to un-embossed areas from about 5% to about 95%, about 20% to about 80% or about 40% to about 60% of the total surface area of the tissue paper are embossed.

Any known type of embossing roll and mode of operation of such roll is within the scope of the present invention. For example, two hard metal embossing rolls can be used, wherein a first roll comprises protruding embossing elements, referred to as the male roll, and a second roll comprises matching recesses, referred to as the female roll. The recesses may be mirror images of the protruding embossing elements or may be adapted to be slightly smaller than exact mirror images, e.g. due to a slight difference in size or shape (e.g. slope) of those recesses in the female roll. It is also possible to use so called pin-to-pin embossing where two rolls are used with matching protrusions. Alternatively, a first embossing roll comprising a web contacting surface made from a hard material comprising protruding embossing elements can be made to contact a second roll comprising a web contacting surface comprising a relatively softer material (e.g. rubber), in which recesses are formed upon sufficiently close contact with the protruding embossing elements. Providing an embossing nip from a relatively hard roll in combination with a softer roll has numerous advantages, such as cheaper and easier production and operation, since the adjustment of the rolls is much less critical than for two hard rolls or two rolls of equal hardness.

The size of the nip formed between the two embossing rolls may be adapted depending on the tissue paper to be processed and depending on the embossing pattern used. Also depending on those considerations no pressure or some pressure may be applied to urge the first embossing roll and the second embossing roll together. When two hard rolls are employed in the process, a male and a female role, the rolls can be operated so as to leave a space corresponding to about 60% or about 140%, preferably about 80%-about 120% of the caliper of the un-embossed tissue paper between the protruding embossing elements of the male role and the bottom of the recesses of the female role. When a hard roll is used in combination with a softer roll, the rolls can be pressed against each other with a pressure of about 10 N/square centimetre to
about 1000 N/square centimetre, about 20 N/square centimetre to about 200 N/square centimetre, about 50 N/square centimetre to about 100 N/square centimetre or any other desired pressure. Further, any of the embossing rolls may be heated or not heated and run at the same speed or different speeds.

[0025] The above described embossing with a fine pattern, in one important aspect serves to increase the caliper, or in other words the bulk of the paper tissue. Therefore, in one mode of the present invention a single tissue is passed through the embossing nip. In alternative modes of operation, a multitude of plies of paper tissues may be passed through the nip at the same time. This will results in embossments which initially match or nest between the tissues.

Brushing

[0026] According to one aspect of the present invention, the brushing of the paper tissue(s) is performed after the embossing step, but can also be considered as an independent step provided it delivers the intended result described. The terms brush and brushing are being used in the present document as an example, but without limiting the scope of this invention. In accordance with the present invention are any tool, equipment or means able to provide the desired modification on the surface and structure of the paper tissue (i.e. to lift fibers end up without complete detachment). Conventionally such means include any type of abrasive surface such as those provided by the bristles of a brush or by sand paper. Useful structures providing abrasive functionality can be made from natural or artificial materials such as foam, metal or polymers. To create the desired abrasion a relative movement between the surface of the paper tissue and means of abrasion can be provided. As alternatives, chemical, optical, or physical processes resulting in the described modification of the surface and/structure of the tissue, are considered within the scope of the present invention.

[0027] Preferably, the modification on the surface and structure of the paper tissue is achieved with a rotating tool which is in abrasive contact with the surface of the tissue(s), typically a brush cylinder comprising brushing bristles along its full circumference is used. The bristles can be polymeric or from natural origins such as animal hair or fur. The brushing step can be performed on one side of the paper tissue or on both, depending on the intended benefits desired, by a combination of one, two or more brushes. One brush (or brush cylinder) or more can be applied to each tissue side. For simplicity, the embodiment of the invention is described in the following with one brush cylinder (identified in the FIG. 3 by the reference numeral 11) acting on one tissue side. Alternative configurations can be practiced also. For example, two or more brushes acting on the same tissue side, brushing of the first and second surfaces simultaneously or consecutively, are envisioned. In one embodiment, five pairs of brushes are used, providing five brushing operations on each side of the web.

[0028] One result of the brushing step is a modification of the most outwardly lying fibers on the surface of the tissue. The tissue fibers are generally bonded by hydrogen bridges to each other during the tissue making, drying or subsequent calendaring at a multitude of points where the fibers intersect. It is believed that, during the brushing step, the paper fibers are provided with sufficient energy to break some of the hydrogen bonds linking the fibers together and insuring the cohesion of the paper structure. This energy is provided by the tearing force or shear force of the individual bristles when colliding with the fibers. Without being bound by the theory, the inventors believe that the energy should be sufficient to break some of the bond between the fibers but low enough not to break all of the bonds which would provoke a complete dislocation of the fibers from tissue surface (also known as Tinting), and to not break the fiber structure itself.

[0029] The brushing step of the present invention creates extending fibers (7), as shown in FIGS. 2 and 5, i.e. fibers having one fiber end still bonded to other fibers while the other fiber end is freed, and able to raise above the surface of the tissue. These extending fibers (7) can help provide tactile smoothness and softness to the tissue.

[0030] The process according to the present invention is believed to loosen or free only one end of the fibers by breaking their bonds to the other fibers at one end. It is however observed that the brushing step may also induce a complete release of some complete fibers or fiber breakage. These fibers or pieces of fibers can be removed from the tissue thereby helping to reduce Tinting. They can be recycled. Schematically the process according to the present invention can be seen in FIG. 3: first a tissue web (13) is provided, usually unwound from a roll of tissue web. The tissue web (13) is guided to an embossing station where the tissue web is guided through a nip (8) between two embossing rolls (9), (10). The tissue (13), after embossing is then guided toward a brushing station where at least one side is exposed to a brushing cylinder (11). The brushing cylinder can be operated to rotate so that its surface moves with or against the tissue movement or simply stands still. The setting of the equipment, particularly the brushing cylinder, such as rotation speed, distance of the brush to the tissue web, extend of wrapping of the tissue web around the brush, and the design of the brush, such as the nature of the bristles, their length, the bending moment of the bristles, the density and the diameter of the bristles, the treatment or coating of the bristles, are optimized to deliver the best results for the quality of the paper tissue after brushing (analyzed by strength, smoothness, softness and bulk of the tissue), the stability of the process, and the life of the equipment.

[0031] The brushing step can be performed with only the inherent force of the moving paper tissue web acting on the brush, i.e. without the use of a counter-roll or counter-surface to apply pressure and/or guide the paper tissue onto the brush. Only the tension of the paper tissue web and to a much lesser extent the own weight of the paper tissue applies a pressure on the rotating brush (11), as shown in FIG. 3. When more than one brush cylinder are used in the process, some of the brushes may, or may not, be positioned in such a way that they brush the two sides of the paper web simultaneously. In one embodiment, the brush rotates in the direction of the web movement on the converting line. However, rotation in the opposite direction is also contemplated. Alternatively, a counter surface (often in the form of a counter roll, rotating at a surface speed close to the surface speed of the web) is used. The counter surface may be positioned as such as a portion of the web is simultaneously both in contact with both the brush and with the counter surface. The position of the counter roll and path of the web may be such that a convex surface of the web is exposed to the action of the brush. Without being bound by the theory it is believed that this configuration “opens up” the micro-structure of the web and consequently enhance the action of the brush on the web tissue fibers. This configuration is achieved by having for example a partial
wrapping of the web around the counter roll (the surface of the web not in contact with the counter roll has, therefore, a convex surface that is in contact with the brush).

[0032] Together with the design of the brush, its speed of rotation is a factor in the effectiveness of the brushing step, affecting the wearing of the equipment as well end results of the process step. In certain preferred embodiments, the speed of the brushing cylinder relatively to the tissue web surface is higher than about 1,000 m/min (linear velocity of point of contact to the paper web), higher than about 1,500 m/min, higher than about 2,000 m/min or higher than about 3,000 m/min. The relative surface speed of the brush can also be calculated in relationship to the surface speed of the web. The surface speed of the brush being between 1.5 and 20 times faster than the surface speed of the web, between 2 and 15 times, and between 5 and 10 times should all provide suitable results.

[0033] The brush 11 as used in the present invention can be of very wide nature and design, including synthetic, metallic or natural hair, over a wide range of dimension and density. In a preferred way to conduct the invention, brushes made of horsehair have been used, as sold by Mink GmbH (Goepppingen, Germany) under the reference ZH 12528-K2509. Such brushes are used conventionally in the treatment of textiles. The brush may be substantially circular and rotate by rotation around one axis. The inventors, however, contemplate as being part of the present invention the use of other types of brushes (for example, fixed brushes or brushes operating by translation of the brush surface or abrasive surface over the surface of the paper tissue), provided the action of the brush induces the described modification on the surface and structure of the paper tissue.

[0034] In one preferred way to practice the invention, the embossed paper tissue web is wrapped around two brush rolls without being fixed on a guide roll. Each brushing roll brushes one surface of the tissue. The travel distance of the paper tissue on the surface of the brush (i.e. the wrapping of the paper tissue around the brush or in other words, length of contact between the brush and the paper tissue) can vary over a wide range. It has been found useful to set this length to less than about 20 cm in some embodiments, less than about 5 cm in other embodiments, and less than about 1 cm in yet other embodiments, although a wider range of length is contemplated.

[0035] For paper tissue, which has been made in the paper making operation as a non-homogeneous mixtures of long and short fibers, with one side of the tissue presenting more short fibers than the other side, the present invention contemplates a preferred orientation of the paper web on the brush. Preferably the paper tissue or the brush are oriented as such as the short fibers of the paper tissue are brought to contact with the brush. Without wishing to be bound by the theory, it is believed that the short fibers present less bonding to each other. It may thus be easier to loosen more fiber ends out of short fiber side than out of long fiber side of a tissue.

[0036] It has been observed that the brushing step of a paper tissue tends to increase its caliper and increases in the range of about 1% to about 25% have been measured, averaging to about 5%. Importantly, this increase in caliper, leading to a high bulk, is additive to the caliper increase created by the embossment step or the stretch deformation process step. The stretch deformation itself generally adds about 50% to about 200% of caliper to the paper tissue, according to the European patent application EP 01103798.3 supra.

[0037] One advantage of the present invention in comparison to the process described in European patent application EP 01103798.3 supra, is the possibility to eliminate the conventional calendering step after the stretch deformation step. This conventional calendering generally results in a decrease of the stretch deformed paper tissue caliper, which led to a total caliper increase (after both steps: stretch deformation and smooth calendering) of about 10% to about 100%. The elimination of the calendering after the embossing but in the case of brushing allows achieving an exceptionally high-end caliper of the treated tissue web, in the range of about 51% to about 225% in the examples given above.

[0038] In one embodiment as shown on FIG. 3, the tissue (13) of FIGS. 3, 4, 5 has been previously submitted to an embossing step, most preferably the micro-embossing (or stretch embossing or stretch deformation step) described under the “Embossing” headline in this document. In that case, the paper tissue (13) enters the brushing step being an essentially non-flat surface, i.e. presenting raised regions (6) and depressed regions (5), relatively to each other, created by the embossing step. The effect of brushing on this pre-deformed paper tissue is unexpected and acts preferentially on the raised regions (6) while leaving the depressed regions (5) substantially un-altered. Thus, more extending fibers (7) are created on the raised regions (6) relative to those created in the depressed regions (5). A network of substantially unaltered depressed regions is thereby created. This network substantially conserves the strength and tensile characteristics of the un-treated tissue. This delivers the intended results of creating a paper tissue with a high degree of softness and smoothness (provided in particular by the extending fibers of the raised regions), a high strength (in particular provided by the network of unaltered depressed regions) and bulkiness (provided by the presence of raised and depressed regions).

Optional Process Steps

[0039] The method for making a paper product according to the present invention may comprise a number of further optional steps. For example, a lotion may be applied to the tissue by any suitable means, such as, but not limited to printing or spraying, onto one or more surfaces of the paper tissue or paper product, or a portion of these surfaces. Further, juxtaposed plies of the paper tissue may be joined so as to provide a multi-ply paper product, preferably by attachment embossing. "Attachment embossing", as used herein, refers to an embossing by which all plies of a multi-ply product according to the present invention are embossed in one process step. “Attachment embossing” has been described by H. Reinheimer, K. Hilbig and W. Schmitt in WO 95/27429. Preferably the attachment embossing does not or at least not to a large extent affects the smoothness of any calendered tissue. Therefore, preferably the paper product has an un-embossed surface over a major part of the surface area of the tissue, preferably on the first and the second surface. As used herein, this means that the tissue has one or more regions not comprising an attachment embossing and, optionally, one or more regions comprising an attachment embossing, and that the region not comprising an attachment embossing is at least about 50%, at least about 80% or in some embodiments as much as 99%, of the surface area of the tissue. Most commonly the regions comprising an attachment embossing lie close to the edge of the tissue (for example along two or four edges). Attachment embossing may also be used for decorative purposes (for example to create a pattern or to spell out a
logo or brand name). In one example embodiment, the attachment embossing may be done by pin-to-pin embossing and with 10 to 40 embossing elements per square-centimetre having a height from 0.01 mm to 1 mm, or 0.05 mm to 0.2 mm. The percentage of attachment embossed areas to un-embossed or fine embossed areas of the total surface area of a paper tissue product can be about 0.01% to about 5%. Attachment embossing involves as substantive densification of the paper tissue products as to achieve the attachment. Therefore the nip or space between one embossing element and its counterpart, e.g. two pins where pin-to-pin embossing is employed, is less that the caliper of the paper tissue to be embossed, typically about 5% to about 50%, about 10% to about 20% of the caliper of the paper tissue to be embossed, which leads to embossing pressures of about 10,000 to about 50,000 N/square-centimetre.

The method of the present invention may further comprise a step of sizing the paper tissue web or paper product to the desired dimensions. Further if desired, the paper products according to the present invention may be provided with functional or aesthetic indicia. The indicia may be applied to either or both of the surfaces of the paper products. The indicia may cover all or part of the paper products and be applied in a continuous or discontinuous pattern. The indicia may be applied to the paper tissue products by any means well known in the art, such as spraying, extruding, and preferably printing.

Examples

Paper Tissue

A piece of paper tissue according to the present invention is cut from a paper tissue web and presents a non-uniform surface, obtainable for example by a process step of micro-embossing. It has typically 30 to 100 depressed regions per cm² and the depressed regions have typically a depth of less than 260μ and typically a diameter of more than 20μ. The thickness of the tissue depends highly on the manufacturing process and is typically 100μ per native paper tissue ply, 150μ to 200μ when embossed or stretch deformed. This results in about 400μ to 500μ when 3 plies are combined (after embossing) to form a finished product. The dimensions of the paper tissue are not relevant as it depends almost only on the setting of the cutting equipment on a manufacturing machine.

As it can be seen in FIG. 5, the raised regions (6) of the paper tissue (13) show extending fibers (7), visible under a microscope or magnifier lens. The ends of the fibers are non-bonded to the other fibers and thus have the ability to stick out of the surface of the paper tissue. These extending fibers are believed to provide the particular characteristics, according to the present invention, which are responsible for the benefits described above, in particular softness, smoothness and bulkiness of a tissue. The strength characteristics of the tissue, on the other hand is substantially not altered because the number of extending fibers in the depressed regions is smaller than in the raised regions.

Counting of the extending fibers can be made under light magnification (for example 10 times magnifier lens) by estimating the density or the number of extending fibers or by numerical counting of those, both in the raised regions and in the depressed regions.

Paper Handkerchiefs

In the particular example of Tempo™ paper handkerchiefs, the handkerchiefs include 3 or 4 plies of paper tissues. Each handkerchief has a basis weight of about 50 to 80 g/sqm (i.e. about 18 g/sqm per ply) and a caliper of 400μ to 600μ (about 140μ per ply). The plies are linked together by a particular embossing, according to WO95/27429, and possibly gluing, which keeps the plies together and enable the design of a particular pattern at the surface of the paper handkerchief. In a particular example, only the 2 outside surfaces of the handkerchiefs (after combining the plies) have unbonded fiber ends in the raised regions of the tissues in accordance with the present invention. The other surfaces of the tissues (inwardly oriented surfaces of the outside tissue and internal tissue’s surfaces) present raised regions and depressed regions providing bulkiness and caliper, but an about equal quantity of unbonded fibers on the raised and depressed regions.

Absorbent Article

In another example, the paper tissue according to the present invention is in an absorbent article. The term “absorbent article” refers to devices that absorb and contain liquid, and more specifically, refers to devices that are placed against or in proximity to the body of the wearer to absorb and contain the various exudates discharged from the body. Absorbent articles include but are not limited to diapers, adult incontinence briefs, training pants, diaper holders and liners, sanitary napkins and the like.

Absorbent articles typically comprise an absorbent core, a topsheet and a backsheet. The absorbent core generally is disposed between the topsheet and the backsheet. The absorbent core may comprise an acquisition system, which includes an upper acquisition layer facing towards the wearer’s skin and a lower acquisition layer facing the garment of the wearer. In one embodiment, the upper acquisition layer comprises a non-woven whereas the lower acquisition layer comprises a mixture of chemically stiffened, twisted and curled fibers, high surface area fibers and thermoplastic binding fibers. In another embodiment, both acquisition layers are provided from a non-woven material. Alternatively, one or all layers of the acquisition system may be provided from a tissue paper in accordance with the present invention. For example, the storage layer may be wrapped by a core wrap material. In one such embodiment the core wrap material comprises a top layer and a bottom layer. The core wrap material, the top layer or the bottom layer can be provided by a paper tissue according to the present invention. The top layer and the bottom layer may be provided from two or more separate sheets of materials of they may be alternatively provided from a unitary sheet of material. Such a unitary sheet of material may be wrapped around the storage layer e.g. in a C-fold.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

All documents cited herein are, in their relevant part, incorporated herein by reference; the citation of any document is not to be construed as an admission that it takes away patentability of the present invention.
What is claimed is:

1. A paper tissue, said tissue comprising:
   paper fibers and having a first surface, a second surface and an embossing pattern disposed thereon,
   said embossing pattern having raised regions surrounded by depressed regions on said first surface,
   said first surface having extending paper fibers wherein said extending paper fibers have a first end and a second end, said first end being un-bonded to said tissue and said second end being integral with, and bonded to, said tissue;
   wherein more of said extending paper fibers are disposed in said raised regions than in said depressed regions; and,
   wherein said embossing pattern comprises at least 30 embossing elements per square centimeter.

2. The tissue of claim 1 further comprising extending paper fibers on said second surface.

3. The tissue of claim 1 comprising at least 25% more of said extending paper fibers in said raised regions of said first surface than in said depressed regions.

4. The tissue of claim 3 comprising at least 50% more of said extending paper fibers in said raised regions of said first surface than in said depressed regions.

5. The tissue of claim 1 in which said embossing pattern further comprises a micro-embossing pattern.

6. The tissue of claim 1 further comprising an interconnected network formed by said depressed regions.

7. The tissue of claim 1 wherein said first surface forms an outer surface.

8. A paper-product including at least two plies, each of which includes the tissue of claim 1, wherein embossing patterns of each of said tissues are registered.

9. A process for making a paper tissue, the process including the following steps:
   providing a tissue, said tissue having a first and a second surface,
   embossing said tissue by passing said tissue between two rolls forming an embossing nip, and
   brushing at least one of said surfaces of said tissue, wherein said brushing process step is subsequent to said embossing step.

10. The process of claim 9 in which said embossing step comprises a micro-embossing step created by stretch deformation of said tissue without creating local tissue breakage.

11. The process of claim 9 in which said brushing process step comprises the use of a brushing tool on said first surface without a counter-surface being applied to said second surface of said tissue.

12. The process of claim 9 wherein said brushing process step uses a brushing tool on said first surface with a counter-surface being applied to said second surface of said tissue.

13. The process of claim 12 wherein the counter-surface is a counter-roll, said first surface of said tissue is in contact with said counter-roll while said second surface of said tissue is in contact with said brushing tool, and said second surface of said tissue contacting said brushing tool is convex.

14. The process of claim 10 wherein said tissue is moving at a first surface speed and the brushing tool has a second surface speed that is been 1.5 and 20 times faster than the first surface speed of said tissue.

15. An article comprising:
   paper fibers and having a first surface, a second surface, and an embossing pattern disposed thereon;
   said embossing pattern having raised regions surrounded by depressed regions on said first surface;
   said first surface having extending paper fibers wherein said extending paper fibers have a first end and a second end, said first end being un-bonded to said tissue and said second end being integral with, and bonded to, said tissue;
   wherein more of said extending paper fibers are disposed in said raised regions than in said depressed regions; and,
   wherein said depressed regions have a depth of less than 260 micrometers.

16. The article of claim 15 wherein said embossing pattern comprises at least 30 embossing elements per square centimeter.

17. The article of claim 15 wherein said embossing pattern further comprises a micro-embossing pattern.

18. The article of claim 15 wherein said extending paper fibers disposed in said raised regions comprise at least 25% more of said extending paper fibers than said extending paper fibers disposed in said depressed regions.

19. The article of claim 15 further comprising an interconnected network formed by said depressed regions.

20. The article of claim 15 wherein said first surface forms an outer surface of said article.