

PAPER TOWEL AND METHOD FOR MANUFACTURING THE SAME

[0001] The present application claims the benefit of priority to Chinese Patent Application No. 201910760175.5, titled "PAPER TOWEL AND METHOD FOR MANUFACTURING THE SAME", filed with the China National Intellectual Property Administration on August 16, 2019, the entire disclosure of which is incorporated herein by reference.

FIELD

[0002] The present application relates to a paper towel and a method for manufacturing the paper towel, and in particular to a method for manufacturing a multi-layer product.

BACKGROUND

[0003] Paper towels are generally made from natural and non-polluting raw materials such as wood pulp, bamboo pulp, cotton pulp, straw pulp and the like. According to the usage, the paper towels include facial tissues, paper napkins, paper handkerchiefs, wipes, toilet papers, kitchen towels and so on. According to the structures of the paper towels, the paper towels can be divided into types of single-layer, double-layer, and multi-layer. Layers of a multi-layer paper towel may easily be separated and peeled off in the process of taking it out. In order to change the layering of the paper, layers of paper are bonded by embossing. The physical properties of the paper towel such as the thickness, touch (surface softness), and absorbency (fluffy softness) are affected in the embossing process. The embossing process becomes a key link that affects the performance of the paper towel in the papermaking technology.

[0004] At present, the embossed toilet paper structure on the market is mainly produced through the embossing process and the bonding of the embossed toilet paper (embossed combination structure). However, the conventional embossed toilet paper is mainly made through two-path embossing, and the conventional disclosed three-path embossed toilet paper is restricted by the technology, which makes the conventional product of the three-path embossed structure has no obvious advantage over the two-path embossed product.

[0005] CN 201510439764.5 discloses a method for manufacturing multi-layer embossed

toilet roll. Raw paper unrolling: the raw paper to be embossed is unrolled; fine embossing of the surface layer: one or more surface layer raw paper are led to a pair of upper finely embossing rollers to be finely embossed to obtain the finely embossed paper; rough embossing of the surface layer and the core layer: the obtained finely embossed paper and a layer of core layer raw paper are rolled together and led to a pair of roughly embossing rollers to be roughly embossed to obtain roughly embossed paper; applying the bonding agent: the obtained roughly embossed paper is led to a pair of rollers including a rubber roller for applying the bonding agent and a roughly embossing steel roller, and the bonding agent is applied to the concave surface of the core layer side of the obtained roughly embossed paper, to obtain a dottedly glued roughly embossed paper; fine embossing of the bottom layer: a layer of the bottom layer raw paper is led to a pair of lower finely embossing rollers to be finely embossed to obtain the bottom layer finely embossed paper; rewinding and packaging: the obtained dottedly glued roughly embossed paper and the bottom layer finely embossed paper are rewound, the roughly embossed concave surface of the dottedly glued roughly embossed paper and the concave surface of the bottom layer finely embossed paper are connected by bonding and packaged during the rewinding process, to obtain a multi-layer embossed toilet roll with the convex surface of the surface layer and the convex surface of the bottom layer being arranged opposite to each other.

[0006] Although the above solution achieves the three-path embossing of the surface layer, the core layer, and the bottom layer, the conventional three-path embossed product has no obvious advantage over the two-path embossed product due to process restrictions. With regard to the surface layer, because the surface layer is embossed twice, the fiber bonding points in the toilet paper are stretched to a great extent and thus be fractured and broken, leading to low strength of the surface layer of the toilet paper, thus the toilet paper is easily torn when gets wet, and thereby resulting in worse user experience. Furthermore, the structure formed by bonding the surface layer which is embossed twice and the core layer does may not greatly improve the thickness structure of the product, and the absorbency and hand feeling may not be greatly changed.

SUMMARY

[0007] In view of this, a paper towel and a method for manufacturing the paper towel are

provided according to the present application, to address the issues in the conventional technology.

[0008] A paper towel is provided according to the present application, which includes a first embossed layer, a second embossed layer, and a third embossed layer; wherein

5 the first embossed layer is embossed to form low protrusions of the first embossed layer and high protrusions of the first embossed layer; each of the low protrusions of the first embossed layer includes a width of the low protrusion of the first embossed layer and a height of the low protrusion of the first embossed layer; each of the high protrusions of the first embossed layer includes a width of the high protrusion of the first embossed layer and a
10 height of the high protrusion of the first embossed layer;

 the second embossed layer is embossed to form protrusions of the second embossed layer and flat surfaces between the protrusions of the second embossed layer; each of the protrusions of the second embossed layer includes a width of the protrusion of the second embossed layer and a height of the protrusion of the second embossed layer; each of the flat
15 surfaces between the protrusions of the second embossed layer has a width of the flat surface between the protrusions of the second embossed layer;

 the third embossed layer is embossed to form protrusions of the third embossed layer and flat surfaces between the protrusions of the third embossed layer; each of the protrusions of the third embossed layer includes a width of the protrusion of the third embossed layer and a height of the protrusion of the third embossed layer; and wherein
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 the height of the high protrusion of the first embossed layer is greater than the height of the protrusion of the second embossed layer; and the height of the protrusion of the second embossed layer is greater than or equal to the height of the protrusion of the third embossed layer;

25 the width of the low protrusion of the first embossed layer is less than or equal to the width of the protrusion of the second embossed layer or the width of the flat surface between the protrusions of the second embossed layer;

 a density of the low protrusions of the first embossed layer is greater than a density of the protrusions of the second embossed layer;

30 during a process of combing the first embossed layer and the second embossed layer

through rollers, the high protrusions of the first embossed layer and the protrusions of the second embossed layer are nested with each other by squeezing and applied with a bonding agent; and a part of the low protrusions of the first embossed layer are supported by the protrusions of the second embossed layer; or

5 during a process of combing the first embossed layer and the second embossed layer through rollers, the high protrusions of the first embossed layer and the flat surfaces between the protrusions of the second embossed layer are nested with each other by squeezing and applied with a bonding agent; and a part of the low protrusions of the first embossed layer are supported by the flat surfaces between the protrusions of the second embossed layer; and

10 the first embossed layer and the second embossed layer, which are combined with each other and applied with the bonding agent, are combined with the third embossed layer through rollers.

[0009] Preferably, the first embossed layer and the second embossed layer, which are combined with each other and applied with the bonding agent, are combined with the third
15 embossed layer through the rollers, wherein the high protrusions of the first embossed layer and the protrusions of the second embossed layer, which are nested with each other by squeezing and applied with the bonding agent, are bonded with the flat surfaces between the protrusions of the third embossed layer, and the protrusions of the third embossed layer and the flat surfaces between the protrusions of the second embossed layer are nested with each
20 other by squeezing.

[0010] Preferably, the first embossed layer and the second embossed layer, which are combined with each other and applied with the bonding agent, are combined with the third embossed layer through the rollers, wherein the high protrusions of the first embossed layer and the flat surfaces between the protrusions of the second embossed layer, which are nested
25 with each other by squeezing and applied with the bonding agent, are bonded with the flat surfaces between the protrusions of the third embossed layer, and the protrusions of the third embossed layer and the protrusions of the second embossed layer are nested with each other by squeezing.

[0011] Preferably, each of the first embossed layer, the second embossed layer, and the
30 third embossed layer may be single-layer, double-layer, or multi-layer.

[0012] Preferably, the low protrusions of the first embossed layer are embodied as embossed dots; and the high protrusions of the first embossed layer are embodied as a pattern composed of dots and lines.

5 [0013] Preferably, the protrusions of the second embossed layer are embodied as a wave structure, or the protrusions of the second embossed layer are embossed dots.

[0014] Preferably, the wave structure is embodied as folds, corrugated contours, or wavy contours.

[0015] Preferably, the bonding agent is glue or water or natural extract liquor; and the bonding agent has color or fragrance or is colorless and odourless.

10 [0016] A method for manufacturing a paper towel is provided according to the present application, wherein the first embossed layer, the second embossed layer, and the third embossed layer are formed through embossing rollers;

the first embossed layer and the second embossed layer are combined with each other through the rollers and the bonding agent is applied, wherein the high protrusions of the first
15 embossed layer and the protrusions of the second embossed layer are nested with each other by squeezing and the bonding agent is applied, to allow a part of the low protrusions of the first embossed layer to be supported by the protrusions of the second embossed layer, and another part of the low protrusions of the first embossed layer to be supported by the flat surfaces between the protrusions of the second embossed layer; and

20 the first embossed layer and the second embossed layer, which are nested with each other by squeezing and applied with the bonding agent, are bonded with the third embossed layer, wherein and the high protrusions of the first embossed layer and the protrusions of the second embossed layer are bonded with the flat surfaces between the protrusions of the third embossed layer, and the protrusions of the third embossed layer and the flat surfaces between
25 the protrusions of the second embossed layer are nested with each other by squeezing.

[0017] A method for manufacturing a paper towel is further provided according to the present application, wherein the first embossed layer and the third embossed layer are formed through embossing rollers;

the first embossed layer and the second embossed layer are combined with each other
30 though the rollers and the bonding agent is applied, wherein the high protrusions of the first

embossed layer and the flat surfaces between the protrusions of the second embossed layer are nested with each other by squeezing and applied with the bonding agent, to allow a part of the low protrusions of the first embossed layer are supported by the flat surfaces between the protrusions of the second embossed layer, and another part of the low protrusions of the first embossed layer are supported by the protrusions of the second embossed layer; and

the first embossed layer and the second embossed layer, which are nested with each other by squeezing and applied with the bonding agent, are bonded with the third embossed layer, wherein the high protrusions of the first embossed layer and the flat surfaces of the protrusions of the second embossed layer are bonded with the flat surfaces between the protrusions of the third embossed layer, and the protrusions of the third embossed layer and the protrusions of the second embossed layer are nested with each other by squeezing.

[0018] In summary, a paper towel and a method for manufacturing the paper towel are provided according to the present application. A three-layer embossed pattern is provided, the high protrusions of the first embossed layer are nested with the protrusions of the second embossed layer or the flat surfaces between the protrusions of the second embossed layer by squeezing, and the bonding agent is applied. During the process of combining the first embossed layer and the second embossed layer, embossed traces made by the high protrusions of the first embossed layer are left on the surface of the second embossed layer, and the embossing traces are applied with the bonding agent, to be bonded with the third embossed layer by squeezing through rollers with certain strength. Since the density of the low protrusions of the first embossed layer is greater than that of the protrusions of the second embossed layer, a part of the low protrusions of the first embossed layer are supported by the protrusions of the second embossed layer, and another part of the low protrusions of the first embossed layer are supported by the flat surfaces between the protrusions of the second embossed layer, which can increase the thickness of the product to the full extent, and the thickness of the product can be increased by about 52% compared with that of the traditional three-layer embossed structure. The first embossed layer and the third embossed layer are mainly embossed dots of a certain density, and the density of the embossed dots is greater than that of the second embossed layer, so as to obtain similar touch feeling. The high protrusions of the first embossed layer run through the second embossed layer and the third embossed layer, and finally the three different embossed layers are bonded and fixed together to form a firm three-dimensional structure, thereby greatly

improving the physical properties of the paper towel product in terms of thickness, tactility, and absorbency.

BRIEF DESCRIPTION OF THE DRAWINGS

5 [0019] For more clearly illustrating embodiments of the present application or the technical solutions in the conventional technology, drawings referred to describe the embodiments or the conventional technology will be briefly described hereinafter. Apparently, the drawings in the following description are only some examples of the present application, and for those skilled in the art, other drawings may be obtained based on these
10 drawings without any creative efforts.

[0020] Figure 1 is a schematic view showing three-path embossing in the prior art;

[0021] Figure 2 is a schematic view showing three-path embossing in the prior art;

[0022] Figure 3 is a schematic view showing a first embossed layer;

[0023] Figure 4 is a schematic view showing a second embossed layer;

15 [0024] Figure 5 is a schematic view showing a third embossed layer;

[0025] Figure 6 is an exploded schematic view showing the first to third embossed layers;

[0026] Figure 7 is a schematic view showing that the first and second embossed layers are combined with each other;

[0027] Figure 8 is a schematic view showing that the first and second embossed layers,
20 which have been combined with each other, are combined with the third embossed layer;

[0028] Figure 9 is a schematic view showing three embossed layers according to a first embodiment;

[0029] Figure 10 is a schematic view showing three embossed layers according to a second embodiment; and

25 [0030] Figure 11 is a schematic view showing three embossed layers according to a third embodiment.

[0031] Reference numerals:

10 first embossed layer,

11 low protrusion of first embossed layer,

- d11 width of low protrusion of first embossed layer,
- h11 height of low protrusion of first embossed layer,
- 111 left side of low protrusion of first embossed layer,
- 113 right side of low protrusion of first embossed layer,
- 5 112 bottom surface of low protrusion of first embossed layer,
- 12 high protrusion of first embossed layer,
- d12 width of high protrusion of first embossed layer,
- h12 height of high protrusion of first embossed layer,
- 121 left side of high protrusion of first embossed layer,
- 10 122 right side of high protrusion of first embossed layer,
- 123 bottom surface of high protrusion of first embossed layer,
- 13 flat surface of first embossed layer,
- 20 second embossed layer,
- 21 protrusion of second embossed layer,
- 15 d21 width of protrusion of second embossed layer,
- h21 height of protrusion of second embossed layer,
- 211 left side of protrusion of second embossed layer,
- 212 right side of protrusion of second embossed layer,
- 213 bottom surface of protrusion of second embossed layer,
- 20 22 flat surface between protrusions of second embossed layer,
- d22 width of flat surface between protrusions of second embossed layer,
- 23 flat surface of second embossed layer,
- 30 third embossed layer,
- 31 protrusion of third embossed layer,
- 25 311 left side of protrusion of third embossed layer,

- 312 right side of protrusion of third embossed layer,
313 bottom surface of protrusion of third embossed layer,
d31 width of protrusion of third embossed layer,
h31 height of protrusion of third embossed layer,
5 32 flat surface between protrusions of third embossed layer,
33 flat surface of third embossed layer.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0032] A paper towel and a method for manufacturing the paper towel are provided
10 according to the present application, to address issues in the conventional technology.

[0033] The technical solution according to the embodiments of the present application
will be described clearly and completely as follows. It is obvious that the described
embodiments are only a part of the embodiments according to the present application, rather
than all of the embodiments. All the other embodiments obtained by those skilled in the art
15 based on the embodiments in the present application without any creative work belong to the
scope of protection of the present application

[0034] In order to describe the present application in more detail, a paper towel and a
method for manufacturing the paper towel according to the present application will be
described in detail below with reference to the accompanying drawings.

20 [0035] A flat surface of an embossed layer refers to the flat surface of the paper towel
layer before embossing; a width of an embossed protrusion refers to the width of the bottom
surface of the embossed protrusion formed after the flat surface of the embossed layer is
embossed, a height of the embossed protrusion refers to a distance between the flat surface
of the embossed layer and the bottom surface of the embossed protrusion formed after
25 embossing; and a flat surface between the embossed protrusions refers to the flat surface of
the embossed layer between the embossed protrusions which is not embossed.

[0036] As shown in Figure 8, a paper towel includes a first embossed layer 10, a second
embossed layer 20, and a third embossed layer 30;

as shown in Figure 3, the first embossed layer 10 is embossed to form low protrusions

11 of the first embossed layer, high protrusions 12 of the first embossed layer, and flat surfaces 13 of the first embossed layer;

each of the low protrusions 11 of the first embossed layer includes a width d11 of the low protrusion of the first embossed layer and a height h11 of the low protrusion of the first embossed layer. The width d11 of the low protrusion of the first embossed layer refers to a width of a bottom surface of the protrusion formed after embossing, and the height h11 of the low protrusions of the first embossed layer refers to a distance between the flat surface of the embossed layer and the bottom surface of the protrusion formed after embossing. The low protrusion 11 of the first embossed layer is composed of a left side 111 of the low protrusion of the first embossed layer, a right side 113 of the low protrusion of the first embossed layer, and a bottom surface 112 of the low protrusion of the first embossed layer. The low protrusion 11 of the first embossed layer may be used to improve the tactility of the embossment. Generally, the height h11 is about 0.6 mm, the width d11 of the low protrusion of the first embossed layer is between 0.3 mm and 0.7 mm; and a slope of each of the left side 111 and right side 113 of the low protrusion of the first embossed layer is about 25 to 35 degrees, and a density of the low protrusions 11 of the first embossed layer is generally between 40 to 80 dots/cm².

[0037] Each of the high protrusions 12 of the first embossed layer includes a width d12 of the high protrusion of the first embossed layer and a height h12 of the high protrusion of the first embossed layer. The high protrusion of the first embossed layer 12 is composed of a left side 121 of the high protrusion of the first embossed layer, a right side 123 of the high protrusion of the first embossed layer and a bottom surface 122 of the high protrusion of the first embossed layer. The high protrusions 12 of the first embossed layer are embodied as a pattern composed of decorative lines and dots. The width d12 of the high protrusion 12 of the first embossed layer is generally between 0.4 mm and 1.6 mm, a slope of each of the left side 121 and right side 123 of the high protrusion of the first embossed layer is about 20 to 30 degrees; and the height h12 of the high protrusion of the first embossed layer is 0.3 mm to 1 mm higher than the height h11 of the low protrusion of the first embossed layer.

[0038] As shown in Figure 4, the second embossed layer 20 has protrusions 21 of the second embossed layer and flat surfaces 22 between the protrusions of the second embossed layer. Each of the protrusions 21 of the second embossed layer includes a width d21 of the

protrusion of the second embossed layer and a height h21 of the protrusion of the second embossed layer. The protrusion 21 of the second embossed layer is composed of a left side 211 of the protrusion of the second embossed layer, a right side 212 of the protrusion of the second embossed layer, and a bottom surface 213 of the protrusion of the second embossed layer. Each of the flat surfaces 22 between the protrusions of the second embossed layer has a width d22 of the flat surface between the protrusions of the second embossed layer. The width d21 of the protrusion of the second embossed layer is generally between 0.4 mm and 1.6 mm, a slope of each of the left side 211 and right side 212 of the protrusion of the second embossed layer is about 20 to 30 degrees; and a density of the protrusions 21 of the second embossed layer is generally about 10 to 60 dots/cm².

[0039] As shown in Figure 5, the third embossed layer 30 is embossed to form protrusions 31 of the third embossed layer, flat surfaces 32a between the protrusions of the third embossed layer, and flat surfaces 33 of the third embossed layer. Each of the protrusions 31 of the third embossed layer includes a width d31 of the protrusion of the third embossed layer and a height h31 of the protrusion of the third embossed layer. The protrusion 31 of the third embossed layer is composed of a left side 311 of the protrusion of the third embossed layer, and a right side 312 of the protrusion of the third embossed layer, and a bottom surface 313 of the protrusion of the third embossed. The height h31 of the protrusion of the third embossed layer is generally about 0.6 mm to 1.5 mm, and the width d31 of the protrusion of the third embossed layer is generally between 0.3 mm and 1.6 mm, a slope of each of the left side 311 and right side 312 of the protrusion of the third embossed layer is about 25 to 35 degrees; and a density of the protrusions 31 of the third embossed layer is generally about 30 to 80 dots/cm².

[0040] The height h12 of the high protrusion of the first embossed layer is greater than the height h11 of the protrusion of the second embossed layer; and the height h21 of the protrusion of the second embossed layer is greater than or equal to the height h31 of the protrusion of the third embossed layer. The high protrusions 12 of the first embossed layer on the first embossed layer 10 run through the second embossed layer 20 and the third embossed layer 30 to form discrete or continuous bonding points, and finally the three different embossed layers are bonded and fixed together to form a firm three-dimensional structure.

[0041] The width d11 of the low protrusion of the first embossed layer is less than or equal to the width d21 of the protrusion of the second embossed layer or the width d22 of the flat surface between the protrusions of the second embossed layer. Since the density of the low protrusions 11 of the first embossed layer is greater than the density of the protrusions 21 of the second embossed layer, a part of the low protrusions 11 of the first embossed layer are supported by the protrusions 21 of the second embossed layer, and another part of the low protrusions 11 of the first embossed layer are supported by the flat surfaces 22 between the protrusions of the second embossed layer, to form discrete or continuous support points, so as to maximize the thickness of the product. A part of the protrusions 21 of the second embossed layer are supported by the protrusions 31 of the third embossed layer, and another part of the protrusions 21 of the second embossed layer are supported by the flat surfaces 32 between the protrusions of the third embossed layer.

[0042] In a process that the first embossed layer 10 and the second embossed layer 20 are combined with each other through rollers, the high protrusions 12 of the first embossed layer and the protrusions 21 of the second embossed layer are nested with each other by squeezing and applied with a bonding agent, and a part of the low protrusions 11 of the first embossed layer are supported by the protrusions 21 of the second embossed layer; or

in a process that the first embossed layer 10 and the second embossed layer 20 are combined with each other through rollers, the high protrusions 12 of the first embossed layer and the flat surfaces 22 between the protrusions of the second embossed layer are nested with each other by squeezing and applied with a bonding agent, and a part of the low protrusions 11 of the first embossed layer are supported by the flat surfaces 22 between the protrusions of the second embossed layer; and

the first embossed layer 10 and the second embossed layer 20, which are combined with each other and applied with the bonding agent, are combined with the third embossed layer 30 through the rollers.

[0043] The first embossed layer 10 and the second embossed layer 20, which are combined with each other and applied with the bonding agent, are combined with the third embossed layer 30 through the rollers, wherein the high protrusions 21 of the first embossed layer and the protrusions 21 of the second embossed layer, which are nested with each other by squeezing and applied with the bonding agent, are bonded with the flat surfaces 32

between the protrusions of the third embossed layer, and the protrusions 31 of the third embossed layer and the flat surfaces 22 between the protrusions of the second embossed layer are nested with each other by squeezing.

5 [0044] The first embossed layer 10 and the second embossed layer 20, which are combined with each other and applied with the bonding agent, are combined with the third embossed layer 30 through the rollers, wherein the high protrusions 21 of the first embossed layer and the flat surfaces 22 between the protrusions of the second embossed layer, which are nested with each other by squeezing and applied with the bonding agent, are bonded with the flat surfaces 32 between the protrusions of the third embossed layer, and the protrusions 31 of the third embossed layer and the protrusions 21 of the second embossed layer are
10 nested with each other by squeezing.

[0045] Each of the first embossed layer 10, the second embossed layer 20, and the third embossed layer 30 is single-layer, double-layer, or multi-layer.

[0046] The low protrusions 11 of the first embossed layer are embodied as embossed dots;
15 and the high protrusions 12 of the first embossed layer are embodied as a pattern composed of dots and lines.

[0047] The protrusions 21 of the second embossed layer are embodied as a wave structure or the protrusions 21 of the second embossed layer are embossed dots.

[0048] The wave structure is embodied as folds, corrugated contours, and wavy contours.

20 [0049] The bonding agent 40 is glue or water or natural extract liquor; and the bonding agent has color or fragrance or is colorless and odourless. The solution whether the bonding agent has color or fragrance or is colorless and odourless may be determined according to specific paper towel products.

[0050] A method for manufacturing the paper towel is also provided according to the
25 present application. The first embossed layer 10, the second embossed layer 20, and the third embossed layer 30 are formed by embossing rollers;

the first embossed layer 10 and the second embossed layer 20 are combined with each other through the rollers and applied with the bonding agent 40, wherein the high protrusions 12 of the first embossed layer and the protrusions 21 of the second embossed layer are nested
30 with each other by squeezing the bonding agent 40 is applied; a part of the low protrusions

11 of the first embossed layer are supported by the protrusions 21 of the second embossed layer, and another part of the low protrusions 11 of the first embossed layer are supported by the flat surfaces 22 between the protrusions of the second embossed layer; and

the first embossed layer 10 and the second embossed layer 20, which are nested with each other by squeezing and applied with the bonding agent 40, are bonded with the third embossed layer 30; wherein the high protrusions 12 of the first embossed layer and the protrusions 21 of the second embossed layer are bonded with the flat surfaces 32 between the protrusions of the third embossed layer, and the protrusions 31 of the third embossed layer and the flat surfaces 22 between the protrusions of the second embossed layer are nested with each other by squeezing.

[0051] Another method for manufacturing the paper towel is further provided according to the present application. The first embossed layer and the third embossed layer are formed through embossing rollers, and the second embossed layer 20 is a conventional and formed product;

the first embossed layer 10 and the second embossed layer 20 are combined with each other through the rollers and applied with the bonding agent 40, wherein the high protrusions 12 of the first embossed layer and the flat surfaces 22 between the protrusions of the second embossed layer are nested with each other by squeezing and applied with the bonding agent 40; a part of the low protrusions 11 of the first embossed layer are supported by the flat surfaces 22 between the protrusions of the second embossed layer, and another part of the low protrusions 11 of the first embossed layer are supported by the protrusions 21 of the second embossed layer; and

the first embossed layer 10 and the second embossed layer 20, which are nested with each other by squeezing and applied with the bonding agent 40, are bonded with the third embossed layer 30, wherein the high protrusions 12 of the first embossed layer and the flat surfaces 22 of the protrusions of the second embossed layer are bonded to the flat surfaces 32 between the protrusions of the third embossed layer, and the protrusions 31 of the third embossed layer and the protrusions 21 of the second embossed layer are nested with each other by squeezing.

First Embodiment

[0052] As shown in Figure 9, a paper towel is provided, wherein a first embossed layer 10, a second embossed layer 20a, and a third embossed layer 30 are formed by embossing rollers.

[0053] The first embossed layer 10 is embossed to form low protrusions 11 of the first embossed layer, high protrusions 12 of the first embossed layer, and flat surfaces 13 of the first embossed layer. The low protrusions of the first embossed layer 11 are embossed dots configured for improving the tactility of the embossment. The high protrusions 12 of the first embossed layer are embodied as a pattern composed of decorative lines and dots. Both the low protrusions 11 of the first embossed layer and the high protrusions 12 of the first embossed layer face downward.

[0054] The second embossed layer 20a has protrusions 21 of the second embossed layer and flat surfaces 22 between the protrusions of the second embossed layer. The protrusions 21 of the second embossed layer face downward.

[0055] The third embossed layer 30 is embossed to form protrusions 31 of the third embossed layer, flat surfaces 32 between the protrusions of the third embossed layer, and flat surfaces 33 of the third embossed layers. The protrusions 31 of the third embossed layer face upward.

[0056] The first embossed layer 10 and the second embossed layer 20a are combined with each other through the rollers and applied with the bonding agent 40, wherein the high protrusions 12 of the first embossed layer and the protrusions 21 of the second embossed layer are nested with each other by squeezing and applied with the bonding agent 40. During the process that the first embossed layer 10 and the second embossed layer 20a are combined with each other, embossing traces of the high protrusions 12 of the first embossed layer are left on bottom surfaces 213 of corresponding protrusions of the second embossed layer, and the embossing traces are applied with the bonding agent. Since the width d11 of the low protrusion of the first embossed layer is less than or equal to the width d21 of the protrusion of the second embossed layer, and since the density of the low protrusions 11 of the first embossed layer is greater than the density of the protrusions 21 of the second embossed layer, a part of the low protrusions 11 of the first embossed layers are supported by the protrusions 21 of the second embossed layer, and another part of the low protrusions 11 of the first embossed layer are supported by the flat surfaces 22 between the protrusions of the second

embossed layer.

[0057] The first embossed layer 10 and the second embossed layer 20a, which are nested with each other by squeezing and applied with the bonding agent 40, are bonded to the third embossed layer 30. The high protrusions 12 of the first embossed layer and the protrusions 21 of the second embossed layer are bonded to the flat surfaces 32 between the protrusions of the third embossed layer, the protrusions 31 of the third embossed layer and the flat surfaces 22 between the protrusions of the second embossed layer are nested with each other by squeezing, the high protrusions 21 of the first embossed layer on the first embossed layer 10 run through the second embossed layer 20a and the third embossed layer 30, and finally the three different embossed layers are bonded and fixed together to form a firm three-dimensional structure.

Second Embodiment

[0058] As shown in Figure 10, a paper towel is provided, and a first embossed layer 10, a second embossed layer 20b, and a third embossed layer 30 are formed by embossing rollers.

[0059] The first embossed layer 10 is embossed to form low protrusions 11 of the first embossed layer, high protrusions 12 of the first embossed layer, and flat surfaces 13 of the first embossed layer. The low protrusions of the first embossed layers 11 are embossed dots configured for improving the tactility of the embossment. The high protrusions 12 of the first embossed layer are embodied as a pattern composed of decorative lines and dots. Both the low protrusions 11 of the first embossed layer and the high protrusions 12 of the first embossed layer face downward.

[0060] The second embossed layer 20b has protrusions 21 of the second embossed layer and flat surfaces 22 between the protrusions of the second embossed layer. The protrusions 21 of the second embossed layer face upward.

[0061] The third embossed layer 30 is embossed to form protrusions 31 of the third embossed layer, flat surfaces 32 between the protrusions of the third embossed layer, and flat surfaces 33 of the third embossed layers. The protrusions 31 of the third embossed layer face upward.

[0062] The first embossed layer 10 and the second embossed layer 20b are combined with each other through the rollers and applied with the bonding agent 40, wherein the high

protrusions 12 of the first embossed layer and the flat surfaces 22 between the protrusions of the second embossed layer are nested with each other by squeezing and applied with the bonding agent 40. During the process that the first embossed layer 10 and the second embossed layer 20b are combined with each other, embossing traces of the high protrusions 12 of the first embossed layer are left on the flat surfaces 22 between the protrusions of the second embossed layer, and the embossing traces are applied with the bonding agent. Since the width d11 of the low protrusion of the first embossed layer is less than or equal to the width d22 of the flat surface between the protrusions of the second embossed layer, and the density of the low protrusions 11 of the first embossed layer is greater than the density of the protrusions 21 of the second embossed layer, a part of the low protrusions 11 of the first embossed layers are supported by two protrusions d21 of the second embossed layer located at an upper end of the flat surface 22 between the protrusions of the second embossed layer, and another part of the low protrusions 11 of the first embossed layer are supported by the flat surfaces 22 between the protrusions of the second embossed layer.

[0063] The first embossed layer 10 and the second embossed layer 20b, which are nested with each other by squeezing and applied with the bonding agent 40, are bonded to the third embossed layer 30. The high protrusions 12 of the first embossed layer and the flat surfaces 22 between the protrusions of the second embossed layer are bonded to the flat surfaces 32 between the protrusions of the third embossed layer, the protrusions 31 of the third embossed layer and the protrusions 21 of the second embossed layer are nested with each other by squeezing, the high protrusions 21 of the first embossed layer on the first embossed layer 10 run through the second embossed layer 20b and the third embossed layer 30, and finally the three different embossed layers are bonded and fixed together to form a firm three-dimensional structure.

Third Embodiment

[0064] As shown in Figure 11, a paper towel is provided, the first embossed layer 10 and the third embossed layer 30 are formed by embossing rollers; a second embossed layer 20c is a conventional product with folds, corrugated contours, or wavy contours.

[0065] The first embossed layer 10 is embossed to form low protrusions 11 of the first embossed layer, high protrusions 12 of the first embossed layer, and flat surfaces 13 of the first embossed layer. The low protrusions of the first embossed layers 11 are embossed dots

configured for improving the tactility of the embossment. The high protrusions 12 of the first embossed layer are embodied as a pattern composed of decorative lines and dots. Both the low protrusions 11 of the first embossed layer and the high protrusions 12 of the first embossed layer face downward.

5 [0066] The second embossed layer has a wave structure such as folds, corrugated contours, or wavy contours, which has upward protrusions and downward protrusions. The downward protrusions can be understood as the protrusions of the second embossed layer.

[0067] The protrusions of the second embossed layer are embodied as a wave structure formed during a wet paper making process, or the protrusions of the second embossed layer
10 are embodied as dots formed on dry paper by an embossing machine.

[0068] The wave structure is embodied as folds, corrugated contours, or wavy contours, and may be manufactured by conventional technologies such as TAD, NTT, QRT, ATMOS, eTAD or the like.

[0069] The third embossed layer 30 is embossed to form protrusions 31 of the third
15 embossed layer, flat surfaces 32 between the protrusions of the third embossed layer, and flat surfaces 33 of the third embossed layers. The protrusions 31 of the third embossed layer face upward.

[0070] The first embossed layer 10 and the second embossed layer 20c are combined with each other through the rollers and applied with the bonding agent 40, wherein the high
20 protrusions 12 of the first embossed layer and the protrusions 21 of the second embossed layer are nested with each other by squeezing and applied with the bonding agent 40. During the process of combining the first embossed layer 10 and the second embossed layer 20c, embossing traces of the high protrusions 12 of the first embossed layer are left on bottom surfaces 213 of the protrusions of the second embossed layer, and the embossing traces are
25 applied with the bonding agent. Since the width d11 of the low protrusion of the first embossed layer is less than or equal to the width d21 of the protrusion of the second embossed layer, and the density of the low protrusions 11 of the first embossed layer is greater than the density of the protrusions 21 of the second embossed layer, the low protrusions 11 of the first embossed layers are supported by the protrusions 21 of the second
30 embossed layer.

[0071] The first embossed layer 10 and the second embossed layer 20c, which are nested with each other by squeezing and applied with the bonding agent 40, are bonded to the third embossed layer 30. The high protrusions 12 of the first embossed layer and the protrusions 21 of the second embossed layer are bonded to the flat surfaces 32 between the protrusions of the third embossed layer, the protrusions 31 of the third embossed layer and the flat surfaces 22 between the protrusions of the second embossed layer are nested with each other by squeezing, the high protrusions 21 of the first embossed layer on the first embossed layer 10 run through the second embossed layer 20c and the third embossed layer 30, and finally the three different embossed layers are bonded and fixed together to form a firm three-dimensional structure.

[0072] In summary, a paper towel and a method for manufacturing the paper towel are provided according to the present application. A three-layer embossed pattern is provided, the high protrusions of the first embossed layer are nested with the protrusions of the second embossed layer or the flat surfaces between the protrusions of the second embossed layer by squeezing, and the bonding agent is applied. During the process of combining the first embossed layer and the second embossed layer, embossing traces made by the high protrusions of the first embossed layer are left on the surface of the second embossed layer, and the embossing traces are applied with the bonding agent, to be bonded with the third embossed layer by squeezing through rollers with certain strength. Since the density of the low protrusions of the first embossed layer is greater than that of the protrusions of the second embossed layer, a part of the low protrusions of the first embossed layer are supported by the protrusions of the second embossed layer, and another part of the low protrusions of the first embossed layer are supported by the flat surfaces between the protrusions of the second embossed layer, which can increase the thickness of the product to the greatest extent, and the thickness of the product can be increased by about 52% compared with that of the traditional three-layer embossed structure. The third embossed layer mainly has embossed dots of a certain density, and the density of the embossed dots is similar to that of the first embossed layer, so as to obtain similar touch feeling. The high protrusions of the first embossed layer on the first embossed layer run through the second embossed layer and the third embossed layer, and finally the three different embossed layers are bonded and fixed together to form a firm three-dimensional structure, thereby greatly improving the physical properties of the paper towel product in terms of thickness, tactility,

and absorbency.

[0073] The above are only preferred embodiments of the present application, it should be noted that, for those skilled in the art, a few of modifications and improvements may be made to the present application without departing from the principle of the present application, and these modifications and improvements are also deemed to fall into the scope of protection of the present application.

CLAIMS

1. A paper towel, comprising a first embossed layer, a second embossed layer, and a third embossed layer; wherein

5 the first embossed layer is embossed to form low protrusions of the first embossed layer and high protrusions of the first embossed layer; each of the low protrusions of the first embossed layer comprises a width of the low protrusion of the first embossed layer and a height of the low protrusion of the first embossed layer; each of the high protrusions of the first embossed layer comprises a width of the high protrusion of the first embossed layer and
10 a height of the high protrusion of the first embossed layer;

 the second embossed layer is embossed to form protrusions of the second embossed layer and flat surfaces between the protrusions of the second embossed layer; each of the protrusions of the second embossed layer comprises a width of the protrusion of the second embossed layer and a height of the protrusion of the second embossed layer; each of the flat
15 surfaces between the protrusions of the second embossed layer has a width of the flat surface between the protrusions of the second embossed layer;

 the third embossed layer is embossed to form protrusions of the third embossed layer and flat surfaces between the protrusions of the third embossed layer; each of the protrusions of the third embossed layer comprises a width of the protrusion of the third embossed layer and a height of the protrusion of the third embossed layer; and wherein
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 the height of the high protrusion of the first embossed layer is greater than the height of the protrusion of the second embossed layer; and the height of the protrusion of the second embossed layer is greater than or equal to the height of the protrusion of the third embossed layer;

25 the width of the low protrusion of the first embossed layer is less than or equal to the width of the protrusion of the second embossed layer or the width of the flat surface between the protrusions of the second embossed layer;

 a density of the low protrusions of the first embossed layer is greater than a density of the protrusions of the second embossed layer;

30 during a process of combing the first embossed layer and the second embossed layer

through rollers, the high protrusions of the first embossed layer and the protrusions of the second embossed layer are nested with each other by squeezing and applied with a bonding agent; and a part of the low protrusions of the first embossed layer are supported by the protrusions of the second embossed layer; or

- 5 during a process of combing the first embossed layer and the second embossed layer through rollers, the high protrusions of the first embossed layer and the flat surfaces between the protrusions of the second embossed layer are nested with each other by squeezing and applied with a bonding agent; and a part of the low protrusions of the first embossed layer are supported by the flat surfaces between the protrusions of the second embossed layer; and
- 10 the first embossed layer and the second embossed layer, which are combined with each other and applied with the bonding agent, are combined with the third embossed layer through rollers.

2. The paper towel according to claim 1, wherein the first embossed layer and the second embossed layer, which are combined with each other and applied with the bonding agent, are combined with the third embossed layer through the rollers, wherein the high protrusions of the first embossed layer and the protrusions of the second embossed layer, which are nested with each other by squeezing and applied with the bonding agent, are bonded with the flat surfaces between the protrusions of the third embossed layer, and the
- 15 protrusions of the third embossed layer and the flat surfaces between the protrusions of the second embossed layer are nested with each other by squeezing.
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3. The paper towel according to claim 1, wherein the first embossed layer and the second embossed layer, which are combined with each other and applied with the bonding agent, are combined with the third embossed layer through the rollers, wherein the high protrusions of the first embossed layer and the flat surfaces between the protrusions of the second embossed layer, which are nested with each other by squeezing and applied with the bonding agent, are bonded with the flat surfaces between the protrusions of the third embossed layer, and the protrusions of the third embossed layer and the protrusions of the
- 25 second embossed layer are nested with each other by squeezing.
- 30

4. The paper towel according to claim 2 or 3, wherein each of the first embossed layer, the second embossed layer, and the third embossed layer is single-layer, double-layer, or multi-layer.

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5. The paper towel according to claim 2 or 3, wherein the low protrusions of the first embossed layer are embodied as embossed dots; and the high protrusions of the first embossed layer are embodied as a pattern composed of dots and lines.

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6. The paper towel according to claim 2 or 3, wherein the protrusions of the second embossed layer are embodied as a wave structure, or the protrusions of the second embossed layer are embossed dots.

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7. The paper towel according to claim 6, wherein the wave structure is embodied as folds, corrugated contours, or wavy contours.

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8. The paper towel according to claim 2 or 3, wherein the bonding agent is glue or water or natural extract liquor; and the bonding agent has color or fragrance or is colorless and odourless.

9. A method for manufacturing the paper towel according to any one of claims 1 to 8, wherein the method comprises:

forming the first embossed layer, the second embossed layer, and the third embossed layer through embossing rollers;

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combining the first embossed layer and the second embossed layer with each other through the rollers and applying the bonding agent, wherein the high protrusions of the first embossed layer and the protrusions of the second embossed layer are nested with each other by squeezing and the bonding agent is applied, to allow a part of the low protrusions of the

first embossed layer to be supported by the protrusions of the second embossed layer, and another part of the low protrusions of the first embossed layer to be supported by the flat surfaces between the protrusions of the second embossed layer; and

bonding the first embossed layer and the second embossed layer, which are nested with each other by squeezing and applied with the bonding agent, with the third embossed layer, wherein the high protrusions of the first embossed layer and the protrusions of the second embossed layer are bonded with the flat surfaces between the protrusions of the third embossed layer, and the protrusions of the third embossed layer and the flat surfaces between the protrusions of the second embossed layer are nested with each other by squeezing.

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10. A method for manufacturing the paper towel according to any one of claims 1 to 8, wherein the method comprises:

forming the first embossed layer and the third embossed layer through embossing rollers;

combining the first embossed layer and the second embossed layer with each other through the rollers and applying the bonding agent, wherein the high protrusions of the first embossed layer and the flat surfaces between the protrusions of the second embossed layer are nested with each other by squeezing and applied with the bonding agent, to allow a part of the low protrusions of the first embossed layer are supported by the flat surfaces between the protrusions of the second embossed layer, and another part of the low protrusions of the first embossed layer are supported by the protrusions of the second embossed layer; and

bonding the first embossed layer and the second embossed layer, which are nested with each other by squeezing and applied with the bonding agent, with the third embossed layer, wherein the high protrusions of the first embossed layer and the flat surfaces of the protrusions of the second embossed layer are bonded with the flat surfaces between the protrusions of the third embossed layer, and the protrusions of the third embossed layer and the protrusions of the second embossed layer are nested with each other by squeezing.