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(54) **ANTI-FORGE MATERIAL DISTRIBUTED ANTI-FIBERS HAVING VISUAL CHARACTER**

(57) An anti-forge material is disclosed. Anti-fibers (2) are distributed on the anti-forge material. Part surfaces (3) of the anti-forge fibers (2) are located on the surface (1) of the anti-forge material (1), Wherein said part surface (3) have concave-convex sheltering structure, and at least two color patterns (A, B) are distributed on the surfaces. Said at least two color patterns(A, B) have distinct visual difference on the said part surface (3), resulting that the color patterns(A, B) can be seen from the

surface (1') of the anti-forge material respectively when observed from different angle. Due to the visual difference according to the present invention is formed by shielding the patterns distributed on the part surfaces(3) of the anti-forge fibers (2) in the anti-forge material with the concave-convex sheltering structure, the exact printing is unable to imitate the three-dimensional structure. Therefore the present invention is capable of preventing imitate of printing effectively.

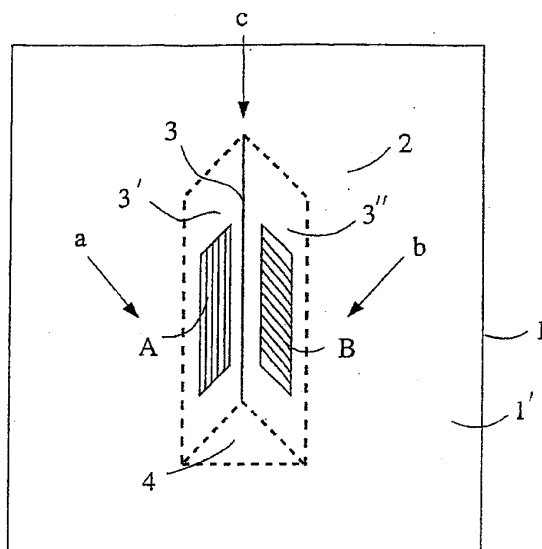


Figure 1

Description

Technical area

[0001] This invention relates to an anti-fake material, such as anti-fake paper, or anti-fake film, or anti-fake package, especially an anti-fake material distributed with anti-fake fiber, which has visual characteristic that cannot be simulated by printing.

Background

[0002] The anti-fake paper made by adding colored fiber into paper has a long history of nearly one hundred years, which has been used in many countries for producing paper money up to now, and also for manufacturing valuable securities, receipts, product's specifications, printing labels and etc; and fluorescent fiber has been specially used in manufacture of almost all paper monies. In short, there are two kinds of anti-fake fibers generally, one is single fiber in one color and other is single fiber with several colors. Chinese patent CN02168121.0 [An anti-fake fiber] revealed a single fiber with several colors of sections, that is, there are at least two colors along with its length direction. Other Chinese patent CN02170092.4 [An anti-fake fiber and an anti-fake paper made thereof] released a fiber with different colors in its upper and down surfaces, that is, the fiber's cross section is oval and there are two surfaces, upper and down, corresponding to the oval, there is obvious color difference between two surfaces. When such fiber is added into paper pulp to manufacture anti-fake paper, the upper surface and the down surface of the oval fiber will be parallel to the paper surface under interaction with the paper fiber. If the paper is thin or transparent and when one fiber in the paper is observed, its one color is on one surface of the paper and its other color is on the other surface of the paper. But shortcoming of the colored fiber mentioned above is that: its visual effect can be simulated by printing thin line, and if it is necessary to precisely distinguish whether it is a fiber or a printed thin line, the only way is to tear the paper or to pick it out with a needle for further observing. It is not only inconvenient, but also impossible for valuable paper money, securities and etc. because such method will destroy them. Therefore, such anti-fake effect is limited and a faker can almost easily get by under false pretences when simulating by printing thin line.

[0003] Chinese patent CN02146589.4 [An anti-fake material and an anti-fake document made thereof] revealed an anti-fake fiber that is a filament having axial length and round or about round cross section, with its characteristics of that: the said filament has two or more colors in its cross section, and axial colored part for each of the said colors stretches axially in spiral status. If observing in any changing angle, common person cannot eye-visually find changes of the colored pattern on the fiber; therefore, it is almost a visual characteristic of a flat

pattern and can be successfully simulated by precious printing method within eye-distinguishable accuracy.

Detailed descriptions of this invention

[0004] The objective of this invention is to offer an anti-fake material that has anti-fake fiber distributed on it, from which different color patterns can be observed by changing the observing angle to the fiber and of which its visual characteristics cannot be simulated by current printing technologies.

[0005] Another objective of this invention is to offer an anti-fake fiber. When its special part surface is presented on at least one surface of the anti-fake material, on the surface the observer can respectively and separately see different color patterns on this special part from different observing angles. Therefore, if it is used in anti-fake material, current printing technology has no way to simulate.

[0006] This invention also provides several anti-fake fibers, the surface of special part of these anti-fake fibers can naturally present on at least one surface of the anti-fake material in the process of the anti-fake material manufacture. This special part makes observer respectively and separately see the different color patterns on the special part from different observing angles on the surface. Therefore, if it is used in anti-fake material, current printing technology has no way to simulate.

[0007] The first objective of this invention is realized by that: an anti-fake material, on which anti-fake fiber is distributed; part surface of the said anti-fake fiber is presented on the surface of the said anti-fake material with characteristics of that: the said part surface has its concave-convex shielding structure on it, on which there are at least two color patterns A and B distributed, the said at least two color patterns A and B on the said part surface have obvious visual difference, therefore on the anti-fake material's surface with presence of the said part surface, when observing the said part surface from different observing angles, the color patterns A and B can be seen respectively.

[0008] The at least two color patterns on the anti-fake fiber distributed in the anti-fake material revealed in this invention include color patterns appeared under visible light, UV-ray, IR-ray and other invisible rays. For the color patterns appeared under visible light, the anti-fake material of this invention can perform the first-level anti-fake identification, that is the public anti-fake identification; for the color patterns appeared under UV-ray, IR-ray and other invisible rays, they can be judged by using special tools to perform the second-level anti-fake identification.

[0009] Because very thin anti-fake fiber (generally, the diameter of the fiber is smaller than 100 μm) is distributed in the anti-fake material in this invention, on which the concave-convex shielding structure is arranged, and the concave-convex shielding structure is located on the said part surface of the anti-fake fiber and this part surface can be presented on at least one surface of the anti-fake material, there is obvious visual difference between the

said at least two color patterns on the said part surface, therefore, because of the shielding of the concave-convex structure, observer can respectively and separately see the color patterns on the part surface from different observing angles on the surface of the anti-fake material, by which the anti-fake effect can be realized. Because such visual difference is caused by using the concave-convex shielding structure to shield feature of the patterns distributed on the part surface of the anti-fake fiber in the anti-fake material, no matter how precious they are, printing technologies have no way to simulate such stereo structure, thus, this invention can efficiently prevent any simulation by printing technologies.

[0010] The visual difference is in diversity, which is produced by color patterns being respectively and separately seen due to the at least two color patterns on the anti-fake fiber distributed in the anti-fake material revealed in this invention being shielded by the concave-convex shielding structure, it could be that: there are at least two observing angles a and b existed on the anti-fake material surface with presence of the said part surface, the color pattern A can be seen if observing the said part surface of the anti-fake fiber from the observing angle a but the pattern B cannot be seen because it is shielded by the concave-convex shielding structure on the part surface of the anti-fake fiber, and the color pattern B can be seen if observing the said part surface of the anti-fake fiber from the observing angle b but the pattern A cannot be seen because it is shielded by the concave-convex structure on the part surface of the anti-fake fiber; it could also be a different visual effect formed by one color pattern shielded incompletely but other color pattern feature shielded completely; in addition it could be a jumped visual conversion along with fiber length direction caused by shielding. In embodiments, each of the differences will be further explained in detail based on their figures.

[0011] The other objective of this invention is realized by that: an anti-fake fiber inserted into the said anti-fake material, which has a part surface able to be presented on one surface of the said anti-fake material, with characteristics of that: the said part surface has a concave-convex shielding structure on it, at least two color patterns A and B are distributed on the part surface, the color patterns A and B have obvious visual difference on the said part surface to make person respectively see the color patterns A and B if observing the said part surface from different observing angles on the anti-fake material with presence of the said part surface.

[0012] Because of the concave-convex shielding structure arranged on the anti-fake fiber in this invention and the concave-convex shielding structure arranged on the part surface of the anti-fake fiber able to be presented on one face of the anti-fake material, and because of shielding by the concave-convex shielding structure, observer can respectively and separately see this special part from different angles on the special surface-the color patterns with visual difference on the part surface. Thus, if it is used in anti-fake material, such visual difference

caused by its stereo structure cannot be simulated by current printing technologies.

[0013] In fact, the purpose of this invention to naturally present the special part of the anti-fake fiber on at least one surface of the anti-fake material is to control certain surface of the anti-fake fiber towards to visible surface of the anti-fake material. On the basis of theoretical analysis and practical experiment, the anti-fake fiber surface parallel to the maximum projection of the anti-fake fiber can naturally present on at least one surface of the anti-fake material, there are three ways to realize it: first method is to coat a flat transparent material on the outside of the anti-fake fiber, and simultaneously to arrange the said part surface of the anti-fake fiber towards to the flat surface of the transparent material, in this way, the flat surface of the flat fiber can naturally be parallel to the visible surface of the anti-fake material to make the needed part surface present on the visible surface of the anti-fake material. The second method is to bend or crook the anti-fake fiber, simultaneously with certain toughness, and to locate the said part surface on the bended or crooked outside surface, in this way, the anti-fake fiber can be presented on the visible surface of the anti-fake material in its self-bended or crooked status. The third method is to make the cross section of whole or part length of the anti-fake fiber into flat shape, to locate the said part surface of the anti-fake fiber onto the flat surface at the flat cross section part or on the anti-fake fiber's surface having the same direction as the flat surface. For the fiber with its full length in flat cross section, the flat surface can be towards to the visible surface when naturally adding into the anti-fake material; for the fiber with its part length in flat cross section, the flat part can be towards to the visible surface, its other part with the same direction corresponded to the flat surface can naturally follow towards to the visible surface.

Drawing description:

[0014]

Figure 1 Drawing of this invention's schematic structure;

Figure 2a-Figure 2b Drawings of color patterns A and B distributed along with length direction of the anti-fake fiber and in parallel arrangement in the anti-fake fiber,

Figure 2a A plane drawing,
Figure 2b A cross section drawing.

Figure 3 Drawing of color patterns A and B distributed on the anti-fake fiber in parallel arrangement but in slope with length direction of the anti-fake fiber;

Figure 4 Side-viewing drawing of color patterns A and B on the anti-fake fiber distributed along with

length direction of the anti-fake fiber,

Figure 5a-Figure 5g Status drawings of color patterns A and B on the anti-fake fiber distributed radially, extended axially and at different positions in length direction; 5

Figure 6a-Figure 6b Drawings of single-triangle cross section of the anti-fake fiber in the anti-fake material, of which: 10

Figure 6a Cross section drawing;

Figure 6b Plane drawing. 15

Figure 7a-Figure 7c Drawings of double-linked triangle cross section of the anti-fake fiber in the anti-fake material, of which:

Figure 7a Cross section drawing; 20

Figure 7b and 7c Plane drawings.

Figure 8a-Figure 8b Drawings of single-quadrilateral cross section of the anti-fake fiber in the anti-fake material, of which: 25

Figure 8a Cross section drawing;

Figure 8b Plane drawing. 30

Figure 9a-Figure 9c Drawings of three-linked quadrilateral cross section of the anti-fake fiber in the anti-fake material, of which: 35

Figure 9a Cross section drawing;

Figure 9b and 9c Plane drawings.

Figure 10a-Figure 10d Drawings of trapezoid cross section of the anti-fake fiber in the anti-fake material, of which: 40

Figure 10a and 10b Cross section drawings;

Figure 10c and 10d Plane drawings. 45

Figure 11a-Figure 11f Drawings of the anti-fake coated with transparent material in the anti-fake material, of which: 50

Figure 11a and 11b Drawings of single-triangle cross section and single-quadrilateral cross section of the anti-fake fibers coated with round transparent material; 55

Figure 11c and 11d Drawings of single-triangle cross section and single-quadrilateral cross sec-

tion of the anti-fake fibers coated with flat transparent material;

Figure 11e and 11f Drawings of multi-triangle cross section and multi-quadrilateral cross section of the anti-fake fibers coated with flat transparent material.

Figure 12a-Figure 12e Cross section drawings for an A1 vacuum-coated shielding layer between color patterns A and B of the anti-fake fiber, of which:

Figure 12a Drawing of triangle cross section with A1-coated layer in the middle of the material;

Figure 12b Drawing of triangle cross section with A1-coated layer on the material surface;

Figure 12c Drawing of quadrilateral section with A1-coated layer in the material;

Figure 12d Drawing of quadrilateral section with A1-coated layer on the material surface;

Figure 12e Drawing of multi-linked triangle section with A1-coated layer on the same visual surface of the material.

Figure 13 Cross section drawing of the anti-fake fiber with curve side of the cross section in this invention;

Figure 14a, Figure 14b and Figure 14c Drawings for minimum square areas of the anti-fake fibers in different shapes;

Figure 15a and Figure 15b Drawing of the bended anti-fake fibers distributed in the anti-fake material in this invention;

Figure 15 Front-viewing drawing of partial section of the anti-fake fiber in flat shape.

Embodiment

[0015] Figure 1 shows one enlarged anti-fake fiber 2 distributed in the anti-fake material 1, the part surface 3 of the anti-fake 2 is presented on the surface 1' of the anti-fake material, the part surface 3 has its concave-convex shielding structure on it, in this Figure the concave-convex shielding structure is constituted of triangle element contained in the cross section 4 of the anti-fake fiber 2, its top angle and its bevel side's surface of the triangle element constitutes a concave-convex shielding structure, surfaces 3' and 3" of these two bevel sides constitute the part surface 3, the color pattern A is distributed on the surface 3' and the color pattern B on the surface 3", if observing the part surface 3 from different observing angles on the surface 1' of the anti-fake ma-

terial 1, it is possible to respectively and separately see the color patterns A and B, for example, if observing from a, it is possible to see the color pattern A, and from b to see the color pattern B, because of the difference between the color patterns A and B, an obvious visual difference is resulted in. The color patterns A and B can be respectively or jointly distributed on the surfaces 3' and 3" fully to make more obvious visual difference. If observing the part surface 3 from different observing angles on the surface 1' of the anti-fake material 1, if observing the part surface 3 from a to b in the direction vertical to the anti-fake fiber 2, there is at least an observing angle c located between two color patterns A and B, from which either the color pattern A or the color pattern B can be seen, because the anti-fake fiber 2 is very thin generally, therefore an pattern combined by the color patterns A and B can be seen generally from the observing angle c.

[0016] The at least two color patterns on the anti-fake fiber distributed in the anti-fake material revealed in this invention include color patterns being able to appear under visible light, UV-ray, IR-ray and other invisible rays. For the color patterns appeared under visible light, the anti-fake material of this invention can perform the first-level anti-fake identification, that is the public anti-fake identification; for the color patterns appeared under UV-ray, IR-ray and other invisible rays, they can be judged by using special tools to perform the second-level anti-fake identification. Because very thin anti-fake fiber 2 (generally, the diameter of the fiber is smaller than 100 μm) is distributed in the anti-fake material 1 in this invention, on which the concave-convex shielding structure is arranged, and the concave-convex shielding structure is located on the said part surface 3 of the anti-fake fiber and this part surface 3 can be presented on at least one surface of the anti-fake material, therefore, because of the shielding function of the concave-convex structure, observer can respectively and separately see the different color patterns on the part surface from different observing angles on the surface of the anti-fake material with results of obvious visual difference, by which the anti-fake effect can be realized. Because such visual difference is caused by using the concave-convex structure to shield the feature of the patterns distributed on the part surface of the anti-fake fiber in the anti-fake material, that is, realization of the objectives mentioned above is depended on shielding light effect from different angles by the precious concave-convex structure on the fiber surface, thus all of the current printing technologies (including printings such as litho, perforating, gravure, letterpress, jetting, copying and etc.) have no way to preciously simulate such stereo structure, thus, this invention can efficiently prevent any simulation by printing technologies.

[0017] The visual difference of this invention is in diversity:

[0018] The at least two color patterns A and B of the anti-fake fibers distributed in the anti-fake material in this invention are shielded by the concave-convex structures

and are able to be respectively seen to result in a visual difference that is in diversity, such visual difference is related with different visions caused by the color patterns differently distributed on the part surface of the anti-fake fibers with different concave-convex shielding structures located on it.

[0019] The embodiment shown in Figure 1 indicates a color pattern distribution that can be completely shielded by the concave-convex structure with each other, because of the shielding structure extended along with length direction of the anti-fake fiber 2, thus only can the different visions vertical to the length direction of the anti-fake fiber be markedly changed under shielding. Because the anti-fake fiber 2 is a very thin and fine, it is recommended to have the maximum cross section diameter of the anti-fake fiber not over than 0.25 mm, thus visible width of the anti-fake fiber, if observing vertically to the length direction of the anti-fake fiber 2, is very limited, so when converting from observing angle a to observing angle b, an obvious visual difference can be produced only if there is difference between the color patterns A and B, it is the only way for such difference possibly felt by common person. It is the merit of this embodiment to make normal eyesight feel large change only based on difference between the color patterns A and B, preferably this difference is only in different colors, but also could be in the same color but in different patterns, and in addition also could be different both in color and pattern. In this embodiment, there are at least two observing angles a and b existed on the surface 1' of the anti-fake material 1, the color pattern A can be seen if observing the said part surface of the anti-fake fiber from the observing angle a, but the color pattern B cannot be seen because it is shielded by the concave-convex triangle structure on the part surface 3 of the anti-fake fiber 2; and the color pattern B can be seen if observing the said part surface 3 of the anti-fake fiber 2 from the observing angle b, but the color pattern A cannot be seen because it is shielded by the concave-convex triangle structure on the part surface 3 of the anti-fake fiber 2; for the second-level anti-fake by using fluorescent fiber, IR fiber and etc., that is, observing by using tools, this embodiment may unnecessarily be limited by the difference between the color patterns A and B, for example, the color patterns A and B can be completely the same ones within normal eyesight scope but one of them shall be treated by certain invisible ray, in this way, the visual difference between them can be seen by using special tools able to distinguish this invisible ray, thus the anti-fake effect can be realized. In this embodiment, the concave-convex shielding structure is arranged on the part surface 3 of the anti-fake fiber 2 in a way to form a pattern completely separated between the color patterns A and B without any overlapping with each other, thus a vision effect of shielding each other is realized.

[0020] The obvious visual difference of the at least two patterns A and B on the part surface 3 can also have a different visual effect formed by one color pattern A un-

able to be shielded completely and other color pattern B able to be shielded completely, such visual effect is often resulted by incorporate relationship of the color patterns, for example, the color pattern A is completely or partly incorporated in the color pattern B, that is, if observing the part surface 3 of the anti-fake fiber from observing angle a, the eyesight can only see the color pattern A because the concave-convex shielding structure on the part surface 3 of the anti-fake fiber shields the color pattern B completely; if observing the part surface 3 of the anti-fake fiber from observing angle b, the eyesight can see the color pattern B because of the concave-convex shielding structure on the part surface 3 of the anti-fake fiber, but the color pattern A is completely or partly not shielded. The color patterns A and B for forming such visual difference must be different; at least the colors of their color patterns are different in order to produce strong visual difference.

[0021] It also could be a visual difference produced when they are all not shielded completely, in this case, the color patterns A and B could be two patterns with their some parts overlapped partly, that is, if observing the part surface 3 of the anti-fake fiber from observing angle a, the eyesight can see that the color pattern A only shields a part of the color pattern B because of the concave-convex shielding structure on the part surface 3 of the anti-fake fiber; if observing the part surface 3 of the anti-fake fiber from observing angle b, the eyesight can see that the color pattern A only shields a part of the color pattern B because of the concave-convex shielding structure on the part surface 3 of the anti-fake fiber. Therefore, though the A and B are not shielded completely, their relative parts have been shielded. Because of human's limited eyesight resolution, the pattern in human's eyes could be a composed pattern incorporated a part of the color pattern B into the color pattern A, but not a pattern simply incorporated the color pattern B fully into the color pattern A or simply incorporated the color pattern A fully into the color pattern B. The patterns A and B for producing obvious visual difference shall be different, at least with different color feature.

[0022] It could also be a visual difference produced by jumped visual conversion along with length direction of the anti-fake fiber caused by shielding, because human has its longer eyesight along with length direction of the anti-fake fiber (the best length of the anti-fake fiber is not more than 15 mm, which can give much longer eyesight in comparison with its width of 0.2 mm), thus, when the at least two color patterns A and B are distributed at different positions along with the length direction of the anti-fake fiber (unlike that distributed axially as shown in the Figure 1), the jumped visual change can be produced, which will be explained in detail in the following embodiments. This visual change has relative lower requirements on the color patterns, that is, the color patterns could be the same and the jumped visual change can be produced, provided there is obvious visual difference at the position along with the length direction of the anti-

fake fiber.

[0023] The color pattern's diversity of this invention and its formed visual effects:

[0024] At least two color patterns A and B could be the patterns composed of various single colored or multi-colored lines. Because the anti-fake fiber in this invention is very thin and fine, for the more practical first-level anti-fake identification, the more simple and direct it is, the more valuable it will be. Because the color feature is the easiest one for human to identify, so thereafter, two color patterns A and B in different colors will be explained in details.

[0025] See Figure 1, the color pattern A and the color pattern B are colored line A and colored line B in parallel and with different color features, for example the colored line A is in red and the colored line B is in blue, if observing the part surface 3 of the anti-fake fiber from observing angle a, only can the red line be seen, but the blue line cannot be seen because it is shielded by the concave-convex shielding structure on the part surface 3 of the anti-fake fiber, thus the common person feels that the fiber is in red; if observing the part surface 3 of the anti-fake fiber from observing angle b, only can the red line be seen, but the blue line cannot be seen because it is shielded by the concave-convex shielding structure on the part surface 3 of the anti-fake fiber, thus the common person feels that the fiber is in red; if observing the part surface 3 of the anti-fake fiber from observing angle c, both of the red line and the blue line can be simultaneously seen, because the colored lines are very close with each other, the common person can only feel a composed effect of the red line and the blue line, that is, the fiber is somewhat in black.

[0026] In the embodiment shown in Figure 1, the colored line A and the colored line B with different color features but in parallel are also parallel with the length direction of the anti-fake fiber. If its observing angle is changed, the full fiber will change its color from red to blue with unique visual conversion effect. The converting angle from the angle a to the angle b should preferably be not more than 120 degree. In this visual feature design, the most obvious color change of the fiber happens when observing the fiber surface with changing angle at the position vertical to the length direction of the fiber.

[0027] Figure 2a and Figure 2b show the composed effect of A1, A2, A3 colors and the composed effect of B1, B2, B3 colors respectively to make the pattern A and the pattern B with different color features and in parallel. The colors A1-A3 and the colors B1-B3 are respectively in strip shape and vertical to the length direction of the anti-fake fiber. In this visual feature design, the most obvious color change of the fiber happens when observing the fiber surface with changing angle at the position along with the length direction of the fiber.

[0028] Figure 3 shows the composed A1, A2, A3 colors and the composed B1, B2, B3 colors respectively to make the pattern A and the pattern B with different color features and in parallel. The colors A1-A3 and the colors

B1-B3 are respectively in strip shape and with a cross angle of 0~90° to the length direction of the anti-fake fiber. In this visual feature design, the most obvious color change of the fiber happens when the observing position is first in slope with the length direction of the fiber, and then the observing angle is changed to observe the fiber's surface.

[0029] The color pattern A and the color pattern B are the same in their patterns and also color features, but the color pattern A and the color pattern B have their different positions on the length direction of the anti-fake fiber, see Figure 4. For example, the color pattern A and the color pattern B are all in black, the color pattern A is located in front part of the fiber and is composed of A1, A2, A3 colors and the color pattern B is located in rear part of the fiber and is composed of B1, B2, B3 colors, when changing the observing angle, the full fiber happens its position move in jumped style with unique visual conversion effect.

[0030] Figure 5a-Figure 5g show the situations of the color pattern A and the color pattern B distributed radially, extended axially but having different positions in the length direction of the fiber. The color pattern A and the color pattern B could be have their positions, fully overlapped, or partly overlapped, or partly lined, or separated with each other, in the length direction of the anti-fake fiber. Figure 5a: the color pattern A in strip shape is red in color and the color pattern B in strip shape is black in color, if the positions of the color pattern A and the color pattern B are fully overlapped axially, when changing angle to observe, the full fiber changes color from red to black, the fiber's position does not move visually, having unique visual conversion effect; Figure 5b: if the positions of the color pattern A and the color pattern B are partly overlapped axially, when changing angle to observe, visually the full fiber changes color from red to black and happens jumped position move, but the jumping is small, having unique visual conversion effect; Figure 5c: if the axial positions of the color pattern A and the color pattern B are linked, when changing angle to observe, visually the full fiber changes color from red to black and happens jumped position move, but the jumping is in form of head linked to tail; Figure 5d: if the axial positions of the color pattern A and the color pattern B are separated, when changing angle to observe, visually the full fiber changes color from red to black and happens jumped position move, but the jumping is in leaping style, having unique visual conversion effect.

[0031] Figure 5e shows the situation of the color pattern A and the color pattern B composed of different colors, its color could be a single-color, or a composition of multi-colors. For example, the color pattern A in strip shape is composed of two lines in different colors with head linked to tail, one line is red A1 and other line is green A2; the color pattern B is a black line, when changing angle to observe, visually the full fiber changes its color from double-color of red/green to single color of black, having unique visual conversion effect.

[0032] The color of the color pattern could be white, or blank, or the same color as that on the surface of the anti-fake fiber. In Figure 5f, if the color pattern A in strip shape is red, and the color pattern B in strip is white and is distributed on the full convex surface 3" of the anti-fake fiber, if the surface of the anti-fake material is in white, when changing angle to observe, the whole fiber changes from red to invisible status, having unique visual conversion effect. If the color pattern A in strip shape is black, and the color pattern B in strip is yellow and is distributed on the full convex surface 3" of the anti-fake fiber, if the surface of the anti-fake material is in yellow, when changing angle to observe, the whole fiber changes from black to invisible status, having unique visual conversion effect. Therefore, if the color of the color pattern B is in the same color as that on the surface of the anti-fake material, the cross section of the fiber can be designed to part or full color pattern B incorporated into the color pattern A visually, but the color pattern A cannot be incorporated into the color pattern B, see Figure 5g.

[0033] In this invention, the concave-convex shielding structure is in diversity:

[0034] The concave-convex shielding structure is composed of a cross section of the anti-fake fiber, having at least one triangle element, the triangle element refers to a cross section structure with at least one top angle and two sides corresponded to it, its typical structure is a triangle section, but also can be a quadrilateral section or polygon's section. The cross section in Figure 1 is a triangle, the color pattern A is located on face 3' related to one bevel side of the triangle and the color pattern B is located on face 3" related to another bevel side of the triangle. The triangle is a typical concave-convex shielding structure to realize one color pattern presented and other color pattern shielded, and is also easy to meet the requirement of converting angle preferably not over than 120° when converting observation from the angle a to the angle b.

[0035] The concave-convex shielding structure is composed of multi-triangles in parallel, the composition of all the color patterns on the relative bevel side of each triangle constitutes the color pattern A and the composition of all the color patterns on the another relative bevel side of each triangle constitutes the color pattern B. Because the fiber is very thin and fine, the concave-convex shielding structure made of single triangle is difficult to present on the surface of the anti-fake material just in a form of its top angle upwards, for this reason the triangle has to be made in flat form, but for such flat triangle, its sensitivity of the color pattern conversion is lower when changing its observing angle, and the color pattern A or the color pattern B is very thin and fine when the fiber is in certain width, which influences the visual effect. Therefore, the parallel-triangle composition design in this invention can overcome the above shortcoming.

[0036] Figure 6a-Figure 6b are the drawings for the anti-fake fiber 2 with single-triangle cross section in the anti-fake material 1, of which Figure 6a is a cross section

drawing and Figure 6b is a plane drawing. There is the color pattern A and the color pattern B on a slope relative to two sides of the triangle, because of the anti-fake material with certain transparency, the color pattern A and the color pattern B presented on the surface of the anti-fake material is visible for eyes, when observing from angle a the color pattern A can be seen but the color pattern B cannot because it is shielded by the convex structure of the triangle, it is the same when observing from angle b the color pattern B can be seen but the color pattern A cannot because it is shielded by the convex structure of the triangle. In addition, the anti-fake fiber 2 in the anti-fake material 1 is bended along with a equally-dividing axis between the said two sides, which ensures that: either both of surface A and surface B are presented simultaneously on the surface of the anti-fake material, or the surface corresponded to third side 6 is presented alone on the surface of the anti-fake material. Here, to bend along with the equally-dividing axis 5 is the key matter for accurately controlling the surface of the fiber with A and B on it simultaneously upwards, in fact the equally-dividing axis is a virtual controlling axis that plays the same role in the all of the following drawings as that in Figure 6 series, its objective is to present the color pattern A and the color pattern B simultaneously on the surface of the anti-fake material 1. The color of the surface corresponded to the third side 6 of the cross section is in white or the same as that on the surface of the anti-fake material 1. Main reasons for selecting this triangle structure are based on three aspects as follows:

1. Generally speaking, when the width of a colored line is less than $30\text{ }\mu\text{m}$, it is hard for eyes to observe, but a triangle structure with the same fiber height has its feature of larger colored area visible by eyes, when the thickness of paper or plastic film is thinner, it is impossible for fiber's height to be larger than thickness of paper or plastic film, generally the thickness of money paper is not over than $90\text{ }\mu\text{m}$ and the thickness of copy paper is not over than $80\text{ }\mu\text{m}$, thus if fiber is necessary to be added into the paper in such thickness, the one with triangle structure is the best choice; 2. In comparison with quadrilateral cross section, the triangle cross section has better stability and can ensure the color patterns A and B homogeneously presented on the surface of the anti-fake material under certain forming press in the process of paper making; 3. One feature of the triangle structure is that the color pattern on the surface corresponded to side 6 can also potentially present on the surface of the anti-fake material alone, because of no concave-convex structure on this flat surface, it is impossible to produce the visual difference caused by changing observing angle, thus for avoiding such situation, we prepare the color pattern on this surface in white or in the same color as that of the surface of the anti-fake material, thus when this color pattern is presented on the surface of the anti-fake material,

this problem can be solved because of the presented fiber's surface in white or in the same color as that of the surface of the anti-fake material, which is invisible for eyes.

[0037] Figure 7a-Figure 7c are the drawings for the anti-fake fiber with double-linked triangle cross section in the anti-fake material, of which Figure 7a is a cross section drawing, and Figure 7b and Figure 7c are their plane drawings. Because the anti-fake material has certain transparency, the triangle color pattern A and the triangle color pattern B presented on the surface of the anti-fake material are visible by eyes, when observing from angle a, the color pattern A (as a composed visual effect of $A1+A2$) can be seen but the color pattern B cannot be seen because it is shielded by the triangle; vice versa, when observing from angle b, the color pattern B (as a composed visual effect of $B1+B2$) can be seen but the color pattern A cannot be seen because it is shielded by the triangle. In addition, the fiber in the anti-fake material can be bended along with the equally-dividing axis 5 (see Figure 3b) and can also be in a straight line (see Figure 3c), thus it can ensure that: either the surface with the color pattern A located on it and the surface with the color pattern B located on it are simultaneously presented on the surface of the anti-fake material 1, or the surface corresponded to the side 6 is presented on the surface of the anti-fake material 1 alone. We prepare the color pattern on the surface corresponded to the side 6 in white or in the same color as that of the surface of the anti-fake material 1. The actual effects of the structure are: 1. In comparison to single-triangle, there is larger visual area when their fiber heights are the same, thus it is possible to be used into a very thin paper, for example the paper's thickness is less than $50\text{ }\mu\text{m}$; 2. Because of the fiber in flat form totally, when the fiber is shorter in its length with certain hardness, the fiber even if unnecessary to be bended can also ensure that: either the surfaces with the color patterns A and B located on them present on the surface of the anti-fake material 1 simultaneously, or the surface corresponded to the side 6 presents on the surface of the anti-fake material 1.

[0038] Figure 8a-Figure 8b are the drawings for the anti-fake fiber 2 with single-quadrilateral cross section in the anti-fake material 1, of which Figure 8a is a cross section drawing and Figure 8b is a plane drawing. In comparison with single-triangle shown in Figure 6 series, the anti-fake fiber 2 is bended along with the equally-dividing axis 5, its visual area in the anti-fake material 1 is reduced by one half if the fiber's height is the same, but its merit is that: either which surface (either the surface with the color patterns A and B located on, or the surface with the color patterns A' and B' located on) is upwards, the fiber can all show color-change effect if the visual angle is changed. It is one of the selections for the paper or film with larger thickness.

[0039] Figure 9a-Figure 9c are the drawings for the anti-fake fiber 2 with three-linked quadrilateral cross sec-

tion in the anti-fake material 1, of which Figure 9a is a cross section drawing, and Figure 9b and Figure 9c are their plane drawings. In comparison to single-quadrilateral shown in Figure 8 series, it has larger visual area if their fiber heights are the same. Because of the fiber in flat form totally, when the fiber is shorter in its length with certain hardness, the fiber even if unnecessary to be bended can also ensure that the color pattern A (composed of A1, A2 and A3) and the color pattern B (composed of B1, B2 and B3) present on the surface of the anti-fake material simultaneously.

[0040] Figure 10a-Figure 10d are the drawings for the anti-fake fiber with trapezoid cross section in the anti-fake material, of which Figure 10a and 10b are their cross section drawings, and Figure 10c and Figure 10e are their plane drawings. The trapezoid has better stability, even though the surfaces with the color patterns A and B located on are in very sloped status (the more inclined it is, the much higher sensitivity will be), it is still very stable, especially when the fiber is shorter in its length with certain hardness, the fiber even if unnecessary to be bended can also ensure that the color pattern A and the color pattern B present on the surface of the anti-fake material simultaneously (see Figure 10c). Figure 10a shows a trapezoid, in comparison with two-trapezoid composition shown in Figure 10b, its merit is that the fiber's height in the paper is much smaller, in Figure 10a the color of the surface corresponded to the side 6 is in white or in the same color as that of the surface of the anti-fake material 1; but compared with Figure 10a, the arrangement shown in Figure 10b can produce color-changing effect regardless of which surface upwards and when changing its observing angle, so it is an alternation for paper or film with larger thickness; the surface corresponded to bottom side 6 of the trapezoid shown in Figure 10a is in white or in the same color as that on the surface of the anti-fake material 1.

[0041] Figure 11a-Figure 11f are the drawings for the anti-fake fiber coated with transparent material 7 in the anti-fake material 1. Because of the transparency of transparent material 7, the part surface 3 with the concave-convex shielding structure on the anti-fake fiber in this invention naturally presents on the surface of the anti-fake material. Figure 11a and Figure 11b show that the fibers respectively with their cross sections of single-triangle or single-quadrilateral are coated with the round transparent material 7, the purpose is to increase the fiber's compressive strength to further ensure the stability of the fiber's cross section shapes in the process of paper making or in the process of adding plastics; Figure 11c and Figure 11d show that the fibers respectively with their cross sections of single-triangle or single-quadrilateral are coated with the flat transparent material 7, the purposes are not only to increase its compressive strength to further ensure the stability of the fiber's cross section shapes in the process of paper making or in the process of adding plastics, but also to ensure the A and B surfaces, even if the fiber is not bended, presented

simultaneously on the surface of the anti-fake material; Figure 11e and Figure 11f show that the fibers respectively with their cross sections of multi-triangle or multi-quadrilateral are coated with the flat transparent material 7, the purpose is to increase fiber's compressive strength to further ensure the stability of the fiber's cross section shapes in the process of paper making or in the process of adding plastics.

[0042] Figure 12a-Figure 12e are the cross section drawings for the vacuum-coated aluminum layer with shielding function between the color pattern A and the color pattern B on the anti-fake fiber 2. We found in our practices that: because of the fiber in very small size, when using organic material to prepare the fiber, the colors interfere with each other between the color patterns A and B, resulting in seriously-influenced beauty of the color patterns A and B, and reduced visual difference between the color patterns A and B. For solving this problem, we design an A1-coated layer 8 between the color patterns A and B, because A1-coating is not only at low cost, but also has completely-shielding function when the A1-coated layer is only 0.2 μm in its thickness. Figure 12a is a drawing of the fiber with its triangle cross section and an A1-coated layer 8 located in the middle position on the material, which is equal to a composition made of two fibers in different colors, the interface of this composition is coated by aluminum; Figure 12b is a drawing of the fiber with its triangle cross section and an Al-coated layer 8 located on the fiber's surface, after coating aluminum the fiber's surface can also be adhered with a layer of color or is only kept with this aluminum layer; Figure 12c is a drawing of the fiber with its quadrilateral cross section and an Al-coated layer 8 located in the middle position on the material, the interface between two different colors on this composition is coated by aluminum; Figure 12d is a drawing of the fiber with its quadrilateral cross section and an A1-coated layer 8 located on the fiber's surface, the A1-coated layer 8 is located on one side of the axis 5 on the surface, after coating aluminum the fiber's surface can also be adhered with a layer of color or is only kept with this aluminum layer; Figure 12e is a drawing of the fiber with its multi-linked triangle cross section and the A1-coated layer 8 located on the surfaces B1, B2, B3 of the triangles with the same vision on the anti-fake fiber. In addition, the surface of whole anti-fake fiber can be coated with aluminum first, and then the color patterns A and B are printed on the relative surfaces.

[0043] The said concave-convex shielding structure can be in arc shape, see Figure 13, and also can be in saw teeth shape or other irregular curve shapes.

[0044] In the above embodiments, the anti-fake materials are the organic films. Previously, no one has added the anti-fake fiber into the plastic films for anti-fake functions, the reason for it is that the plastic films are difficult to tear and easy to melt with the anti-fake fibers, thus there is difficult to tear the plastic film or to pick the anti-fake fiber out for checking the anti-fake fiber. When the

faker simulates the visual features via printing fine line, there is no simple way to verify. Because it is unnecessary to tear the plastic films for observing in this invention, it can be used in plastic film areas.

[0045] In the above embodiments, the anti-fake fiber is a fluorescent fiber, when illuminating via fluorescent lamp and changing observing angle, there will be obvious visible visual difference.

[0046] In the above embodiments, the anti-fake fiber is an IR fiber, when illuminating via IR-ray and changing observing angle, there will be obvious visible visual difference.

[0047] The way for controlling the part surface 3 of the anti-fake fiber presented on the surface of the anti-fake material is as follows:

[0048] For realizing the objectives of this invention, the most important technique is to control efficient concave-convex shielding structure of the fiber being really presented on the surface of the anti-fake material in the practical production process. Theoretical analysis and a large amount of experiments indicate that: in the paper making process, when the fiber has certain elastic hardness, the maximum projection area of the whole fiber shape will certainly present on the surface of the paper. In this invention, the projection area of the anti-fake fiber refers to the minimum square area corresponded to the projective line of the substance, that is, when the anti-fake fiber is in straight line and the fiber's cross section is equivalent in the length direction, the minimum square area is the area of the projective lines of the substance, see the area covered by bevel lines in Figure 14a; when the anti-fake fiber is in straight line and the fiber's cross section is not equivalent in the length direction, the minimum square area is the product area of the maximum width of the projective area of the anti-fake fiber substance and the length of the anti-fake fiber, see the area covered by bevel lines in Figure 14b; when the anti-fake fiber is in curve, the minimum square area is just the square area constituted of and covered by the projective lines of the bended substance of the anti-fake fiber, see the area covered by bevel lines in Figure 14c.

[0049] Another description has the same effects as that mentioned above, when to envelop the anti-fake fiber 2 by a cube can fully wrap the part surface 3 of the anti-fake fiber, which is corresponded by two maximum surfaces in minimum cube of the anti-fake fiber, the two maximum surfaces of the minimum cube are certainly towards to the surface of the anti-fake material because of their lowest energy status, therefore, the part surface 3 with the concave-convex shielding structure on it can present on the surface of the anti-fake material.

[0050] Accordingly, this invention designs especially as follows, these designs are also applicable to distribute the anti-fake fiber into a sandwich with a paper in it, or distribute it into a sandwich with a plastic film in it, or distribute it into a single-layer plastic film.

[0051] The anti-fake fiber 2 is in curve shape, the upward surface of the bended fiber is the part surface 3 of

the anti-fake fiber, see Figure 15a and Figure 15b. The maximum width c of the cross section of the anti-fake fiber, in its length direction and being parallel to the surface of the anti-fake material, is equal to or less than the maximum width d of the cross section being vertical to the surface of the anti-fake material, that is, the long axis d of the cross section in the length direction of the anti-fake fiber 2 is vertical to the surface of the anti-fake material, see Figure 15b, thus when the fiber is in bended status, its cross section, even if not in flat shape, can still expose the necessary part surface 3 of the anti-fake fiber onto the paper's surface. The maximum horizontally-surmounted length formed by the bended anti-fake fiber 2 is a geometrical width e , see Figure 15a, when this geometrical width is at least over twice of the long axis d of the cross section in the length direction of the anti-fake fiber, the bended anti-fake fiber 2 can completely present on the surface of the anti-fake material in its naturally-bended status.

[0052] If the cross section of the anti-fake fiber 2 has at least its some part 9 in flat shape in the fiber length direction, the flat surface corresponded to the flat shape will present on the surface of the anti-fake material, see Figure 16. The cross section of the anti-fake fiber 2 in its length direction can also be fully in flat shape, thus the flat surface corresponded to this flat shape will present on the surface of the anti-fake material. The color of the flat part of the anti-fake fiber 2 is preferably blank or white in color, or the same color as that on the surface of the anti-fake material 1.

[0053] The materials of the anti-fake fiber in this invention can be organic or metal ones.

[0054] The anti-fake material in this invention refers to paper, or paper-board, or organic film. The anti-fake fiber 2 can be sandwiched between two pulp layers, or between two organic films; or between pulp layer and other material layer; or between organic film layer and other material layer; or can be adhered onto the surface of an anti-fake material, or can be inserted into the surface of the anti-fake material in other ways.

[0055] Various concave-convex structures of the anti-fake fibers in this invention can be formed via dies. The color patterns on the concave-convex structures can be prepared onto the anti-fake fibers by processes of adhering film, fine-printing, heat-pressing and etc.; for the color pattern with pure colors, it can be prepared first by jetting and then synthesizing, and also can be composed by heat pressing fibers in different colors.

[0056] The anti-fake fiber can be inserted into paper by directly adding it into pulp in the process of papermaking, and can also be done by pressing it into multi-layers of paper.

Claims

1. An anti-fake material, on which an anti-fake fiber (2) is distributed and part surface (3) of the said anti-

fake fiber (2) is presented on surface (1') of the said anti-fake material (1), with characteristics of that: there is a concave-convex shielding structure on the said part surface (3), on which there are at least two color patterns A and B distributed, on the said part surface (3) there is obvious visual difference between the said at least two color patterns A and B, therefore on the surface (1') of anti-fake material (1) with presence of the said part surface (2), when observing the said part surface (3) from different observing angles, the color patterns A and B can be seen respectively.

2. An anti-fake material as said in Claim 1, with characteristics of that: there are at least two observing angles a and b on the surface (1') of the anti-fake material (1) with presence of the said part surface (3), the color pattern A can be seen if observing the said part surface (3) of the anti-fake fiber (2) from the observing angle a but the pattern B cannot be seen because it is shielded by the concave-convex shielding structure on the part surface (3) of the anti-fake fiber (2), and the color pattern B can be seen if observing the said part surface (3) of the anti-fake fiber (2) from the observing angle b but the pattern A cannot be seen because it is shielded by the concave-convex shielding structure on the part surface (3) of the anti-fake fiber (2).
3. An anti-fake material as said in Claim 1 or 2, with characteristics of that: the concave-convex shielding structure of the said anti-fake fiber (2) is constituted of at least one triangle element at its cross section (4), the color pattern A is on the surface (3') of one bevel side at the top angle of the said triangle element and the color pattern B is on the surface (3'') of another bevel side at the said top angle.
4. An anti-fake material as said in Claim 3, with characteristics of that: the cross section (4) of the said anti-fake fiber (2) is constituted of one triangle or multi-linked triangles.
5. An anti-fake material as said in Claim 4, with characteristics of that: the said anti-fake fiber (2) is a bended fiber with a triangle cross section (4), the color patterns A and B are respectively located on bevel surfaces of two sides of the triangle, the color on surface corresponding to the third side is white or the same color as that of the said anti-fake material (1) surface, and the anti-fake fiber (2) is bended along with equally-divided axis (5) between the said two sides.
6. An anti-fake material as said in Claim 3, with characteristics of that: the cross section of the said anti-fake fiber (2) is constituted of one quadrilateral or multi-linked quadrilaterals, and the anti-fake fiber (2)

is bended along with equally-divided axis (5).

7. An anti-fake material as said in Claim 3, with characteristics of that: the cross section of the said anti-fake fiber (2) is constituted of one trapezoid or two-linked trapezoids.
8. One of the anti-fake material as said in Claims 1~7, with characteristics of that: the said part surface (3) of the said anti-fake fiber (2) has its projection on the surface of the anti-fake material (1) in the maximum projection size of the anti-fake fiber (2) or is parallel to its maximum projection.
9. An anti-fake material as said in Claim 1 or 2 or 3, with characteristics of that: the said anti-fake fiber (2) is a bended or crooked fiber being able to present on the surface of the anti-fake material (1) in self-bended or self-crooked status.
10. One of the anti-fake material as said in Claims 1~7, with characteristics of that: the cross section of the said anti-fake fiber (2) is in flat shape along with its full length or its partial length direction, and the said part surface (3) of the said anti-fake fiber (2) is located on the flat surface or on the surface of the anti-fake fiber (1) having their same projection on the anti-fake material (1).
11. One of the anti-fake material as said in Claims 1~10, with characteristics of that: the outside of the said anti-fake fiber (2) is coated with a transparent material (7).
12. An anti-fake material as said in Claims 11, with characteristics of that: the transparent material (7) coated on the outside of the said anti-fake fiber (2) is in a flat shape, and the said part surface (3) of the said anti-fake fiber (2) is on the surface of the anti-fake fiber (2) corresponding to the transparent material (7).
13. One of the anti-fake material as said in Claims 1~12, with characteristics of that: the said anti-fake material (1) is an organic film.
14. One of the anti-fake material as said in Claims 1~13, with characteristics of that: the said anti-fake fiber (2) also includes the fiber made by one added with fluorescent material or IR-illuminating material.
15. One of the anti-fake material as said in Claims 1~14, with characteristics of that: between surfaces located by the said at least two color patterns A and B, there is at least one layer of vacuum-coated aluminum for shielding light.
16. An anti-fake fiber inserted into one of the anti-fake

materials as said in Claims 1~15, which has the part surface (3) presented on one surface (1') of the said anti-fake material (1), with characteristics of that: the said part surface (3) has the concave-convex shielding structure, on which there are at least two color patterns A and B distributed, the said at least two color patterns A and B have obvious visual difference on the said part surface (3), resulting that the color patterns A and B can be seen respectively from the surface (1') of the anti-fake material (1) with the presence of the said part surface (3) when observing from different angles of said part surface (3).

17. An anti-fake fiber as said in Claim 16, with characteristics of that: there are at least two observing angles a and b on the surface (1') of the anti-fake material (1) with presence of the said part surface (3), the color pattern A can be seen if observing the said part surface (3) of the anti-fake fiber (2) from the observing angle a but the color pattern B cannot be seen because it is shielded by the concave-convex shielding structure on the part surface (3) of the anti-fake fiber (2), and the color pattern B can be seen if observing the said part surface (3) of the anti-fake fiber (2) from the observing angle b but the color pattern A cannot be seen because it is shielded by the concave-convex shielding structure on the part surface (3) of the anti-fake fiber (2).
18. An anti-fake fiber as said in Claims 16 or 17, with characteristics of that: the said part surface (3) has its projection on the said anti-fake material (1) in the maximum projection size of the anti-fake fiber (2) or is parallel to the maximum projection.
19. An anti-fake fiber as said in Claims 16 or 17, with characteristics of that: the said anti-fake fiber (2) is a bended or crooked fiber being able to present on the surface of the anti-fake material (1) in self-bended or self-crooked status.
20. An anti-fake material as said in Claims 16 or 17, with characteristics of that: the cross section (4) of the said anti-fake fiber (2) is in flat shape along with its full length or its partial length direction, and the said part surface (3) of the said anti-fake fiber (2) is located on the flat surface or on the surface of the anti-fake fiber having their same projection on the anti-fake material.

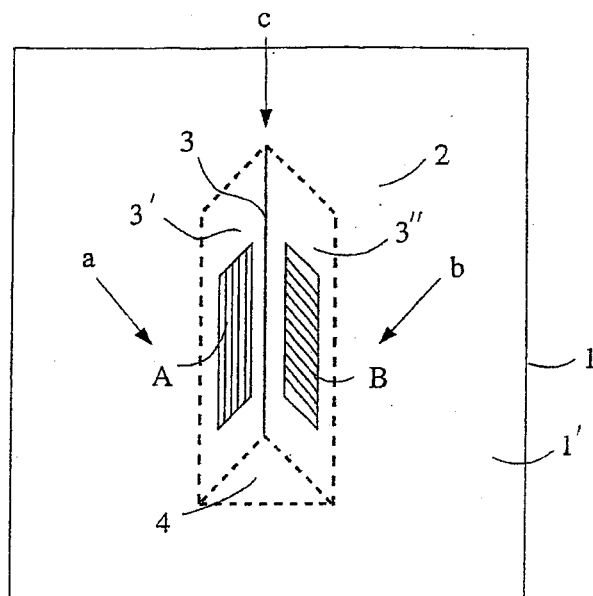


Figure 1

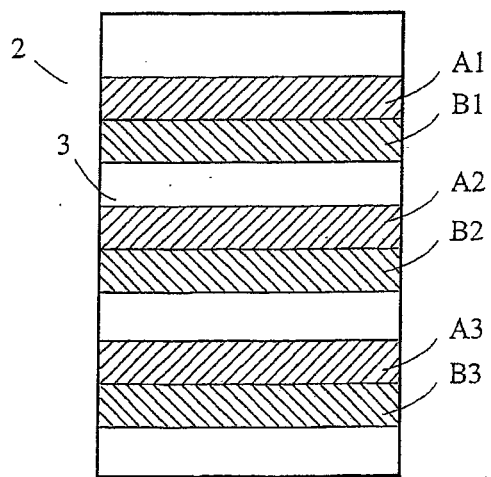


Figure 2 a

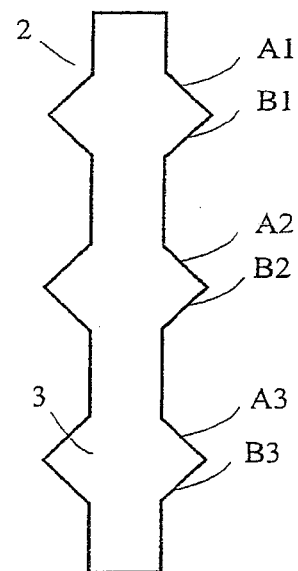


Figure 2 b

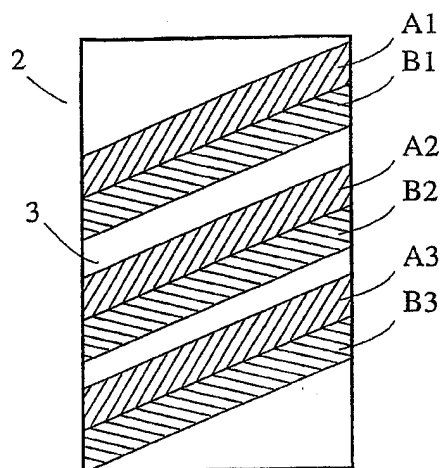


Figure 3

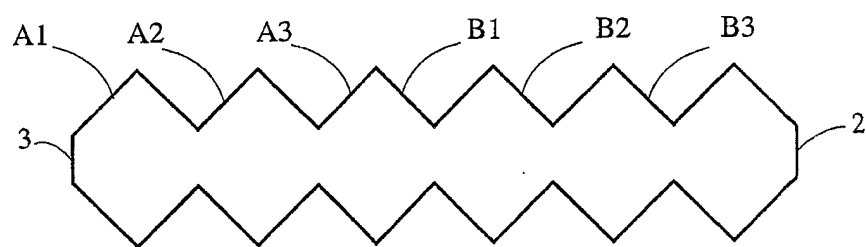


Figure 4

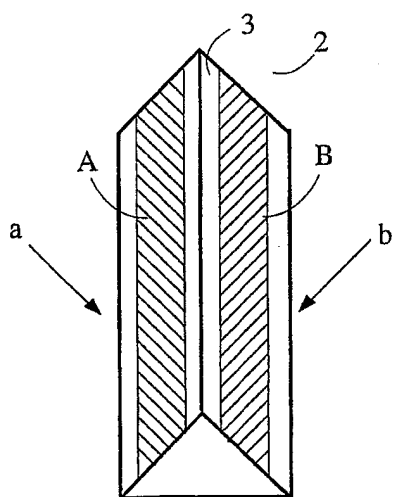


Figure 5 a

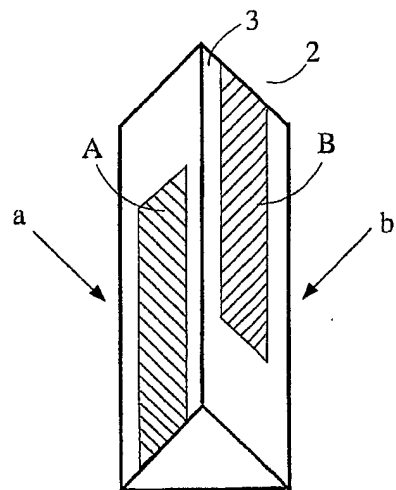


Figure 5 b

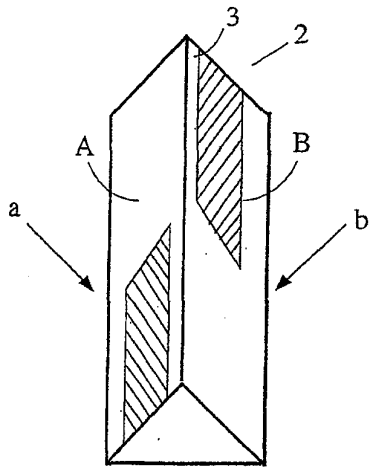


Figure 5 c

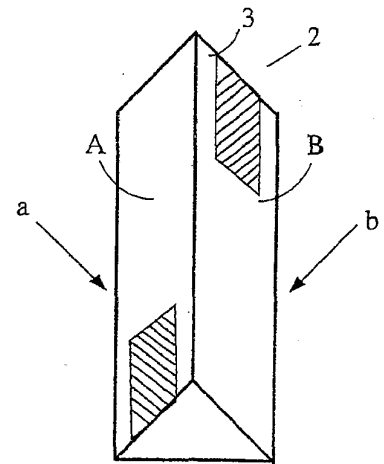


Figure 5 d

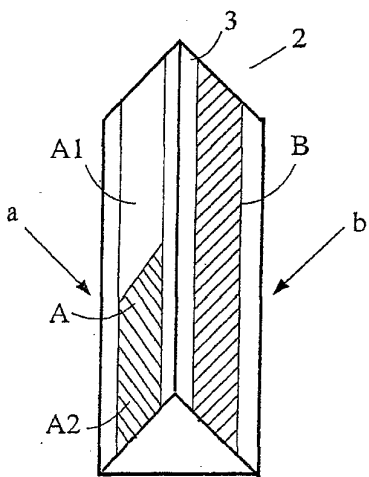


Figure 5 e

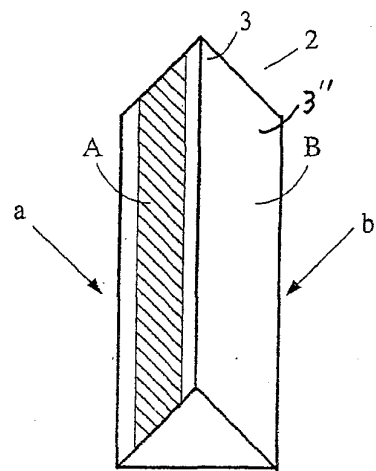


Figure 5 f

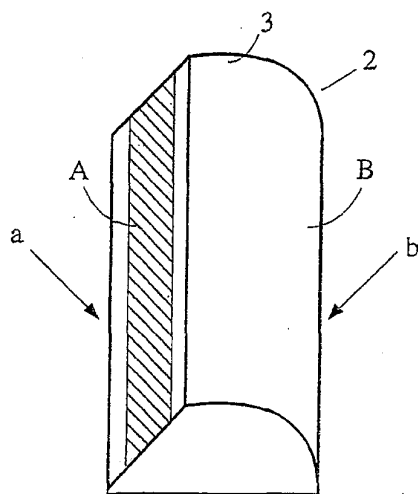


Figure 5 g

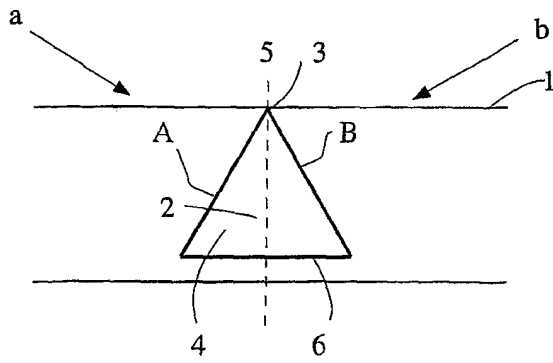


Figure 6 a

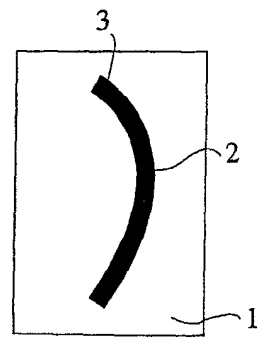


Figure 6 b

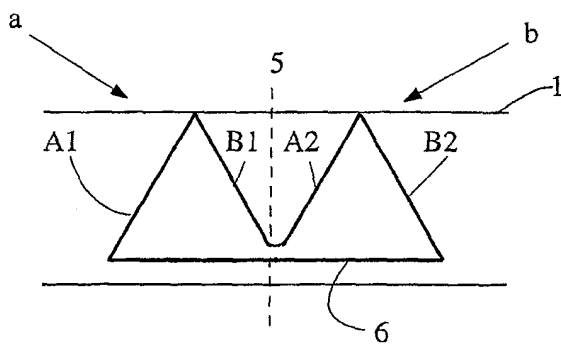


Figure 7 a

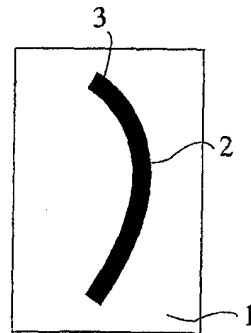


Figure 7 b

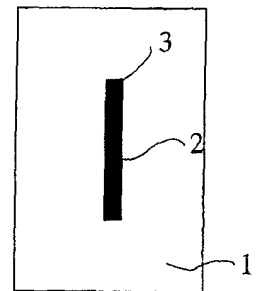


Figure 7 c

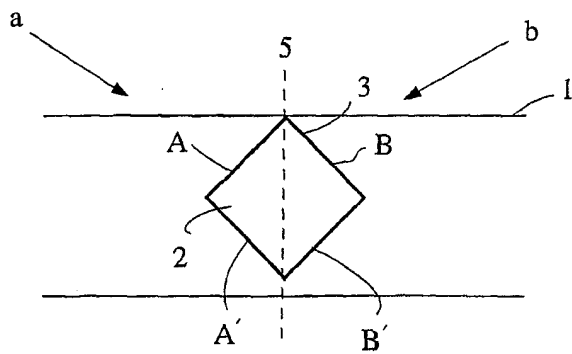


Figure 8 a

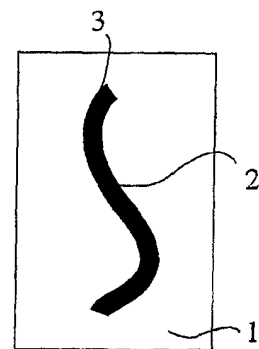


Figure 8 b

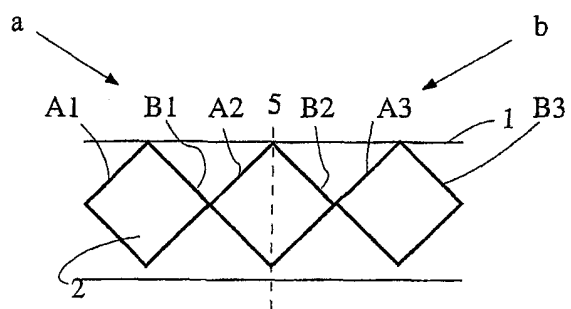


Figure 9 a

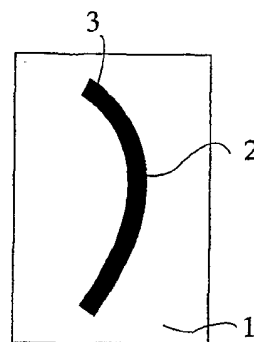


Figure 9 b

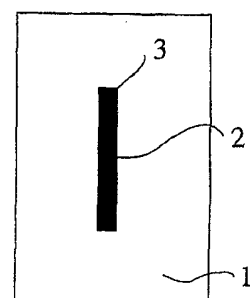


Figure 9 c

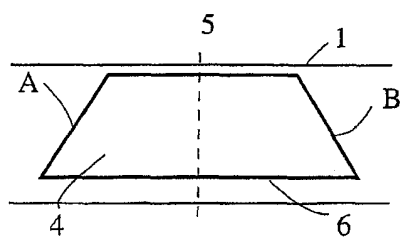


Figure 10 a

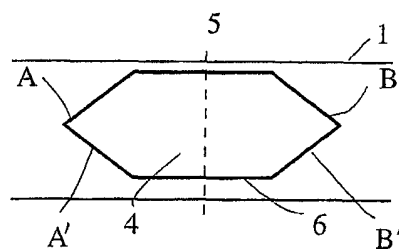


Figure 10 b

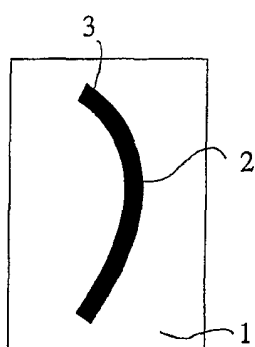


Figure 10 c

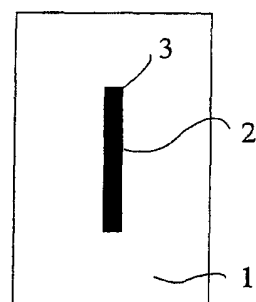


Figure 10 d

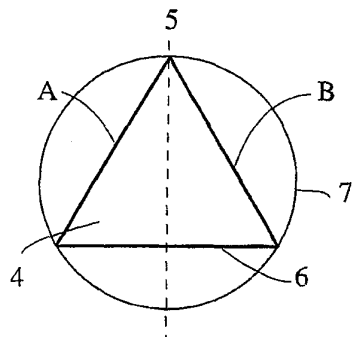


Figure 11 a

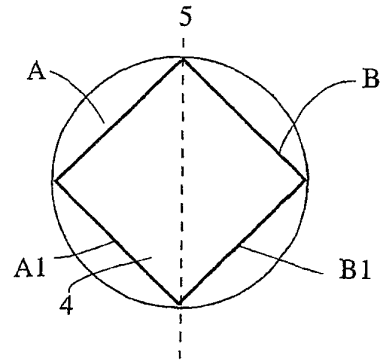


Figure 11 b

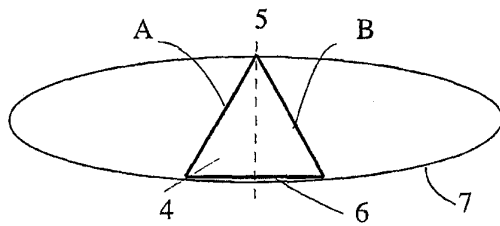


Figure 11 c

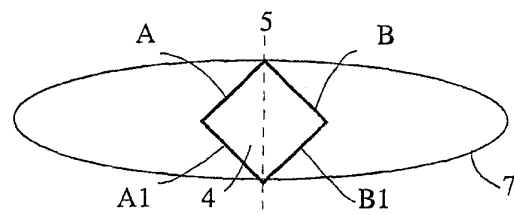


Figure 11 d

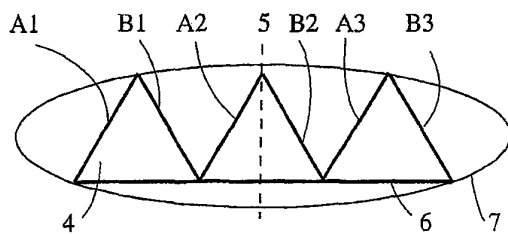


Figure 11 e

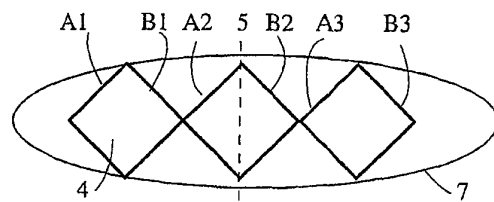


Figure 11 f

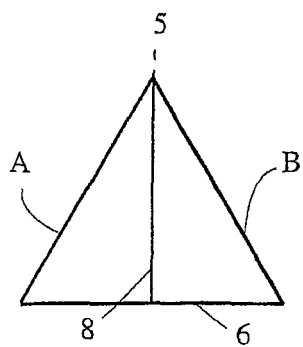


Figure 12 a

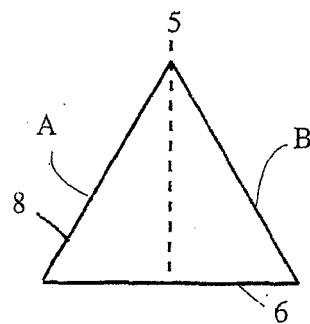


Figure 12 b

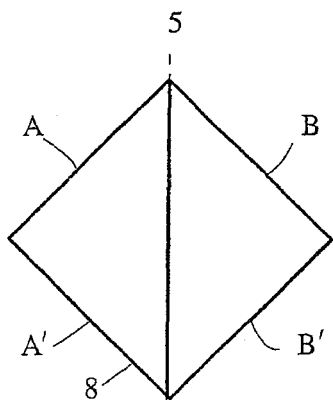


Figure 12 c

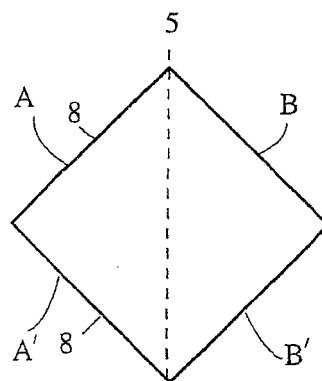


Figure 12 d

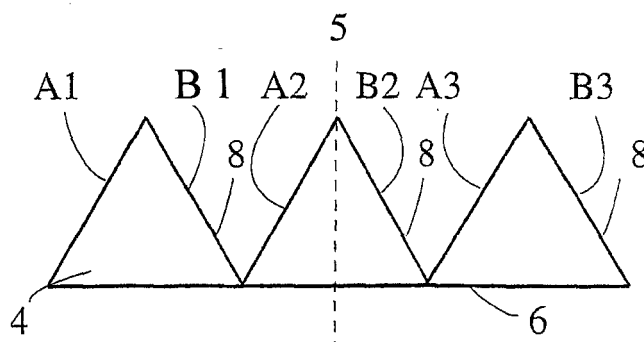


Figure 12 e

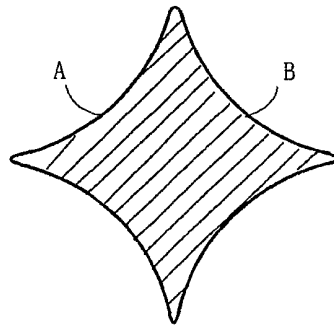


Figure 13

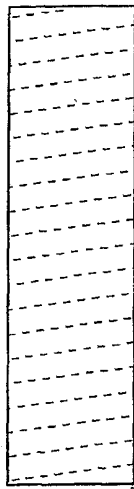


Figure 14 a

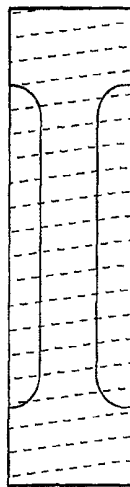


Figure 14 b

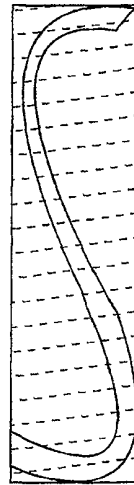


Figure 14 c

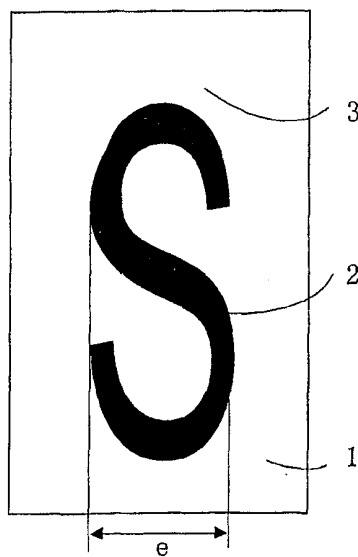


Figure 15 a

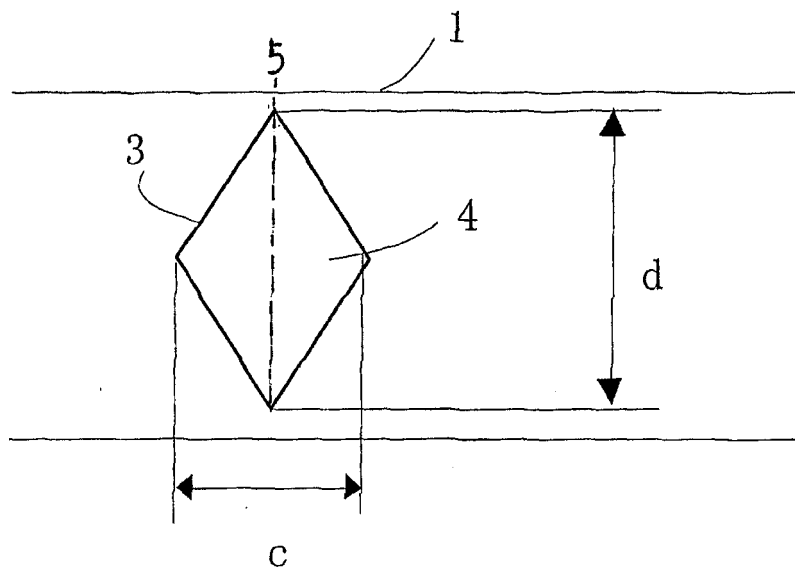


Figure 15 b

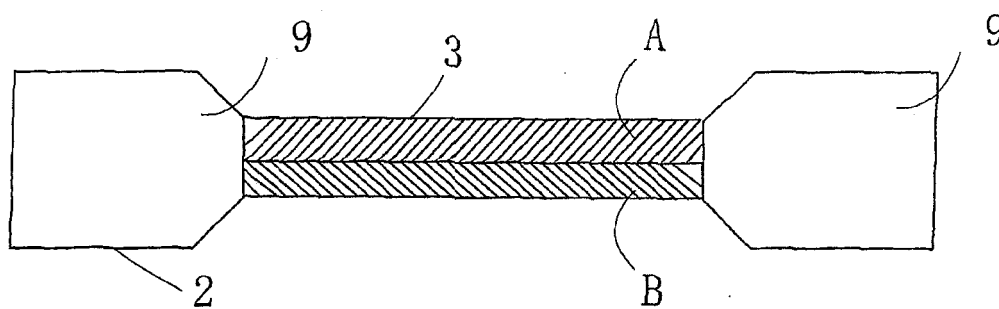


Figure 16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2005/001543

A. CLASSIFICATION OF SUBJECT MATTER		
IPC ⁷ : D21H21/42		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC ⁷ : D21H21		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
CNPAT,WPI,EPODOC,PAJ, anti-forg, fibre, fiber, shelter, structure, color, pattern, cross section, triangle, counterfeit, imitate, fraud, false, forge, concave, convex, uneven, raise		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP2000309182A(TOPPAN PRINTING CO.,LTD.), 07.Nov.2000(07.11.2000), the whole document	1,16
A	CN1503859A(HONEYWELL INTERNATIONAL INC.), 09.Jun.2004(09.06.2004), the whole document	1,4,16
A	JP2001032192A(DAINIPPON PRINTING CO.,LTD.), 06.Feb.2001(06.02.2001), the whole document	1
P, X	CN2716320Y(SUN,Xianlin),10.Aug.2005(10.08.2005), the whole document	1-20
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&"document member of the same patent family		
Date of the actual completion of the international search 01.Dec.2005(01.12.2005)		Date of mailing of the international search report 29 · DEC 2005 (29 · 12 · 2005)
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451		Authorized officer GAO, Beibei Telephone No. 86-10-62084824

Form PCT/ISA /210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT
 Information on patent family members

 International application No.
 PCT/CN2005/001543

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP2000309182A	07.Nov. 2000 (07.11.2000)	none	
CN1503859A	09.Jun.2004 (09.06.2004)	US2004209052 A1 WO02068736 A1 US2002160188 A1 EP1373605 A1 AU2002250121 A1 JP2004532358T T	21.Oct.2004(21.10.2004) 06.Sep.2002(06.09.2002) 31.Oct.2002(31.10.2002) 02.Jan.2004(02.01.2004) 12.Sep.2002(12.09.2002) 21.Oct.2004(21.10.2004)
JP2001032192A	06.Feb.2001 (06.02.2001)	none	
CN2716320Y	10.Aug.2005 (10.08.2005)	none	

Form PCT/ISA /210 (patent family annex) (April 2005)

REFERENCES CITED IN THE DESCRIPTION

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- CN 02168121 [0002]
- CN 02170092 [0002]
- CN 02146589 [0003]