(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 389 537 A1

(12) EUROPEAN PATENT APPLICATION
published in accordance with Art. 158(3) EPC

(43) Date of publication:
18.02.2004 Bulletin 2004/08

(21) Application number: **02714537.4**

(22) Date of filing: **08.04.2002**

(51) Int Cl.[7]: **B41M 3/14**

(86) International application number:
PCT/JP2002/003495

(87) International publication number:
WO 2002/090121 (14.11.2002 Gazette 2002/46)

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **26.04.2001 JP 2001128514**

(71) Applicant: **Japan as represented by Secretary of Agency of Printing Bureau, Ministry of Finance
Minato-ku, Tokyo 105-8445 (JP)**

(72) Inventor: **NAKAI, Masanori;c/o Dokuritsugyouseihoujin
Minatu-ku, Tokyo 105-8445 (JP)**

(74) Representative: **Panten, Kirsten et al
Reichel & Reichel,
Patentanwälte,
Parkstrasse 13
60322 Frankfurt am Main (DE)**

(54) FORGERY PREVENTING PRINTED MATTER HAVING FLIP-FLOP OR COLOR FLIP-FLOP CHARACTERISTIC

(57) After a first printed image (3) of gold ink is formed on a printing base, a second printed image (5) of a color ink is printed such that second single lines (6A) of microcharacter printing by the color ink in the second printed image (5) are superposed on first single lines (4A) in the image (3). The first printed image (3) includes a first background image (4) formed from the first single lines (4A) and second image lines (4B) and a first latent image (3A) (character "I"). The second printed image (5) includes a second background image (6) formed from the second single lines (6A) and a second latent image (5A) (character "O") formed by executing outline printing on the second background image (6). In a scattered light region, the first latent image (3A) can be visually recognized. In a regularly reflected light region, the second latent image (5A) can be visually recognized. Accordingly, the authenticity can be determined and the anti-forgery effect can be further increased.

FIG. 1A

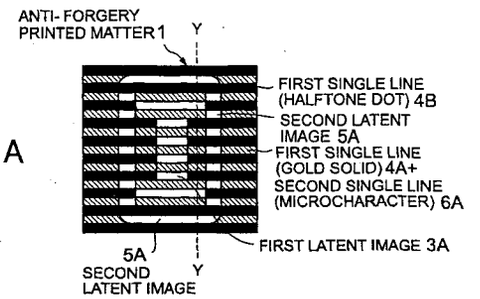


FIG. 1B

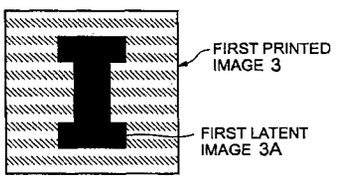
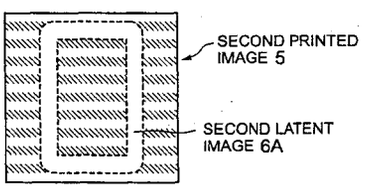


FIG. 1C



EP 1 389 537 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to anti-forgery printed matter and, more particularly, to anti-forgery printed matter having a flip-flop effect or a color flip-flop effect.

[0002] For printed matter such as securities including banknotes, stock certificates, and bonds, various kinds of certificates, and important documents, measures against forgery and alteration are important. Hence, a pattern is formed on the printing surface of such printed matter by very fine image lines. Examples of techniques used as measures against forgery and alteration of such printed matter are a technique for printing, on printed matter, a collective pattern of characters called microcharacters each having a character size of 1 mm or less and a technique for forming an unnoticeable latent image which becomes visible when predetermined processing is executed for printed matter. More specifically, latent image intaglio printing is used, or printing is executed using anti-copy image lines or functional ink whose color cannot be accurately reproduced by a copying machine.

[0003] In the anti-forgery and anti-alteration measure using microcharacters, a fine and complex pattern is formed, thereby making it difficult to create counterfeit matter having the same pattern as an authentic one. The effect of the anti-forgery measure is increased by, e.g., using colors that are hard to reproduce by extraction by a photomechanical process apparatus or a copying machine. In addition, when an enormous number of microcharacters are formed on the printing surface, a ground tint pattern that can effectively prevent any forgery or alteration can be formed. Simultaneously, a large quantity of character information that is essential in printed products can be added.

[0004] Furthermore, when an ordinary citizen observes the printed matter in a market distribution process by using a magnifying glass or the like, he/she can easily identify whether the words and shapes of the microcharacters are authentic. For these reasons, microcharacters are widely used all over the world in designing printed matter such as securities. Especially, in printed matter such as banknotes, stock certificates, and bonds with monetary values, microcharacters are used as a pattern. A microcharacter pattern is currently an important element that adds a quality appearance.

[0005] Hence, in printed matter such as securities including banknotes, stock certificates, and bonds, various kinds of certificates, and important documents, microcharacters are handled as a pattern that is indispensable for a design.

[0006] Recently, however, since an advanced photomechanical process apparatus or copying machine with high performance is available, no sufficient anti-forgery and anti-alteration effect can be obtained by only microcharacters.

[0007] Anti-forgery elements and printing techniques capable of obtaining new design and high anti-forgery effect are lately demanded for printed matter such as important documents that need high level of security. In recent years, inks or coatings containing special luminescent powder such as interference mica, oxidized flake mica, pigment-coated aluminum flakes, or optical change flakes are available. They allow production of a large quantity of printed matter which are excellent in color flip-flop effect, i.e., which can change their colors in accordance with the observation angle or printed matter having security elements such as hologram whose images change in accordance with the observation angle.

[0008] The color flip-flop effect means the angle dependence of colors, i.e., a characteristic representing that the light/shade and colors of a coating surface changes depending on the viewing angle. Especially, a characteristic representing a change in light/shade of colors is called a flip-flop effect, and a characteristic representing a change in hue is called a color flip-flop effect.

[0009] As a technique using a special luminescent powder that exhibits such a characteristic, a polarizing ink layer containing a pearl pigment is solidly printed on the entire surface of a base sheet. An abstract pattern or character pattern formed from an aggregate of straight lines or curved lines is printed as a color ink layer on the polarizing ink layer. Incident light from the upper surface side is periodically reflected to a predetermined direction by the pearl pigment in the polarizing ink layer to generate gloss. In addition, the abstract pattern or character pattern by the color ink layer can be seen as a three-dimensional pattern (e.g., Japanese Utility Model Laid-Open No. 5-76765).

[0010] Anti-copy printed matter formed by a technique using a metallic luster ink is proposed (Japanese Patent Laid-Open No. 57-20395). In this technique, especially, silver ink is used to print, on a base, a latent image formed from fine components as halftone dots having a resolution of 85 lines/inch and a percent dot area of 30%. Dots having a higher density than the latent image, i.e., a resolution of 150 lines/inch and a percent dot area of 30% are printed on the margin portion except the latent image. In addition, a pattern of lathe works or ground tints is printed on the printed surface.

[0011] In addition, an anti-forgery and anti-alteration information carrier is proposed (e.g., Japanese Patent Laid-Open No. 8-58224). In this information carrier, an authenticity determination identifying portion which contains transparent optical change flakes and indicates a plurality of colors in accordance with the angle of incidence is formed at an arbitrary portion on a base. At least part of the identifying portion of the base is transparent. A color indicated by reflected light from the authenticity determination identifying portion and transmitted light having the complementary color of the reflected light changes depending on the observation angle.

[0012] A color flip-flop metallic coating is also proposed (e.g., Japanese Patent Laid-Open No. 7-292994). This color flip-flop metallic coating can form a coating that is excellent in color flip-flop effect by combining a plurality of kinds of scaly coloring pigments having different color tones or combining a scaly coloring metal pigment and an organic pigment having a color different from the metal pigment.

[0013] As an anti-copy technique using the difference in density of halftone dots, one of two images is formed using a small number of lines at a high percent dot area. The other image is formed using a larger number of lines at almost the same percent dot area as the image with the small number of lines.

[0014] Another anti-copy technique is also proposed (e.g., Japanese Patent Laid-Open No. 6-71156), in which the latent image of a first latent image portion formed on a base is printed using halftone dots at a resolution of 150 lines/inch and a percent dot area of 10%. The background around the latent image is printed using halftone dots at a resolution of 60 lines/inch and a percent dot area of 10%. The latent image of a second latent image portion adjacent to the first latent image portion is printed using halftone dots at a resolution of 60 lines/inch and a percent dot area of 10%. The background around it is printed using halftone dots at a resolution of 150 lines/inch and a percent dot area of 10%.

[0015] As described above, since recent advanced color copy machines can produce sophisticated copies that are hard to distinguish from authentic ones, forgery of securities, checks, and banknotes using copying machines is going on. Skilled specialists of authentication or special identifying apparatuses can identify copied or forged printed matter as a counterfeit. However, there are a variety of securities that are widely distributed, and they are often handled by ordinary citizens. It is not practical that only the skilled specialists of authentication or special identifying apparatuses should determine the authenticity of all securities. Hence, an authenticity determination technique that allows an ordinary citizen to easily and instantaneously identify a counterfeit is demanded.

[0016] The anti-forgery method or authenticity determining printed matter using an ink containing a special luminescent powder increases the cost of printed matter because the luminescent powder itself is expensive. In addition, such printed matter uses only the angle dependence of colors by the photoluminescence. Hence, when a similar or the same luminescent powder is available, and the luminescent powder is mixed with an ink or coating, it is easy to forge printed matter. More specifically, authenticity determining printed matter using an ink which contains luminescent powder and has only the angle dependence of colors can easily be forged. It is difficult for an ordinary citizen to easily and instantaneously determine the authenticity.

[0017] Furthermore, as described above, as the color copying machines are making progress in recent years, high-performance copying machines become available. Since sophisticated copies that are hard to distinguish from authentic ones can be created, the effect of the anti-copy technique using the difference in density of halftone dots tends to decrease.

[0018] A technique for solving the above problems is proposed (Japanese Patent Application No. 10-365279 filed by the present applicant), in which an image is formed by using arbitrary luminescent inks corresponding to printing plates (C), (M), and (Y) having arbitrary tone levels and an arbitrary light absorption ink corresponding to a printing plate (K) having an arbitrary tone level. When the observation angle is changed, a first visible image changes to a second visible image.

[0019] In addition, an information carrier (Japanese Patent Application No. 11-307052 filed by the present applicant) is proposed, in which a luminescent shielding layer having a high base hiding ratio is formed in one of a first visual information image region (18) and a background image region (19). A luminescent shielding layer having a low base hiding ratio is formed in the other region. In addition, a luminescent shielding layer having a high base hiding ratio is formed in both of a second visual information image region (20) and a background image region (21). A shielding layer having a high visible light absorptance and a very low base hiding ratio is formed at least at part of the luminescent shielding layer having the high base hiding ratio. The visible information changes when the observation angle is changed.

[0020] Generally, anti-forgery printed matter having an optical change requires expensive and special apparatus and materials. However, the techniques proposed in Japanese Patent Application Nos. 10-365279 and 11-307052 use general materials and manufacturing methods and are therefore advantageous in cost reduction.

[0021] These images are formed by complex image structures, and their authenticity can instantaneously be determined. They are also advantageous in preventing forgery and determining authenticity. Unlike hologram, an image can be formed without using any special adhesive for the printing base. For this reason, no additional manufacturing process is required. In addition, the printed matter can maintain its high mechanical strength during distribution.

[0022] However, in this anti-forgery printed matter, the basic image line constituent element is a tint or solid fill. Security printed matter generally requires a design that sends a quality appearance into the subconscious mind, and the tint or solid fill is insufficient for this. Additionally, security printed matter must have the anti-forgery effect in addition to the semantic information of printed matter such as securities including banknotes, stock certificates, and bonds or various kinds of certificates. To effectively use the limited printing area, the anti-forgery element preferably has a plurality of pieces of semantic information.

[0023] For the reasons described above, develop-

ment of printed matter has been demanded, which requires no complex manufacturing process, ensures a conspicuous color tone difference to a color copy of the printed matter, can hardly reproduce the angle dependence of colors of the authentic printed matter only by obtaining its special luminescent material and mixing it with an ink or coating, and allows an ordinary citizen to determine the authenticity without using any special method or apparatus, and whose anti-forgery element has a plurality of pieces of semantic information.

SUMMARY OF THE INVENTION

[0024] The present invention has been made in consideration of the above situation, and has as its object to provide anti-forgery printed matter which allows authenticity determination of printed matter without requiring any special apparatus and has a flip-flop effect or color flip-flop effect capable of obtaining a high anti-forgery effect.

[0025] According to the present invention, there is provided anti-forgery printed matter with a flip-flop effect, which has a printed image formed on a printing base,

wherein the printed image has a latent image region and a background image region,

the latent image region is formed by a solid printed layer containing an ink or coating containing at least one luminescent material,

the background image region is formed by alternately repeating the solid printed layer containing the ink or coating containing at least one luminescent material and a halftone printed layer containing an ink or coating containing at least one luminescent material at a predetermined interval, and

the latent image is more easily visually recognized when an observation angle is in a diffused or scattered light region with respect to an illumination light source than when the observation angle is in a regularly reflected light region with respect to the illumination light source.

[0026] The background image region may include a single line pattern including at least one of a horizontal stripe pattern, a vertical stripe pattern, a concentric circle pattern, and a concentric polygonal pattern, a check pattern, or a grid pattern.

[0027] According to the present invention, there is provided anti-forgery printed matter with a color flip-flop effect, which has first printed image and second printed image formed on a printing base,

wherein the first printed image has a first latent image region and a first background image region,

the first latent image region is formed by a solid printed layer containing an ink or coating containing at least one luminescent material,

the first background image region is formed by alternately repeating the solid printed layer containing the ink or coating containing at least one luminescent material and a halftone printed layer containing an ink or coating containing at least one luminescent material at a predetermined interval,

the second printed image has a second latent image region and a second background image region,

the second latent image region is an unprinted region or a region where outline printing on a printed region is executed,

the second background image region is formed by alternately repeating a microcharacter printed layer containing an ink and an unprinted layer at a predetermined interval,

the microcharacter printed layer in the second background image region in the second printed image is superposed on the solid printed layer in the first background image region in the first printed image,

the first latent image is more easily visually recognized than the second latent image when an observation angle is in a diffused or scattered light region with respect to an illumination light source, and

the second latent image is more easily visually recognized than the first latent image when the observation angle is in a regularly reflected light region with respect to the illumination light source.

[0028] Each of the first background image region and the second background image region may include a single line pattern including at least one of a horizontal stripe pattern, a vertical stripe pattern, a concentric circle pattern, and a concentric polygonal pattern, a check pattern, or a grid pattern.

[0029] The luminescent material may include a material selected from the group consisting of interference mica, oxidized flake mica, pigment-coated aluminum flakes, optical change flakes, and a combination thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030]

Fig. 1A is a plan view of anti-forgery printed matter according to an embodiment of the present invention, in which a first printed image and a second printed image are printed on a base;

Fig. 1B is a plan view showing the visually recognized state of the latent image of the first printed image according to the embodiment;

Fig. 1C is a plan view showing the visually recognized state of the latent image of the second printed image according to the embodiment;

Fig. 2A is a plan view showing the background image in the first printed image in the anti-forgery printed matter according to the embodiment;

Fig. 2B is a plan view showing the first printed image according to the embodiment;

Fig. 3A is a plan view showing the background image in the second printed image in the anti-forgery printed matter according to the embodiment;

Fig. 3B is a plan view showing the second printed

image according to the embodiment;

Fig. 4A is a longitudinal sectional view taken along a line Y - Y in Fig. 2B, which shows the anti-forgery printed matter having the first printed image printed on the base according to the embodiment;

Fig. 4B is a longitudinal sectional view taken along a line Y - Y in Fig. 1A, which shows the anti-forgery printed matter having the first printed image and second printed image printed on the base according to the embodiment; and

Figs. 5A to 5D are plan views showing background image patterns in the first printed image according another embodiment of the present invention, in which Fig. 5A shows a vertical stripe pattern, Fig. 5B shows a concentric circle pattern, Fig. 5C shows a concentric polygonal pattern, and Fig. 5D shows a check pattern.

1	Anti-forgery printed matter
2	Printing base
3	First printed image
3A	First latent image
4	First background image
4A	First single line (Gold solid printing)
4B	Gold halftone dot printing region
5	Second printed image
5A	Second latent image (Negative printing of micro-characters)
6	Second background image
6A	Second single line (Microcharacters)

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] The embodiments of the present invention will be described below with reference to the accompanying drawings.

[0032] The structure of printed matter according to an embodiment of the present invention will be described with reference to Figs. 1A to 1C which show plan views of the anti-forgery printed matter. Anti-copy printed matter 1 according to this embodiment shown in Fig. 1A is formed by printing a first printed image 3 shown in Fig. 1B and then superposing a second printed image 5 shown in Fig. 2B on the first printed image 3.

[0033] The first printed image 3 is printed on a printing base using an ink containing a luminescent material. A first latent image 3A is formed, as shown in Fig. 1B.

[0034] The second printed image 5 is printed on the first printed image 3 using a color ink. A second latent image 5A is formed, as shown in Fig. 1C.

[0035] For the printed matter 1 having the structure of this embodiment, when the observation angle changes from the diffused light (scattered light) region to the regularly reflected light region with respect to the illumination light source, the first latent image 3A in the first printed image 3 changes from a visible image to an invisible image. Simultaneously, the second latent image 5A in the second printed image 5 changes from an invisible image to a visible image.

[0036] When the observation angle of the printed matter 1 changes from the regularly reflected light region to the diffused light (scattered light) region with respect to the illumination light source, the first latent image 3A in the first printed image 3 changes from an invisible image to a visible image. Simultaneously, the second latent image 5A in the second printed image 5 changes from a visible image to an invisible image.

[0037] The first printed image 3 and second printed image 5 will be described next in detail.

[0038] As shown in Figs. 2B and 4A, the first printed image 3 is formed on a printing base 2 by using an ink (e.g., gold ink) containing a luminescent material.

[0039] After that, as shown in Figs. 3B and 4B, the second printed image 5 is formed on the first printed image 3 by using a color ink.

[0040] As shown in Figs. 2A, 2B, and 4A, the first printed image 3 has a first background image 4 and the first latent image 3A (character "I" shown in Fig. 2B). The first background image 4 has a horizontal stripe pattern obtained by alternately laying out first single lines 4A formed by gold ink solid printing as single lines each having a predetermined width and gold halftone printing regions 4B formed by gold ink printing (gold halftone printing) at a high dot ratio (e.g., 70% to 80%) as single lines each having a predetermined width. The first latent image 3A is formed by gold ink solid printing. The gold halftone printing region 4B corresponds a halftone printing region where the percent dot area falls within the range of 0% (exclusive) to 100% (exclusive).

[0041] As shown in Figs. 3A, 3B, and 4B, the second printed image 5 has a second background image 6 and the second latent image 5A (character "O" shown in Fig. 3B). The second background image 6 is formed by printing a horizontal stripe pattern formed from microcharacters of a color ink or second single lines 6A each having a low dot ratio (e.g., 20% to 30%) and a predetermined width.

[0042] The second latent image 5A is formed by executing negative printing on the second background image 6 formed from a horizontal stripe pattern.

[0043] When the second printed image 5 is to be formed using a color ink on the first printed image 3 formed using gold ink, printing is executed such that the second single lines (regions where microcharacters are printed by the color ink) 6A in the second printed image 5 are superposed on the first single line (regions where the gold ink is printed by solid printing) 4A in the first printed image 3, as shown in Figs. 1A and 4B.

[0044] As shown in Fig. 1B, in the scattered light region, the first printed image 3 has a density difference between the first latent image 3A in which the character "I" is formed by gold ink solid printing and the first background image 4 in which single lines are formed by gold ink printing at a high dot ratio. Hence, the first latent image 3A can be visually recognized.

[0045] Conversely, in the regularly reflected light region, the density difference between the first latent image 3A and the first background image 4 is small. Hence, the first latent image 3A cannot be visually recognized.

[0046] As shown in Fig. 1C, in the regularly reflected light region, the second printed image 5 has a density difference between the second background image 6 in which the horizontal stripe pattern including the second single lines 6A at a low dot ratio is printed using a color ink and the second latent image 5A in which the character "O" is formed by negative printing on the second background image 6. Hence, the second latent image 5A can be visually recognized.

[0047] In the scattered light region, the density difference between the second background image 6 and the second latent image 5A is small. Hence, the second latent image 5A cannot be visually recognized.

[0048] As described above, in the printed matter according to this embodiment, when the observation angle is in the diffused light (scattered light) region, the first latent image 3A is visible while the second latent image 5A is invisible. Conversely, when the observation angle is in the regularly reflected light region, the second latent image 5A is visible while the first latent image 3A is invisible. That is, an ordinary person can visually easily and clearly determine the authenticity of printed matter by a simple operation without any special apparatus, i. e., by changing the observation angle between the diffused light (scattered light) region and the regularly reflected light region.

[0049] In addition, latent images can be formed by different printing methods using a plurality of character patterns, like the first latent image 3A and second latent image 5A. For this reason, the anti-forgery element can have a plurality of pieces of semantic information, and the anti-forgery effect can be further increased.

[0050] Furthermore, when microcharacters are printed at the color ink printed portion such as the second single lines 6A, the authenticity can be determined by using a simple means such as a loupe. Hence, the anti-forgery effect can be increased at a low cost.

[0051] The above-descried embodiment is merely an example and does not limit the present invention. For example, in the anti-forgery printed matter having the color flip-flop effect according to this embodiment, the first printed image 3 is formed on the printing base 2 by using an ink such as gold link containing a luminescent material. After that, the second printed image 5 is formed on the first printed image 3 by using a color ink.

[0052] However, the present invention is not limited to this. Even anti-forgery printed matter with a flip-flop effect, which has only the first printed image 3 formed on the printing base 2 by using an ink containing a luminescent material, has a sufficient anti-forgery effect and can be put into practical use. More specifically, the anti-forgery effect can be obtained only by forming the first background image 4 on the printing base 2, as described with reference to Fig. 2A, and then forming the first latent image 3A to form the first printed image 3, as shown in Figs. 2B and 4A.

[0053] In the above embodiment, a horizontal stripe pattern is formed in each of the first and second background images 4 and 6. However, the present invention is not limited to this. A single line pattern such as a vertical stripe pattern as shown in Fig. 5A, a concentric circle pattern as shown in Fig. 5B, or a concentric polygonal pattern as shown in Fig. 5C, a check pattern or grid pattern as shown in Fig. 5D, or any other pattern may be used. Similarly, even when only the first printed image 3 is to be formed, a single line pattern such as a horizontal stripe pattern, a vertical stripe pattern, a concentric circle pattern, or a concentric polygonal pattern, a check pattern or grid pattern, or any other pattern may be formed in the first background image 4.

[0054] In the above embodiment, a single line formed from a collective pattern of microcharacters is used as the second single line 6A of the second background image 6. However, the present invention is not limited to this. Instead, a single line having a low dot ratio may be used.

[0055] In the above embodiment, gold ink is used as the luminescent ink. However, the present invention is not limited to this. Instead, an ink containing luminescent powder such as interference mica, oxidized flake mica, pigment-coated aluminum flakes, or optical change flakes may be used.

Claims

1. Anti-forgery printed matter with a flip-flop effect, which has a printed image formed on a printing base,

   wherein the printed image has a latent image region and a background image region,

   the latent image region is formed by a solid printed layer containing an ink or coating containing at least one luminescent material,

   the background image region is formed by alternately repeating the solid printed layer containing the ink or coating containing at least one luminescent material and a halftone printed layer containing an ink or coating containing at least one luminescent material at a predetermined interval, and

   the latent image is more easily visually recognized when an observation angle is in a diffused or scattered light region with respect to an illumination light source than when the observation angle is in a regularly reflected light region with respect to the illumination light source.

2. Printed matter according to claim 1, wherein the background image region includes a single line pattern including at least one of a horizontal stripe pattern, a vertical stripe pattern, a concentric circle pat-

tern, and a concentric polygonal pattern, a check pattern, or a grid pattern.

3. Anti-forgery printed matter with a color flip-flop effect, which has first printed image and second printed image formed on a printing base,

wherein the first printed image has a first latent image region and a first background image region,

the first latent image region is formed by a solid printed layer containing an ink or coating containing at least one luminescent material,

the first background image region is formed by alternately repeating the solid printed layer containing the ink or coating containing at least one luminescent material and a halftone printed layer containing an ink or coating containing at least one luminescent material at a predetermined interval,

the second printed image has a second latent image region and a second background image region,

the second latent image region is an unprinted region or a region where outline printing on a printed region is executed,

the second background image region is formed by alternately repeating a microcharacter printed layer containing an ink and an unprinted layer at a predetermined interval,

the microcharacter printed layer in the second background image region in the second printed image is superposed on the solid printed layer in the first background image region in the first printed image,

the first latent image is more easily visually recognized than the second latent image when an observation angle is in a diffused or scattered light region with respect to an illumination light source, and

the second latent image is more easily visually recognized than the first latent image when the observation angle is in a regularly reflected light region with respect to the illumination light source.

4. Printed matter according to claim 3, wherein each of the first background image region and the second background image region includes a single line pattern including at least one of a horizontal stripe pattern, a vertical stripe pattern, a concentric circle pattern, and a concentric polygonal pattern, a check pattern, or a grid pattern.

5. Printed matter according to any one of claims 1 to 4, wherein the luminescent material includes a material selected from the group consisting of interference mica, oxidized flake mica, pigment-coated aluminum flakes, optical change flakes, and a combination thereof.

FIG. 1A

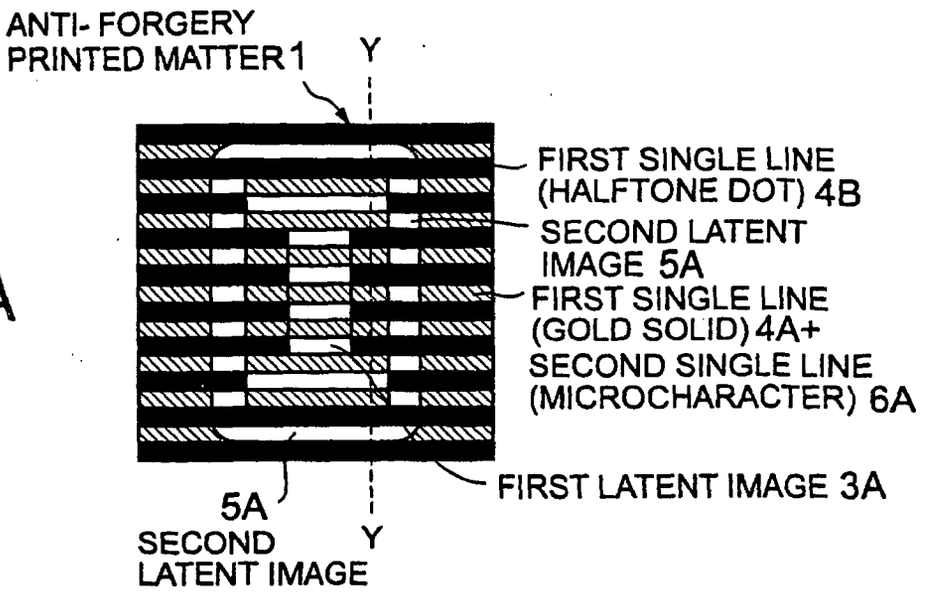


FIG. 1B

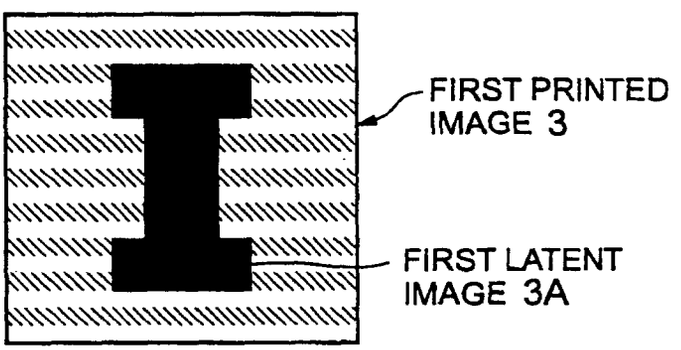


FIG. 1C

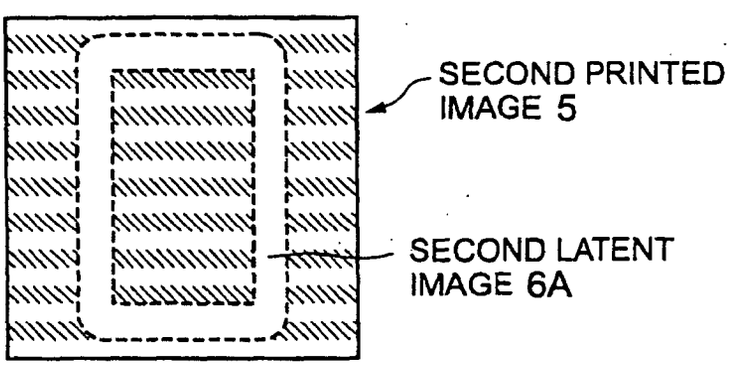


FIG. 2A

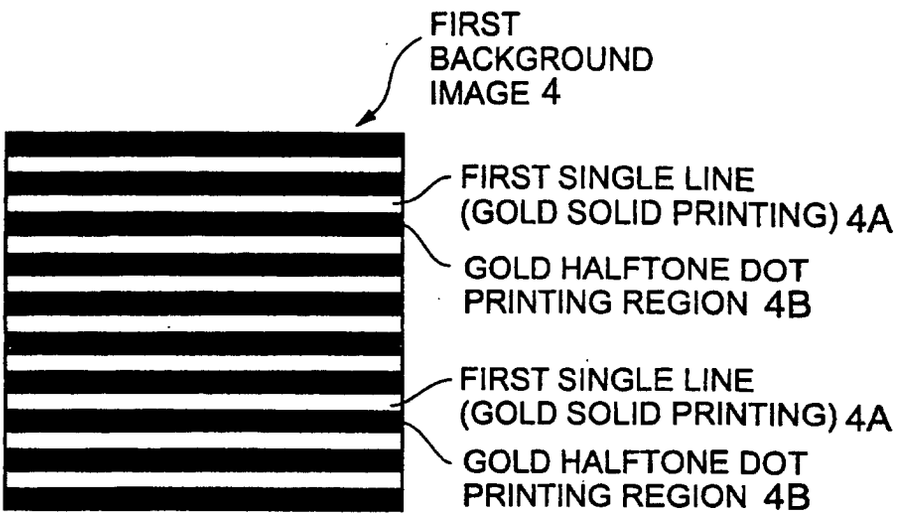

FIRST
BACKGROUND
IMAGE 4
FIRST SINGLE LINE
(GOLD SOLID PRINTING) 4A
GOLD HALFTONE DOT
PRINTING REGION 4B
FIRST SINGLE LINE
(GOLD SOLID PRINTING) 4A
GOLD HALFTONE DOT
PRINTING REGION 4B

FIG. 2B

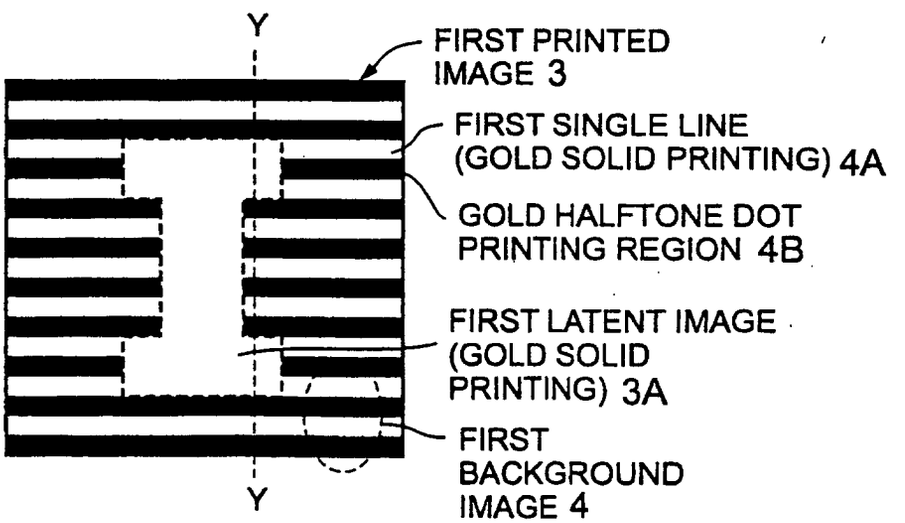

Y
FIRST PRINTED
IMAGE 3
FIRST SINGLE LINE
(GOLD SOLID PRINTING) 4A
GOLD HALFTONE DOT
PRINTING REGION 4B
FIRST LATENT IMAGE
(GOLD SOLID
PRINTING) 3A
FIRST
BACKGROUND
IMAGE 4
Y

FIG. 3A

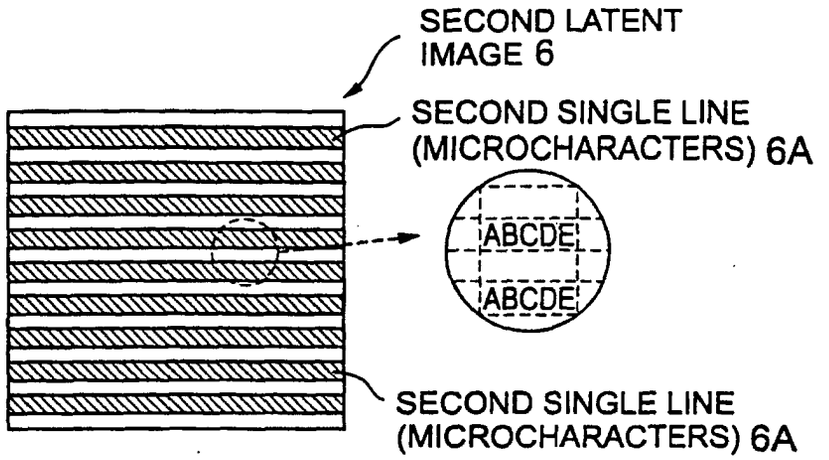
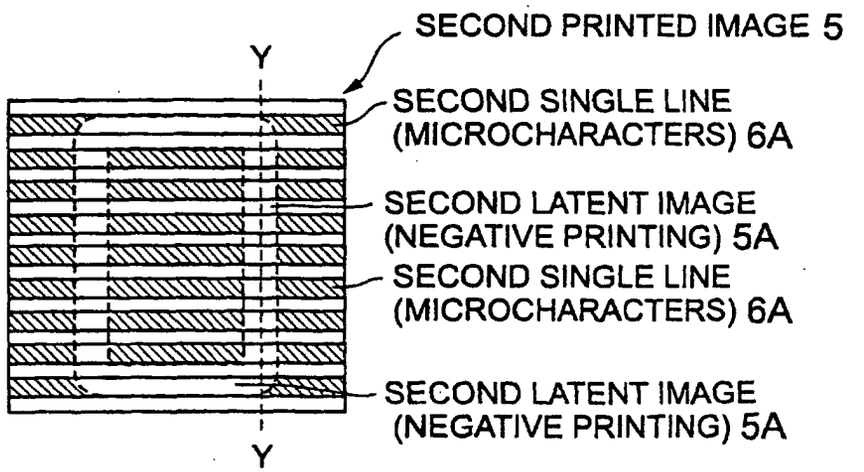

SECOND LATENT IMAGE 6
SECOND SINGLE LINE (MICROCHARACTERS) 6A
ABCDE
ABCDE
SECOND SINGLE LINE (MICROCHARACTERS) 6A

FIG. 3B


SECOND PRINTED IMAGE 5
Y
SECOND SINGLE LINE (MICROCHARACTERS) 6A
SECOND LATENT IMAGE (NEGATIVE PRINTING) 5A
SECOND SINGLE LINE (MICROCHARACTERS) 6A
SECOND LATENT IMAGE (NEGATIVE PRINTING) 5A
Y

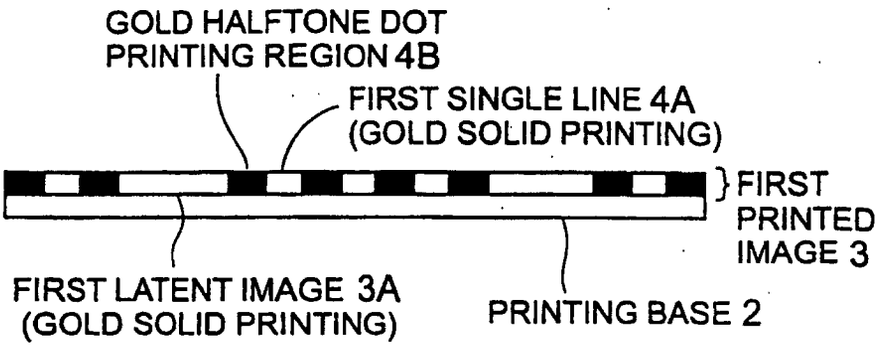

GOLD HALFTONE DOT
PRINTING REGION 4B
FIRST SINGLE LINE 4A
(GOLD SOLID PRINTING)
FIRST
PRINTED
IMAGE 3
FIRST LATENT IMAGE 3A
(GOLD SOLID PRINTING)
PRINTING BASE 2

FIG. 4A

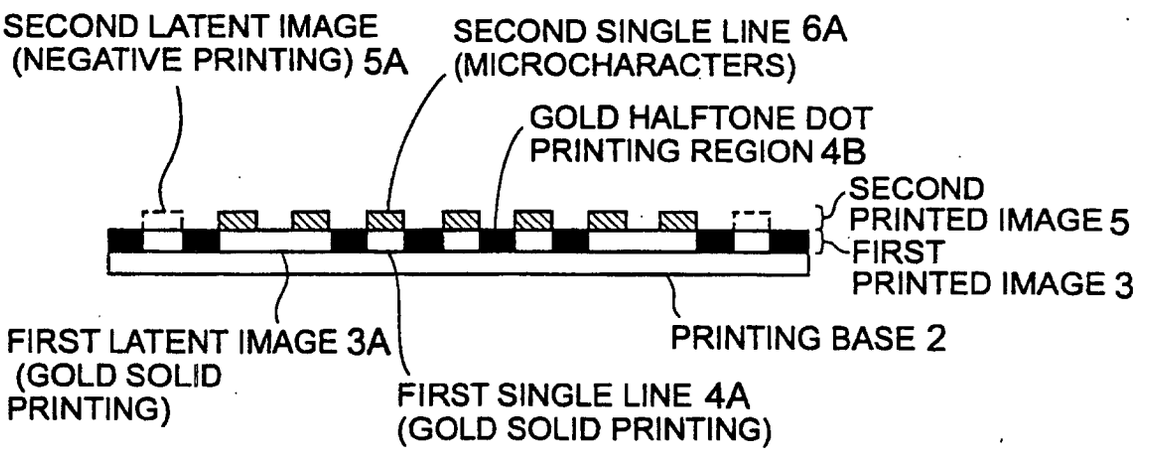

SECOND LATENT IMAGE
(NEGATIVE PRINTING) 5A
SECOND SINGLE LINE 6A
(MICROCHARACTERS)
GOLD HALFTONE DOT
PRINTING REGION 4B
SECOND
PRINTED IMAGE 5
FIRST
PRINTED IMAGE 3
FIRST LATENT IMAGE 3A
(GOLD SOLID
PRINTING)
PRINTING BASE 2
FIRST SINGLE LINE 4A
(GOLD SOLID PRINTING)

FIG. 4B

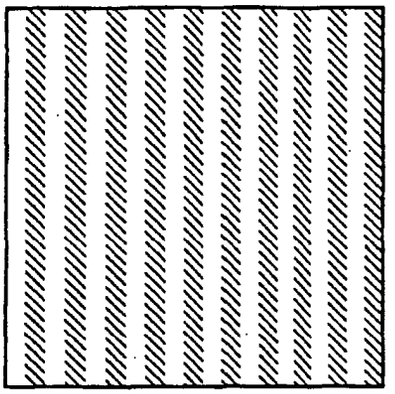


FIG. 5A

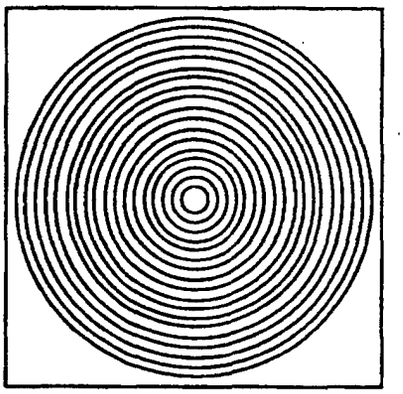


FIG. 5B

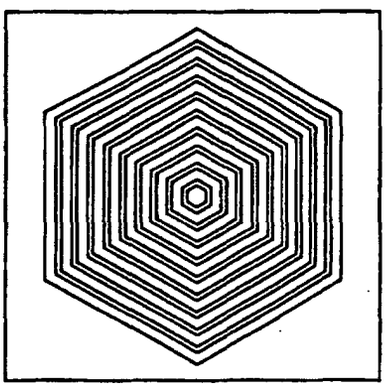


FIG. 5C

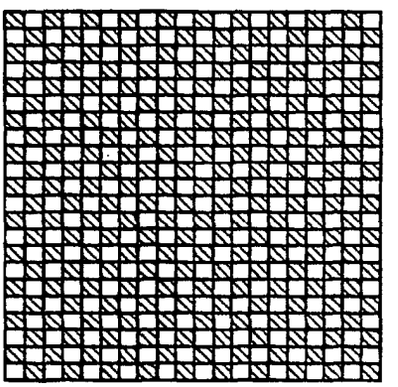


FIG. 5D

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/03495

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B41M3/14

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)
Int.Cl[7] B41M3/14, B42D15/10, B44F1/12

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2002
Kokai Jitsuyo Shinan Koho	1971-2002	Toroku Jitsuyo Shinan Koho	1994-2002

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	JP 2001-121804 A (Director General of Printing Bureau, Ministry of Finance), 08 May, 2001 (08.05.02), Claim 3; column 16, lines 17 to 37 (Family: none)	3-5
A	JP 2000-158789 A (Director General of Printing Bureau, Ministry of Finance), 13 June, 2000 (13.06.00), Column 5, lines 7 to 49; Fig. 10 (Family: none)	1-5

☐ 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 document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07 May, 2002 (07.05.02)	21 May, 2002 (21.05.02)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)